Associations between adolescent sport and exercise participation and device assessed physical activity in adulthood: evidence from the 1970 British Cohort Study

RUNNING HEAD: SPORT AND PHYSICAL ACTIVITY ACROSS LIFE

Nicholas Scicluna[1,2] scicnick@gmail.com
Mark Hamer[1] m.hamer@ucl.ac.uk
Joanna M Blodgett [1*] Joanna.blodgett@ucl.ac.uk

[1] Institute of Sport Exercise & Health, Division of Surgery & Interventional Science, University College London, 170 Tottenham Court Road, W1T 7HA, London, UK
[2] Mater Dei Hospital, Triq Dun Karm, MSD2090, Msida, Malta.

*** Corresponding Author:**
Joanna M Blodgett
Institute of Sport Exercise & Health
Division of Surgery & Interventional Science
University College London
170 Tottenham Court Road
W1T 7HA
London, UK

Manuscript type: Original research

Keywords: birth cohort, life course, moderate-vigorous physical activity, device-measured activity, epidemiology

Abstract word count: 249

Manuscript word count: 4994

Date of submission: 14 November 2022

ABSTRACT

Background: Adolescence is a critical period filled with life changes. Early implementation of effective health promotion strategies could help alleviate the morbidity and mortality associated with inactivity. This study investigated if adolescent participation in exercise and sport is associated with device-assessed physical activity (PA) levels in midlife.

Methods: 2984 participants (41.2% male) from the 1970 British Cohort Study were included. Participants were surveyed at age 16 on five indicators of exercise and sport participation. Total daily PA and moderate-vigorous PA (MVPA) at age 46 was measured using a thigh-worn accelerometer, worn for 7 days. Associations between each adolescent exercise or sport indicator and adulthood total daily PA and MVPA were examined using linear regressions, adjusting for sex, wear time, BMI, smoking, disability, malaise, alcohol consumption, social class, education, self-rated health.

Results: In fully-adjusted models, adolescents who reported exercising 'much more' than others (8.6mins/day; 95%CI:-0.1,17.1), who played sports at the park/playground more than once a week (8.5(3.0,14.0)mins/day) and who exercised on the most recent Saturday (3.8(-0.7,6.9)mins/day) had higher adult total PA levels than those who reported the lowest activity levels in sex-adjusted models. There was no evidence of an association between greater sport and exercise participation at age 16 and MVPA at age 46. There was no association between playing sports at school and either measure of adult PA.

Conclusion: Active adolescents, particularly those who engaging in out-of-school exercise, had higher total daily PA levels, but not MVPA levels, in midlife. This highlights the potential of early physical activity interventions to improve PA levels in adulthood.

INTRODUCTION

Despite the proven benefits conferred by physical activity (PA), and in particular moderate-to-vigorous physical activity (MVPA), in preventing physical and mental illnesses[1] and the continuous efforts to promote this to the public, over a third of adults in the UK do not meet the current recommended levels of PA[2]. One in six deaths are associated with inactivity in UK, at an estimated annual cost of 7.4 billion pounds[2]. Public health policies and physical education classes aim to promote life-long PA from a young age[3]. Adolescence is a critical period in a person's life, with many physiological and psychosocial changes occurring which can strongly influence activity behaviours[4,5]. Evidence suggests that the behavioural aspects exhibited early in life persist into adulthood [6,7], therefore implementing successful health promotion strategies at this stage in life could be of great importance [4,5], given the potentially sensitive period of adolescence for developing regular active habits.

Before implementation of public health policies, it is imperative to monitor and understand how PA changes across the different stages of life and whether this acts independently of health or social pathways[9]. Identifying these factors will provide insight for targeted, evidence-based health promotion strategies[4,5,9–11]. Existing evidence suggests that PA tracking, defined as PA levels remaining stable over time or the maintenance of an individual's relative activity rank within a group[6,12], into adulthood is low to moderate[4,12–15]. Correlations are stronger in studies carried out over shorter time-periods and with older participants at baseline[12]. Furthermore, exercise can take various forms (e.g. gym, sports, walking) and social contexts (individual/group, in/out of school)[8], and may have different impacts on long-term PA behaviours.

Previous research has predominantly focused on PA patterns from childhood into early adulthood[4,7,9,14,20–22] with little investigation beyond 40 years[3,11,23,24]. Additionally, PA has mainly been measured through self-reported measures which are susceptible to inaccuracies from recall bias[6,7,20,21], although recent evidence has shown associations between greater sports participation throughout childhood and higher device-measured PA in midlife [24]. As PA is a complex behaviour, consisting of several domains, types and contexts, this study focuses on adolescent participation in

organised sport, whether in school or at a sports club, as evidence shows these to be good predictors of adult PA[3,14,16–19]. The aim of this study is to investigate if participation in activity and sport in adolescence is associated with PA at age 46, and if associations remain after adjustment for health and psychosocial pathways that influence adulthood PA.

