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Of weekend warriors and couch potatoes: Socio-economic determinants of physical activity in Swiss middle-aged adults

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ABSTRACT

Determinants of the interplay between physical activity (PA) and sedentary (SE) status are poorly known. We assessed the socio-economic determinants of PA and SE behaviours and patterns in a population-based study (The CoLaus study, Lausanne, Switzerland, 2014–2017). 2229 adults (51.8% women, age range 45–86 years) had PA and SE levels measured for 14 days using a wrist-worn accelerometer. Four activity behaviours: (1) 'Couch potato': low PA & high SE; (2) 'Light mover': low PA & low SE; (3) 'Sedentary exerciser': high PA & high SE, and (4) 'Busy bee': high PA & low SE; and three activity patterns: (1) 'Inactive', (2) 'Weekend warrior', and (3) 'Regularly active' were defined. Employment, household income and educational level were collected by questionnaire. For activity behaviours, relative to 'Couch potatoes', multivariate analysis showed that being employed and having a low educational level were positively associated with 'Light movers': relative risk ratios and (95% confidence interval): 1.54 (1.00–2.37) and 1.73 (1.11–2.69), respectively, and also with 'Busy bees': 1.49 (1.09–2.04) and 1.71 (1.26–2.32), respectively. High household income was negatively associated with 'Light movers': 0.58 (0.34–0.97) and positively with 'Sedentary exercisers': 1.85 (1.10–3.10). For activity patterns, relative to 'Inactives', being employed and having a high household income were positively associated with 'Weekend warriors': 1.78 (1.26–2.50) and 1.59 (1.07–2.36), respectively, while having a low educational level was positively associated with 'Regularly actives': 1.76 (1.32–2.34). Employment, educational level and household income are significantly but differently associated with activity behaviours and patterns.

1. Introduction

The beneficial effects of regular physical activity (PA) have been well established (Warburton et al., 2006). According to the World Health Organization, adults should spend at least 150 min of moderate-intensity PA per week (World Health Organization, 2010). Still, 60% of the world population does not adhere to these recommendations; further, interventions to increase PA levels are often ineffective (Robison and Rogers, 1994). Beyond the dose-response effect, other components of PA have been shown to impact health: (i) its interplay with sedentary (SE) levels (i.e. 'activity behaviour') as described by Bakrania et al. (2016); and (ii) its distribution over time (i.e. 'activity pattern') (Lee et al., 2004). Indeed, the benefits of PA could be altered either by being SE instead of performing light-intensity physical activity (LIPA) such as standing (Bakrania et al., 2016; Buman et al., 2014), or by performing only 1–2 sessions per week (Lee et al., 2004). Hence, to promote optimal activity patterns and behaviours in the general population, a better understanding of their determinants is necessary.

Several socio-economic factors have been associated with PA and SE. Namely, employment (Van Domelen et al., 2011), high income (Trost et al., 2002) and high educational level (Trost et al., 2002) are related to higher PA levels. Paradoxically, high income and high education have also been related to higher SE levels, although this association has been debated (O'Donoghue et al., 2016). This paradox is likely due to the fact that most studies focused either on PA (Trost et al., 2002) or on SE (O'Donoghue et al., 2016) but not on their combinations. For instance, high PA levels can be associated either with high or low SE levels, and reciprocally (Sugiyama et al., 2008); hence, analysis of PA and SE combinations might provide more information than of PA or SE alone.

To date, little is known about the determinants of activity behaviours and patterns. The existent literature is limited as: (i) it took into account a single socio-economic factor (Kruger et al., 2007; O'Donovan et al., 2017) or used socio-economic status instead of studying the different socio-economic factors (Bakrania et al., 2016), or (ii) the definition of behaviours and patterns relied on self-reported data (Lee et al., 2004; Sugiyama et al., 2008; Kruger et al., 2007; O'Donovan et al., 2017). Further, all previous findings were limited to simple

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descriptive analyses, and no adjustment for major confounders such as age, gender or lifestyle was performed (Bakrania et al., 2016; Sugiyama et al., 2008; Kruger et al., 2007; O'Donovan et al., 2017).

Therefore, this study aimed to assess the socio-economic determinants of activity behaviours and patterns in a population-based sample aged 45–86 years from the city of Lausanne, Switzerland (CoLaus study).

2. Methods

2.1. Recruitment of participants

The detailed description of the recruitment of the CoLaus study and the follow-up procedures has been described previously (Firmann et al., 2008; Marques-Vidal et al., 2011). Briefly, the CoLaus study is a population-based cohort exploring the biological, genetic and environment determinants of cardiovascular diseases. A non-stratified, representative sample of the population of Lausanne (Switzerland) was recruited between 2003 and 2006 based on the following inclusion criteria: (i) age 35–75 years and (ii) willingness to participate. The second follow-up occurred ten years after the baseline survey and included an optional module assessing the participant's PA levels for 14 days.

