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Correlates of weekday compliance to physical activity recommendations in Swiss youth non-compliant in weekend days

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ABSTRACT

Some children are inactive on weekends but active on weekdays. Correlates of such behavior remain to be clarified. We assessed school, out-of-school and family correlates of compliance with physical activity (PA) recommendations during weekdays among weekend non-compliant youth in Switzerland. Cross-sectional data collected in 2013–2015 from the SOPHYA study. PA was objectively measured during one week using waist-worn accelerometers. Compliance with PA recommendations (≥ 60 min/day of moderate-to-vigorous PA) was assessed separately for weekend and weekdays. Data on school sport, transport to school, sports club participation, household income, parent's PA and education were collected by phone interview and questionnaires. Data from 540 youth (316 girls) aged 6–16 years were available for analysis. Participants who were compliant to recommendations during weekdays were more frequently boys (50.3% *vs.* 31.4%, $p < 0.001$), more often participated in sports club (73.3% *vs.* 64.3%, $p = 0.024$), and were more prone to adopt active transport to school (75.8% *vs.* 62.0%, $p = 0.001$) than non-compliers. Multivariable adjustment showed male gender [odds ratio and (95% confidence interval): 4.30 (2.71–6.81)], sports club participation [1.91 (1.21–3.02)], and PA-active parent [1.98 (1.20–3.28)] were significantly associated with weekday compliance. Being a male, a sports club participant and having a physically active parent significantly increase compliance with PA recommendations during weekdays among Swiss youth who are inactive on weekends.

1. Introduction

The beneficial effects of regular physical activity (PA) in youth are well established (Poitras et al., 2016). According to the World Health Organization (WHO) recommendations, youth should spend at least 60 min per day in moderate-to-vigorous intensity physical activity (MVPA) to maintain a healthy cardiorespiratory and metabolic risk profile (World Health Organization, 2010). However, in industrialized countries, a significant proportion of youth fail to reach these recommendations (Verloigne et al., 2012), and while interventions to increase their PA levels are often not effective (van Sluijs et al., 2011a). In order to increase PA levels in this population, a better understanding of PA correlates is necessary.

Adopting active transport to school (Lee et al., 2008), and participating in school sports and sports club (Stuart et al., 2011) are related to higher PA levels in youth. Factors such as parent's socioeconomic status, PA habits and educational level are also positively associated with PA levels in children (Stuart et al., 2011). Most of these associations relate to a higher compliance with PA recommendations (Guinhouya et al., 2009; Butcher et al., 2008; Telford et al., 2016). In a meta-analysis, Brooke and colleagues found that youth are more active on weekdays than weekend days, and suggested that future research should explore time-specific correlates of PA (Brooke et al., 2014). Indeed, PA correlates may differ within week segments (Corder et al., 2013; McMinn et al., 2013; Bürgi and de Bruin, 2016). For example, parental rules on child's PA behavior influence after-school PA levels, whereas other family factors seem to be more important during weekends (McMinn et al., 2013). To date, little is known about correlates' distribution throughout the week. The existent literature is also limited since: (i) it mainly focuses on parental (Vander Ploeg et al., 2013) or

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environmental factors (Bürgi and de Bruin, 2016), (ii) only includes children (Pereira et al., 2017; van Sluijs et al., 2011b), (iii) or describes the correlates in relation to amounts of PA and not compliance with PA recommendations (Fuemmeler et al., 2011; Fairclough et al., 2012).

During weekdays, school attendance reduces inequalities in PA levels (Lamprecht et al., 2015) partly due to compulsory school sport lessons. Conversely, during weekends, PA behaviors tend to vary due to lower constraints. Indeed, Bürgi and de Bruin (Bürgi and de Bruin, 2016) combined Global Positioning System and accelerometry, and demonstrated that Swiss youth spend much of their weekend time at home and practice little PA. Based on their findings they formulated recommendations for interventions aiming at increasing weekend PA (Bürgi and de Bruin, 2016). However, weekday interventions aiming to increase PA in youth who are inactive during the weekend are also of interest. Indeed, youth tend to be less active during weekends (Brooke et al., 2014), and this regards mostly obese youth (Aires et al., 2007). Hence, characterizing youth who are inactive during the weekend and exploring what makes them active during the week will allow further tailoring of interventions toward those most in need, *i.e.* youth whom are inactive throughout the week.

Therefore, the aim of this study was to assess school, out-of-school and family correlates of weekday compliance with PA recommendations in weekend non-compliant youth aged 6–16 years old in Switzerland.

2. Methods

2.1. Recruitment

SOPHYA (*Swiss children's Objectively measured PHYsical Activity*) is a cross-sectional study conducted among children and adolescents living in Switzerland. It aims to identify socio-demographic and environmental correlates of objectively measured PA in a nation-wide sample of Swiss youth, to develop evidence-based PA promotion strategies (Swiss Tropical and Public Health Institute, 2016).