METHODS

Study sample

The 1970 British Cohort Study (BCS70) is an ongoing longitudinal population-based cohort study of 17,196 participants born in the UK in the same week in 1970[25,26]. This study uses data from the surveys carried out in 1986 (age 16) and 2016 (age 46)[27]. The age 16 assessment involved face-to-face surveys with the cohort members, their parents, teachers and headteachers. The age 46 assessment consisted of a self-completion questionnaire, computer-assisted interviews and an assessment by a trained nurse during which several biomedical measures were taken including implementation of a physical activity monitor[26]. Of the 17,196 people who initially formed part of BCS70, 11,622 participated at age 16 and 8,581 participated at age 46. The derivation of the sample size is shown in detail in Figure 1. The final analysis comprised 2,984 participants. Informed consent was provided by all participants and the study received full ethical approval from NRES Committee South East Coast – Brighton and Sussex (Ref 15/LO/1446).

Sport and exercise at age 16

Five measures of sports and exercise at age 16 were ascertained through the following questions: "How often do you exercise compared to other people your age?" (responses: 'much less', 'less', 'the same', 'more', 'much more'), "How often do you play sport at a club?" ('rarely', 'less than once a week', 'once a week' or 'more than once a week'), "How often do you play sports in a park/playground?" ('rarely', 'less than once a week', 'once a week' or 'more than once a week') and "Did you take any exercise last Saturday?" ('Yes', 'No'). For the fifth measure, participants were asked "During the past year which of the following sports did you play in school and how often?" (see complete list in Supplemental File 1). Each of the 35 listed sports were scored as 0 (never practiced), 1 (1+

times/month) or 2 (1+ times/week). Due to the skew of the data, participant total scores (range: 0-70) were divided into quartiles. Although no objective measures of PA or sport were collected at age 16, resting heart rate – measured as an indicator of cardiometabolic fitness – was consistently lower in those who self-reported higher participation in sport and exercise (see Supplemental Table 2).

Physical activity at age 46

At age 46, participants were asked to wear an activPAL device, secured to the midline of the anterior upper thigh by a nurse following their physical examination. The activPAL device is a triaxial accelerometer which provides information on body position and stepping speed[28–30]. Devices were programmed to sample at the default frequency of 20 Hz with 60 second sampling intervals. Participants were instructed to keep the device on for an entire week without removing it at any time, including while sleeping, bathing or swimming[30]. Participants were included in this study if they provided at least one full day of data, defined as having a waking wear time of at least 10 hours/day[28,29,31]. The two outcome variables considered were the average daily total time spent engaging in total daily PA (PA of any intensity) and in MVPA. MVPA was derived using a step cadence threshold of 100 steps/minute, which has been previously validated and widely used[28,30,32,33].

Covariates

To assess the independence of potential life course pathways, covariates were selected based on previously established life-course associations with PA [9–11,28,34,35]. Height and weight were measured at age 46 as part of a physical assessment carried out by a nurse and used to calculate **BMI**. Where missing, self-reported height and weight were used (n=48). **Alcohol consumption** was assessed using the Alcohol Use Disorder Identification Test (AUDIT) questionnaire; participants were asked about the quantity and frequency with which they consume alcohol and categorised as non-drinkers, non-problematic drinkers or problematic drinkers[36]. Participants rated their own **general health** as excellent, very good, good, fair or poor. **Disability** was classified according to the European Statistics of Income and Living Conditions (EU-SILC) as no disability, limited to some extent or severely hampered[37]. **Smoking status** was classified into three groups: smoker, ex-smoker or non-smoker.

Highest academic achievement was categorized into the following groups: no formal education, obtained A-levels or diploma (finished school) and obtained a degree or higher (attended university). **Psychological well-being** was assessed through the 9-item Malaise Inventory, where participants were classified as either having low malaise (scoring 0-3) or high malaise (4+)[38,39].

Participant's **father's social class** was collected from the age 16 cohort and categorised based on the Registrar-General's model of Social Class (1980) as professional or managerial, non-manual or manual skilled worker and semi-skilled or unskilled worker[40]. If no data was available for father's social class at age 16, data from the age 10 survey was used instead (n=651).

Statistical analysis

Descriptive analysis of participant characteristics by sex was carried out using Chi-squared tests for categorical variables and one-way ANOVA tests for continuous variables. Linear regression models were used to assess associations between each of the five measures of exercise and sport participation at age 16 with MVPA and total daily PA at age 46. For each analysis, four models were considered. Model 1 adjusted for sex and wear time, model 2 adjusted for sex, wear time and health-related factors (BMI, alcohol consumption, general health, disability, smoking status), model 3 adjusted for sex, wear time and psycho-social factors (highest academic achievement, psychological well-being and father social class) and model 4 adjusted for all covariates simultaneously. Males and females were combined in all models as no interaction was present between sex and any of the selected measures of PA. Following a missing at random assumption, covariate data were imputed using multiple imputation chained equations[41]; estimates from 20 imputed datasets were combined using Rubin's rules[42]. Missing data ranged from 0% for smoking and self-reported health to 4.3% for father's social class. Data analyses were carried out using Stata 17.0.