2.2. Physical activity measurement

Physical activity was assessed using a wrist-worn triaxial accelerometer (*GENEActiv*, Activinsights Ltd., United Kingdom). The accelerometers were pre-programmed with a 50 Hz sampling frequency and subsequently attached to the participants' right wrist. Participants were requested to wear the device continuously for 14 days in their free-living conditions.

Accelerometry data were downloaded using the *GENEActiv* software version 2.9 (*GENEActiv*, Activinsights Ltd., United Kingdom) and transformed into 1-minute epoch files. Data were analyzed using the *GENEActiv macro file* 'General physical activity' version 1.9 (GENEActiv, 2014) which had been previously validated (Esliger et al., 2011). A valid day was defined as ≥ 10 h (i.e. 600 min-epoch) and ≥ 8 h (i.e. 480 min-epoch) of diurnal wear-time on week days and weekend days, respectively. For each participant, the number of minutes spent in LIPA, moderate-to-vigorous intensity PA (MVPA) and in SE were averaged for all valid days and separately for valid week and weekend days. At least 5 week days and 2 weekend days of valid accelerometry data were required (see exclusion criteria) (Dillon et al., 2016).

2.3. Activity behaviours

Activity behaviours were defined according to the interplay between MVPA and SE status. For MVPA status, participants were split into tertiles of average MVPA time and classified as 'low PA' if they were in the first tertile and as 'high PA' if they were in the second or third tertile. Based upon other studies (Bakrania et al., 2016; Loprinzi et al., 2014), SE status was defined according to the ratio between the average SE time and the average LIPA time. Participants were classified as 'high SE' if they were in the third tertile and as 'low SE' if they were in the first or second tertile. This classification allowed creating four mutually exclusive activity behaviours (Fig. 1) as described by Bakrania et al. (2016): 1) 'Couch potato': 'low PA' & 'high SE'; 2) 'Light mover': 'low PA' & 'low SE'; 3) 'Sedentary Exerciser': 'high PA' & 'high SE'; and 4) 'Busy bee': 'high PA' & 'low SE'.

2.4. Activity patterns

Activity patterns were defined according to MVPA status and its distribution throughout the week. For MVPA status, participants were classified as 'low PA' if they were in the first tertile of average MVPA time and as 'high PA' if they were in the second or third tertile. For the distribution of MVPA, average MVPA time on weekend days was divided by average MVPA time on week days and split into tertiles. Participants were categorized as 'PA mainly on weekends' if they were in the third tertile and as 'PA throughout the week' if they were in the first or second tertile. This classification allowed creating three mutually exclusive activity patterns (Fig. 1) as described by O'Donovan et al. (2017): 1) 'Inactive': 'low PA'; 2) 'Weekend warrior': 'high PA' & 'PA mainly on weekends'; and 3) 'Regularly active': 'high PA' & 'PA throughout the week'.

2.5. Socio-economic and other data

Demographic, smoking status, employment and household income data were collected at second follow-up by questionnaire. Educational level was collected at baseline by questionnaire. Educational level was categorized as low (obligatory school or apprenticeship), medium (high school), or high (university degree). Participants were considered as employed if they were currently working. Conversely, no information regarding working patterns (i.e. which were the work and non-work days during the week) was collected. Monthly household income before social charges was collected and expressed in Swiss francs (1 CHF = 1.007 US$ or 0.937 € as of 29 March 2017).

2.6. Exclusion criteria

Participants were excluded if they: (i) did not participate in accelerometry; (ii) had < 5 week days or < 2 weekend days of valid accelerometry data, and (iii) had missing data for the other covariates. As a significant proportion of the participants refused to provide household income data, two datasets were used in the analysis: one with all included participants but without income data (dataset 1), and another including only participants who provided income data (dataset 2, Fig. 2).

2.7. Statistical analysis

Statistical analyses were conducted using Stata version 14.0 for windows (Stata Corp, College Station, Texas, USA). Results were expressed as number of participants (percentage) for categorical variables or as average ± standard deviation for continuous variables. Between-group comparisons were performed using chi-square and one-way analysis of variance for categorical and continuous variables, respectively.

Multivariate analyses using the activity behaviours or patterns as the dependent variables were conducted using multinomial logistic regression. For activity behaviours, the 'Couch potato' group was considered as base outcome and the variables associated with 'Light mover', 'Sedentary exerciser' and 'Busy bee' behaviours were assessed. For activity patterns, the 'Inactive' pattern was considered as base outcome and the variables associated with the 'Weekend warrior' and 'Regularly active' patterns were assessed. The variables included in the model were: age (continuous), gender (male/female), marital status (yes/no), smoking status (current/former/never), employment (no/yes), educational level (high/medium/low), and household income (< 5000/5000–9499/ > 9500 CHF). Results were expressed as relative-risk ratio and 95% confidence interval. Trends were assessed using the **test** function of Stata.

2.8. Ethical statement and consent

The institutional Ethics Committee of the University of Lausanne, which afterwards became the Ethics Commission of Canton Vaud approved the baseline CoLaus study (reference 16/03, decisions of 13th January and 10th February 2003); the approval was renewed for the first (reference 33/09, decision of 23rd February 2009) and the second