All youth living in Switzerland and born between 1998 and 2007 were considered for inclusion. A random sample was recruited between 2013 and 2015 by the Federal Statistical Office. 3113 youth and their parent or legal guardian accepted to be interviewed by a field research institute regarding their socio-demographic factors and sport behavior. At the end of the telephone interview, their willingness to participate in an accelerometry measurement was assessed. A total of 1611 youth accepted and were subsequently mailed a pre-programmed accelerometer with detailed instructions for use, a questionnaire about sport behavior during the measured week, and a pre-paid postage box to return the items to the investigators. At the end of the study, 1439 (89.3%) youth provided accelerometry data. Of the 172 remaining, 20 had technical problems (1.2%), and 152 (9.4%) did not wear or return the accelerometer.

2.2. Accelerometry

PA was assessed using accelerometers (*ActiGraph GT1M* or *GT3X*, Pensacola, Florida, USA) positioned on the right hip using an elastic waist belt, without filtering and in 15-s epoch mode, to capture short bursts of MVPA typically performed by children (Trost et al., 2005). As uniaxial and triaxial accelerometers were used, only the vertical axis output was considered since it is similar between the *GT1M* and *GT3X ActiGraph* models in youth (Robusto and Trost, 2012). Participants were requested to wear the device continuously for seven consecutive days, but to take it off during water activities and during sleeping time. Season of wear was defined according to the month when the measurement was performed (spring: March–May; summer: June–August; autumn: September–November; winter: December–February).

Accelerometry data were downloaded using *ActiLife* software version 6.11 (ActiGraph, Pensacola, Florida, USA). A period of > 60 min of consecutive zeros counts was defined as non-wear time. A day was considered valid if it met at least 10 or 8 h of wear time, on weekdays or weekend days, respectively. Time spent in MVPA (min/day) was estimated using the age-dependent Freedson's count cut-offs (Freedson et al., 2005) with a threshold of 4 METs and averaged separately for valid weekdays and weekend days. Finally, compliance with WHO's PA recommendations was defined as an average ≥ 60 min/day of MVPA for weekday and weekend day.

2.3. School, out-of-school and family factors

The youth and one parent or legal guardian were interviewed by phone for socio-demographic data and sport behavior before the measurement week, and completed a questionnaire on sport behavior during the measurement week (*i.e.* number of school sport lessons and transport to school). Children aged 10 years or younger had their data provided by the parent or legal guardian. Older youth self-reported the data, except home income, parent's education, and parent's PA.

The number of school sport lessons (45 min each) performed during the week of the accelerometry measurement was categorized as 0–2 (less than the Swiss Federal recommendation (Confédération suisse, 2015)) or 3–5 (equal or more than the Swiss Federal recommendation (Confédération suisse, 2015)). Daily modes of transport to and from school were collected during the accelerometry measurement and categorized as active (walking, cycling, inline skating or other active form) or inactive (public transport, school bus, car, or other non-active form). Active transport to school was considered when > 50% of transports were active.

Participation in sports club was defined as attending organized sports club activities at least once a week, irrespective of the duration.

Parent's education was categorized into university or lower level. Parents were considered as physically active if they reported performing sport activities for at least one hour per week. Home income was defined as monthly household income before social charges and expressed in Swiss francs (1 CHF = 0.998 US$ or 0.937 € as of 10 February 2017).

2.4. Exclusion criteria

Participants who had an insufficient number of valid days for the accelerometry measurement, *i.e.* < 3 weekdays or 1 weekend day, were previously excluded from the SOPHYA data set. For the present analysis a sub-sample of the data set was used. Only youth who did not comply with the WHO's PA recommendations during the weekend were considered as eligible. From that sub-sample youth were further excluded if: 1) there were issues in data processing (60-s epoch setting and/or low frequency filtering); 2) they were on holidays during the accelerometry measurement; 3) they had missing data for age, or any school, out-of-school or family factors.

2.5. Statistical analysis

Statistical analyses were conducted in 2016 using Stata version 14.0 for MS-Windows (Stata Corp, College Station, Texas, USA). Descriptive analyses were stratified by age group (children: 6–10 years; adolescents: 11–16 years), and expressed as percentage for categorical variables or as average ± standard deviation for continuous variables. Bi- and multivariable analyses were performed on the whole sample, as no interactions were found between age group and the different covariables. Between-group comparisons were performed using chi-square test and Student's *t*-test, for categorical and continuous variables, respectively. Multivariable analyses using compliance with PA recommendations on weekdays as the dependent variable were conducted using logistic regression. Independent variables included in the model were: age (continuous), gender (female/male), season (spring/summer/autumn/winter), linguistic region (French-Italian/German),