Differences between the analytical sample and various groups of cohorts missing data were examined. First, we compared MVPA and total daily PA time at age 46 between three groups: those with age 16 sport and exercise data (e.g. analytical sample), those who did not participate in any data collection

age 16 and those who participated at age 16 but had no data on sport and exercise. Next, we compared sport participation at age 16 and all covariates between three different groups: the included analytical sample, those who participated at age 46 but did not wear an accelerometer and those who did not participate at age 46.

RESULTS

Sample characteristics

Sample characteristics by sex are shown in Tables 1 and 2. At age 16, boys were more likely to report exercising 'much more' frequently (15.9% vs 7.8%) and on the previous Saturday compared to girls (66.1% vs 61.9%). Compared to boys, girls were more likely to report rarely performing sports at a sports club (53.7% vs 32.0%) or in a park/playground (77.1% vs 42.8%). There was no difference in total sports participation in school between boys and girls. At age 46, males had higher total daily PA (122.4 ±43.9 vs 118.0 ±40.4 mins/day) compared to females, but similar levels of MVPA (52.4±27.1 vs 52.7±24.7 mins/day). Males were more likely to be problematic drinkers at age 46, while females were more likely to have obtained A-levels and have a disability status of 'severely hampered'. Finally, there were no significant sex differences for BMI, smoking status, father's social class, self-rated health and malaise scores (see Table 2).

Total daily physical activity

In linear regressions, there was a positive association between higher reported exercise, participation in sports at the park and having exercised during the weekend at age 16 with greater total daily PA at age 46 (Table 3). Compared to those who reported exercising 'much less' than others, those who exercised 'more' or 'much more' had 7.8 mins/day (95% Confidence Interval: -0.2, 15.8) and 9.3 (0.4, 18.2) mins/day higher total PA, respectively in sex adjusted models. These positive trends are maintained across all stages of adjustment (Model 4, fully-adjusted: 8.6 (-0.01,17.1) min/day for 'much more'). When compared to cohort members who rarely participated in sport at a park/playground, those who played sport more than once a week had 5.7 (-0.05, 11.4) mins/day higher total daily PA in

adulthood in sex-adjusted models. This pattern was also maintained across all four models (Model 4; 8.5 (3.0,14.0) mins/day). Compared to those who had not performed exercise on the previous Saturday, those who did, had higher total daily PA at age 46 in all models (Model 4: 3.8 (0.7,6.9) mins/day). No association was found between increased sports club participation or number of sports played at school with total adult daily PA (see Table 3).

Moderate-vigorous physical activity

Across all linear regressions, there was no evidence to suggested that sport and exercise participation at age 16 was associated with time spent in MVPA at age 46 (see Table 4). There was a small positive trend of higher adult MVPA amongst adolescents who played sports at the park more than once a week when compared to those who rarely did so (Model 4; 3.2 (-0.3, 6.8) mins/day), but all other associations were negligible.

Sensitivity analyses

Those who did not participate in data collection at age 16 (49.3±26.0 min/day) or who participated but had no data on sport and exercise (49.2±24.5 min/day) had lower levels of MVPA than the analytical sample (52.6±25.7; $p<0.001$), however there was no difference in total daily PA time between the three groups ($p=0.85$). When comparing the analytical sample, those who did not participate in data collection at age 46 and those who participated at age 46 but had no accelerometer data (Supplemental Table 3), there was no difference in total sport participation quartiles ($p=0.12$) or Saturday exercise at age 16 ($p=0.24$). However, those who participated in the age 46 wave but had no accelerometer data were less likely to play sports in school and more likely to report exercising less than their peers in adolescence compared to those in the analytical sample and those who did not participate at age 46. Conversely, the analytical sample were the least likely to play sports in the street/park more than once a week. Finally, at age 46, those without accelerometer data were more likely to be male, smokers, non-drinkers or problematic drinkers, have a disability classification, poorer

self-rated health, higher malaise scores, lower academic qualifications and lower father social class compared to the analytical sample (Supplemental Table 3).

DISCUSSION

In a large British birth cohort study, we found that higher levels of exercise and sport participation at age 16 were associated with higher levels of total daily PA at age 46. In particular, adolescents who exercised more regularly and played sports during their leisure time at a park were found to have increased levels of total daily PA as adults. There was no evidence of an association between any measure of adolescent sport and exercise and adult MVPA. The associations found were independent of the health and psychosocial pathways explored in this study, suggesting that adolescence may be a sensitive period for the consolidation of sport and exercise habits.

Comparison with previous evidence

Direct comparisons with previous studies in the same field is challenging as each study uses different indicators of PA, ages of measurement and analytical methods. However, previous studies assessing PA tracking from adolescence to adulthood generally show low but significant levels of tracking with the strength of the associations diminishing as the interval between follow-ups increases. These studies, however, largely relied upon self-reported measures of PA[3,4,13,14,16,17]. Previous longitudinal studies in this field have shown that increased adolescent PA, participation in sports out of school and at sports clubs to be predictors of increased adult PA[4,6,17,43]; the association between early years sports participation and adult PA levels also appears to diminish after longer follow-up periods[13,15,23]. In contrast to the null association between in-school sports participation and adulthood total PA, other studies have shown increased school sports participation to be associated with increased adult PA[44,45].

Interpretation

Tracking is often assessed by means of correlation coefficients [3], which does not allow for the role of covariates to be considered. The linear regressions used here suggested that frequent adolescent participation in sport and exercise was associated with increased likelihood of being an active adult; this association was independent of the covariates controlled for in this study which are known to

impact adulthood activity levels. The results found were consistent, but effect sizes were smaller than expected, possibly due to the complex factors across the life course together with the large number of life changes that can contribute to physical activity behaviours. These results suggest that PA is influenced by many other factors, such as internal and environmental factors, which may limit available time and resources for adult PA[20,43,46,47].

Early experiences of PA may influence on health outcomes in adulthood by forming a preference for PA participation which is maintained throughout life[11,12,14]. After secondary school, individuals become responsible for structuring their own exercise. Continued PA levels are positively affected by enjoyment of exercise, motivation and positive values of expected outcomes from exercise[17,48]. Conversely, some evidence has suggested that adult PA levels are negatively impacted by being forced to exercise in adolescence[10,49]. Outdoor sports played in the park or playground during adolescence reflects a free and unstructured form of sport which varies between different individuals. The contrast of the observed association for free sports played in the street or playground and the null association of organised school sports and sports club participation with adulthood PA levels could reflect the decision to engage in sports due to intrinsic enjoyment and free will. This purposeful and desired engagement in sports could potentially be the result of being brought up in an environment that encourages and supports living a physically active lifestyle. An upbringing in an environment with strong social support and positive encouragement towards sports participation leads to increased levels of pleasure from maintain an active life style and thereby also increases the motivation to maintain this across the life course[11,35]. The null results for sport participation at school may indicate a negative reflection on the way physical education (PE) is taught at schools. There is currently a heavy emphasis on team sports within current PE curriculums[50,51] but attempts are being made to shift to a concept-based PE through which students are exposed to a wide variety of non-competitive exercises adapted to their age with potential for future carry over[18,52–55]. Since not all youth are inherently interested in sport, providing these opportunities can help one feel part of a valued social unit, more autonomous and increase intrinsic motivation to exercise[11].

Although greater sport and exercise participation in adolescence was associated with higher levels of total daily PA in adulthood, there was minimal evidence of an association with MVPA-specific activity. The contrast in results is surprising, given the mechanisms suggested above. However, there was still some evidence of a correlation with performing exercise and an association between playing sports at the park with greater levels of adult MVPA. This could be due to device-measured MVPA capturing any form of exercise, including incidental bouts of non-sustained PA (e.g. running for bus, climbing stairs) and not just structured PA, which are expected to have weaker associations with sport in adolescence. Device-measured MVPA records any bodily movement above the threshold of 100+ counts/minute. Some adult MVPA, such as jobs involving heavy manual labour, may not be classified as MVPA as the nature of the task may involve moderate exertion that does not meet the defined cadence threshold. Additionally, leisure-time walking is a common type of PA in midlife and is most commonly accrued as lower-intensity activity, rather than higher intensity brisk or breathless walking [33]. Finally, the lack of associations could be a result of the selection bias present in this study with the analysis being carried out on a healthier and more active subset of the cohort members. Non-participants were also more likely to be of lower socio-economic position, which has been shown to have a negative impact on PA in childhood [5,48] and physical inactivity has been demonstrated to track better than physical activity, thereby also potentially contributing to the small effect size.

Implications

There was a clear association between adolescent exercise and sport and total adulthood PA. This was particularly evident amongst those who exercised much more than others and those who played sports in the park more than once a week. For example, the 8.5 and 8.6 mins/day coefficients (Table 3) equate to a substantial and clinically significant increase in total PA levels of about 1 hour per week in adulthood (8.5min*7days=59.5minutes). Although such findings were not seen with adult MVPA levels, clinically favourable cardiometabolic risk factor outcomes have been shown even amongst those participating in regular exercise at cadences of less than 100steps/minute[56]. Further research is required in this field and studies should make use of device-measured PA carried out at numerous

time-points from adolescence into adulthood to help better understand these associations and to discover whether efforts should be made to promote sport in early life.

The results obtained showed the associations of PA into adulthood to be independent of the covariates controlled for in this study. This highlights the potential of intervention opportunities to influence behaviours early on in life that may contribute to engagement in more physically active lifestlyes. Interventions should aim to increase activity levels amongst those that are inactive whilst maintaining PA levels amongst those who are already active. Schools, through PE classes, are essential in imparting the values of sport and exercise and allow for equal exposure irrespective of student backgrounds[10]. While sport is an integral part of PE and should be encouraged, PE should also encourage skills that will be commonly used as adults such as individual, fitness oriented, non-competitive exercises which are inclusive of all[10,57]. This increases the chances that an exercise may meet the needs and skill levels of an individual and increase their motivation to continue exercising long-term.

Strengths and limitations

The strengths of this study include its longitudinal design, the long 30-year follow-up period, prospective ascertainment of early life PA, objective thigh-worn measurement of PA and the nationally representative birth cohort. A further strength of this study is the high level of adherence to the activPAL3 wear protocol; 79.6% of participants recorded 6 full days of wear. The analytical approach considered various types of sport and exercise in adolescents and applied a robust statical approach that considered the impact of multiple relevant covariates.

There are several limitations to be noted. PA measures at age 16 may be subject to inaccuracies due to social desirability bias[7]. These measures only reported frequency of PA with no information on duration or intensity and therefore may not be sufficiently sensitive indicators of sport and exercise participation. As with all longitudinal cohort studies, many individuals were lost to follow-up over the 30-year study period, with further restrictions due to accelerometer consent. When compared to

included cohort members, excluded participants were likely to be less healthy, with lower education levels and social class. This selection bias resulted in the analysis being performed on a healthier section of the cohort, which may limit the generalisability of findings. Although widely used and validated by Tudor-Locke et al[32,33], the cut-points of 100steps/minute does not take into account individual factors such as fitness, health, or anthropometry, and therefore may have resulted in mis-estimation of MVPA[58]. A final limitation is the amount of data missing completely at random at age 16 due to a national teachers strike that occurred in 1986 which limited participation as members were traced via their schools[25].

CONCLUSION

The results from this study suggested that out of school sport and exercise engagement in adolescence are associated with higher total daily PA, but not MVPA levels, in adulthood. Contrary to this, frequent participation in sports at school or at a sports club did not translate into significant increases in adult PA levels. Considering the enormous financial impact of preventable non-communicable diseases, even small increases in adult PA levels can prove to be highly cost-effective. This study shows there are undeniable advantages to promoting adolescent PA, with increases in PA levels of up to 1 hour/week in adulthood amongst the most active adolescents, justifying the need to promote it from a public health viewpoint.

Funding: JB is supported through a British Heart Foundation grant SP/F/20/150002.

REFERENCES

1. LaMonte MJ, Lewis CE, Buchner DM, et al. Both Light Intensity and Moderate-to-Vigorous Physical Activity Measured by Accelerometry Are Favorably Associated With Cardiometabolic Risk Factors in Older Women: The Objective Physical Activity and Cardiovascular Health (OPACH) Study. *J Am Heart Assoc*. 2017;6(10). doi:10.1161/JAHA.117.007064

2. Office for Health Improvement and Disparities (OHID). Physical activity: applying All Our Health - GOV.UK. https://www.gov.uk/government/publications/physical-activity-applying-all-our-health/physical-activity-applying-all-our-health. Published 2022. Accessed August 10, 2022.

3. Telama R, Yang X, Viikari J, Välimäki I, Wanne O, Raitakari O. Physical activity from childhood to adulthood: a 21-year tracking study. *Am J Prev Med*. 2005;28(3):267-273. doi:10.1016/J.AMEPRE.2004.12.003

4. Malina RM. Tracking of physical activity and physical fitness across the lifespan. *Res Q Exerc Sport*. 1996;67(3 Suppl):S48-57. doi:10.1080/02701367.1996.10608853

5. Tammelin T, Näyhä S, Laitinen J, Rintamäki H, Järvelin MR. Physical activity and social status in adolescence as predictors of physical inactivity in adulthood. *Prev Med (Baltim)*. 2003;37(4):375-381. doi:10.1016/S0091-7435(03)00162-2

6. Matton L, Thomis M, Wijndaele K, et al. Tracking of physical fitness and physical activity from youth to adulthood in females. *Med Sci Sports Exerc*. 2006;38(6):1114-1120. doi:10.1249/01.mss.0000222840.58767.40

7. Hayes G, Dowd KP, MacDonncha C, Donnelly AE. Tracking of Physical Activity and Sedentary Behavior From Adolescence to Young Adulthood: A Systematic Literature Review. *J Adolesc Health*. 2019;65(4):446-454. doi:10.1016/J.JADOHEALTH.2019.03.013

8. Werneck AO, Stubbs B, Kandola A, Hamer M, Silva DR. Prospective associations of different contexts of physical activity with psychological distress and well-being among middle-aged adults: An analysis of the 1970 British Cohort Study. *J Psychiatr Res*. 2021;140:15-21. doi:10.1016/J.JPSYCHIRES.2021.05.049

9. Aira T, Vasankari T, Heinonen OJ, et al. Physical activity from adolescence to young adulthood: patterns of change, and their associations with activity domains and sedentary time. *International Journal of Behavioral Nutrition and Physical Activity*. 2021;18(1):1-11. doi:10.1186/S12966-021-01130-X/TABLES/2

10. Vilhjalmsson R, Thorlindsson T. Factors related to physical activity: a study of adolescents. *Soc Sci Med*. 1998;47(5):665-675. doi:10.1016/S0277-9536(98)00143-9

11. Smith L, Gardner B, Aggio D, Hamer M. Association between participation in outdoor play and sport at 10 years old with physical activity in adulthood. *Prev Med (Baltim)*. 2015;74:31-35. doi:10.1016/J.YPMED.2015.02.004

12. Telama R. Tracking of physical activity from childhood to adulthood: a review. *Obes Facts*. 2009;2(3):187-195. doi:10.1159/000222244

13. Vanreusel B, Renson R, Beunen G, et al. A longitudinal study of youth sport participation and adherence to sport in adulthood. *http://dx.doi.org/101177/101269097032004003*. 2016;32(4):373-387. doi:10.1177/101269097032004003

14. Telama R, Yang X, Laakso L, Viikari J. Physical activity in childhood and adolescence as predictor of physical activity in young adulthood. *Am J Prev Med*. 13(4):317-323.

15. Malina RM. Physical activity and fitness: pathways from childhood to adulthood. *Am J Hum Biol*. 13(2):162-172. doi:10.1002/1520-6300(200102/03)13:2<162::AID-AJHB1025>3.0.CO;2-T

16. Curtis J, Mcteer W, White P. Exploring Effects of School Sport Experiences on Sport Participation in Later Life . *Kinesiology and Physical Education Faculty Publications*. 1999. https://scholars.wlu.ca/kppe_faculty/4. Accessed August 4, 2022.

17. Telama R, Yang X, Hirvensalo M, Raitakari O. Participation in Organized Youth Sport as a Predictor of Adult Physical Activity: A 21-Year Longitudinal Study. *Pediatr Exerc Sci*. 2006;18(1):76-88. doi:10.1123/PES.18.1.76

18. Shephard RJ, Trudeau F. The Legacy of Physical Education: Influences on Adult Lifestyle. *Pediatr Exerc Sci*. 2000;12(1):34-50. doi:10.1123/PES.12.1.34

19. Engström LM. Exercise adherence in sport for all from youth to adulthood. *Sport for all Proceedings of the World Congress on Sport for all, held in Tampere, Finland*. June 1990:473-`483. https://www.cabdirect.org/cabdirect/abstract/19931853579. Accessed August 4, 2022.

20. Palakshappa D, Virudachalam S, Oreskovic NM, Goodman E. Adolescent Physical Education Class Participation as a Predictor for Adult Physical Activity. *Child Obes*. 2015;11(5):616-623. doi:10.1089/CHI.2015.0024

21. Kjønniksen L, Torsheim T, Wold B. Tracking of leisure-time physical activity during adolescence and young adulthood: a 10-year longitudinal study. *Int J Behav Nutr Phys Act*. 2008;5:69. doi:10.1186/1479-5868-5-69

22. Faust L, Wang C, Hachen D, Lizardo O, Chawla N v. Physical Activity Trend eXtraction: A Framework for Extracting Moderate-Vigorous Physical Activity Trends From Wearable Fitness Tracker Data. *JMIR Mhealth Uhealth*. 2019;7(3):e11075. doi:10.2196/11075

23. Herman KM, Craig CL, Gauvin L, Katzmarzyk PT. Tracking of obesity and physical activity from childhood to adulthood: The Physical Activity Longitudinal Study. *International Journal of Pediatric Obesity*. 2009;4(4):281-288. doi:10.3109/17477160802596171

24. Yang X, Kukko T, Lounassalo I, et al. Organized Youth Sports Trajectories and Adult Health Outcomes: The Young Finns Study. *Am J Prev Med*. 2022;63(6):962-970. doi:10.1016/j.amepre.2022.06.018

25. Elliott J, Shepherd P. Cohort Profile: 1970 British Birth Cohort (BCS70). *Int J Epidemiol*. 2006;35(4):836-843. doi:10.1093/IJE/DYL174

26. Centre for Longitudinal Studies. BCS70 Age 46 Biomedical Sweep. Available at: https://cls.ucl.ac.uk/cls-studies/1970-british-cohort-study/bcs70-age46-biomedical-sweep/.

27. University of London, Institute of Education, Centre for Longitudinal Studies. 1970 British Cohort Study: Age 46, Sweep 10, 2016-2018. [data collection]. UK Data Service, 2021. DOI: 10.5255/UKDA-SN-8547-1.

28. Cooper R, Stamatakis E, Hamer M. Associations of sitting and physical activity with grip strength and balance in mid-life: 1970 British Cohort Study. *Scand J Med Sci Sports*. 2020;30(12):2371-2381. doi:10.1111/SMS.13793

29. Winkler EAH, Bodicoat DH, Healy GN, et al. Identifying adults' valid waking wear time by automated estimation in activPAL data collected with a 24 h wear protocol. *Physiol Meas*. 2016;37(10):1653-1668. doi:10.1088/0967-3334/37/10/1653

30. Senaratne N, Stubbs B, Werneck AO, Stamatakis E, Hamer M. Device-measured physical activity and sedentary behaviour in relation to mental wellbeing: An analysis of the 1970 British cohort study. *Prev Med (Baltim)*. 2021;145:106434. doi:10.1016/j.ypmed.2021.106434

31. Huang BH, Inan-Eroglu E, Hamer M, Stamatakis E. Joint associations of device-measured physical activity and sleep duration with cardiometabolic health in the 1970 British Cohort Study. *J Sci Med Sport*. 2020;23(12):1191-1196. doi:10.1016/J.JSAMS.2020.07.012

32. Tudor-Locke C, Ducharme SW, Aguiar EJ, et al. Walking cadence (steps/min) and intensity in 41 to 60-year-old adults: the CADENCE-adults study. *Int J Behav Nutr Phys Act*. 2020;17(1). doi:10.1186/S12966-020-01045-Z

33. Tudor-Locke C, Camhi SM, Leonardi C, et al. Patterns of adult stepping cadence in the 2005–2006 NHANES. *Prev Med (Baltim)*. 2011;53(3):178-181. doi:10.1016/J.YPMED.2011.06.004

34. Trost SG, Owen N, Bauman AE, Sallis JF, Brown W. Correlates of adults' participation in physical activity: review and update. *Med Sci Sports Exerc*. 2002;34(12):1996-2001. doi:10.1097/00005768-200212000-00020

35. Yang X, Telama R, Laakso L. Parents' Physical Activity, Socioeconomic Status and Education as Predictors of Physical Activity and Sport among Children and Youths - A 12-Year Follow-Up Study: *http://dx.doi.org/101177/101269029603100304*. 2016;31(3):273-291. doi:10.1177/101269029603100304

36. Gómez A, Conde A, Santana JM, Jorrín A. Diagnostic usefulness of brief versions of Alcohol Use Disorders Identification Test (AUDIT) for detecting hazardous drinkers in primary care settings. *J Stud Alcohol*. 2005;66(2):305-308. doi:10.15288/jsa.2005.66.305

37. Smith C. Measuring disability with European Union (EU) data harmonisation guidance – GSS. Government Statistical Service. https://gss.civilservice.gov.uk/policy-store/measuring-disability-with-eu-data/. Published 2019. Accessed August 7, 2022.

38. Rodgers B, Pickles A, Power C, Collishaw S, Maughan B. Validity of the Malaise Inventory in general population samples. *Soc Psychiatry Psychiatr Epidemiol*. 1999;34(6):333-341. doi:10.1007/S001270050153

39. Ploubidis GB, McElroy E, Moreira HC. A longitudinal examination of the measurement equivalence of mental health assessments in two British birth cohorts. *Longitudinal and Life Course Studies , 10 (4) pp 471-489 (2019)* . 2019;10(4):471-489. doi:10.1332/175795919X15683588979486

40. Rose D. Social Research Update 9: Official Social Classifications in the UK. Department of Sociology, University of Surrey. https://sru.soc.surrey.ac.uk/SRU9.html. Accessed August 10, 2022.

41. Royston P, White IR. Multiple Imputation by Chained Equations (MICE): Implementation in Stata. *J Stat Softw*. 2011;45(4):1-20. doi:10.18637/JSS.V045.I04

42. Little RJA, Rubin DB. Multiple Imputation for Nonresponse in Surveys, Classic Edition. 2004. https://www.wiley.com/en-us/Multiple+Imputation+for+Nonresponse+in+Surveys-p-9780471655749. Accessed October 18, 2022.

43. Tammelin T, Näyhä S, Hills AP, Järvelin MR. Adolescent participation in sports and adult physical activity. *Am J Prev Med*. 2003;24(1):22-28. doi:10.1016/s0749-3797(02)00575-5

44. Nelson MC, Gordon-Larsen P, Adair LS, Popkin BM. Adolescent physical activity and sedentary behavior: Patterning and long-term maintenance. *Am J Prev Med*. 2005;28(3):259-266. doi:10.1016/J.AMEPRE.2004.12.006

45. Kuh DJ, Cooper C. Physical activity at 36 years: patterns and childhood predictors in a longitudinal study. *J Epidemiol Community Health (1978)*. 1992;46(2):114-119. doi:10.1136/jech.46.2.114

46. Sallis JF, Zakarian JM, Hovell MF, Hofstetter CR. Ethnic, socioeconomic, and sex differences in physical activity among adolescents. *J Clin Epidemiol*. 1996;49(2):125-134. doi:10.1016/0895-4356(95)00514-5

47. Powell KE, Dysinger W. Childhood participation in organized school sports and physical education as precursors of adult physical activity. *Am J Prev Med*. 3(5):276-281.

48. Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. *Med Sci Sports Exerc*. 2000;32(5):963-975. doi:10.1097/00005768-200005000-00014

49. Taylor WC, Blair SN, Cummings SS, Wun CC, Malina RM. Childhood and adolescent physical activity patterns and adult physical activity. *Med Sci Sports Exerc*. 1999;31(1):118-123. doi:10.1097/00005768-199901000-00019

50. Pate RR, Small ML, Ross JG, Young JC, Flint KH, Warren CW. School physical education. *J Sch Health*. 1995;65(8):312-318. doi:10.1111/J.1746-1561.1995.TB03380.X

51. Reports of the Surgeon General. Physical Activity and Health: A Report of the Surgeon General - Profiles in Science. https://profiles.nlm.nih.gov/spotlight/nn/catalog/nlm:nlmuid-101584932X106-doc. Accessed August 4, 2022.

52. Dale D, Corbin C, Science TCPE, 1998 undefined. Can conceptual physical education promote physically active lifestyles? *researchgate.net*. https://www.researchgate.net/profile/Charles-Corbin-4/publication/234392676_Dale_D_Corbin_C_B_Cuddihy_T_F_1998_Can_conceptual_physical_education_promote_physically_active_lifestyles_Pediatric_Exercise_Science_Vol_10_97-109/links/623376d4446f4b075bfb4b6e/Dale-D-Corbin-C-B-Cuddihy-T-F-1998-Can-conceptual-physical-education-promote-physically-active-lifestyles-Pediatric-Exercise-Science-Vol-10-97-109.pdf. Accessed August 4, 2022.

53. Brynteson P, Adams TM. The Effects of Conceptually Based Physical Education Programs on Attitudes and Exercise Habits of College Alumni after 2 to 11 Years of Follow-Up. *http://dx.doi.org/101080/02701367199310608798*. 2013;64(2):208-212. doi:10.1080/02701367.1993.10608798

54. Sallis J, McKenzie T. Physical education's role in public health. *Res Q Exerc Sport*. 1991;62(2):124-137. doi:10.1080/02701367.1991.10608701

55. Watson ER, Sherrill A, Weicand B. Curriculum Development in a Worldwide School System. *http://dx.doi.org/101080/07303084199410606824*. 2013;65(1):17-20. doi:10.1080/07303084.1994.10606824

56. Tudor-Locke C, Schuna JM, Han H, et al. Step-Based Physical Activity Metrics and Cardiometabolic Risk. *Med Sci Sports Exerc*. 2017;49(2):283-291. doi:10.1249/MSS.0000000000001100

57. Green K. Physical Education and 'the Couch Potato Society'1 - Part One. *http://dx.doi.org/101080/1740898020070203*. 2006;7(2):95-107. doi:10.1080/1740898020070203

58. Tudor-Locke C, Brashear MM, Katzmarzyk PT, Johnson WD. Peak stepping cadence in free-living adults: 2005-2006 NHANES. *J Phys Act Health*. 2012;9(8):1125-1129. doi:10.1123/JPAH.9.8.1125

Table 1. Sample characteristics by sex: sport and physical activity measures at ages 16 and 46 (up to n=2,984)

	Male (up to n=1227)	**Female (up to n=1757)**	**p-value for difference**
AGE 16 MEASURES			
"Compared with others – I perform exercise" n (%)			
Much less	41 (4.1)	76 (5.2)	
Less	162 (16.4)	373 (25.3)	
About the same	319 (32.2)	552 (37.4)	<0.001
More	311 (31.4)	361 (24.4)	
Much more	158 (15.9)	115 (7.8)	
"I play sports at a sports club or sports centre" n (%)			
Rarely	320 (32.0)	800 (53.7)	
Less than once a week	183 (18.3)	304 (20.4)	<0.001
Once a week	224 (22.4)	242 (16.2)	
More than once a week	272 (27.2)	145 (9.7)	
"I play sports at a park playground or in the street" n (%)			
Rarely	433 (42.8)	1156 (77.1)	
Less than once a week	189 (18.7)	206 (13.7)	<0.001
Once a week	183 (18.1)	88 (5.9)	
More than once a week	206 (20.4)	49 (3.3)	
Total sport participation at school: n (%)[a]			
Q1 (0-3)	251 (26.3)	358 (25.8)	
Q2 (4-8)	278 (29.1)	421 (30.4)	0.79
Q3 (9-13)	212 (22.2)	287 (20.7)	
Q4 (14+)	215 (22.5)	321 (23.1)	
"Did you take any exercise last Saturday?" n (%)			
Yes	754 (66.1)	1044 (61.9)	0.02
No	386 (33.9)	644 (38.2)	
AGE 46 MEASURES			
Total activity time (mins/d), mean ±SD	122.4 ±43.9	118.0 ±40.4	<0.005
MVPA (mins/day), mean ± SD	52.4 ±27.1	52.7 ±24.7	0.83

SD: Standard Deviation, MVPA: moderate-vigorous physical activity

[a] Participants were provided with a list of 35 sports. The sport was assigned a score of 0 if never practiced, a score of 1 if performed at least once a month and a score of 2 if performed at least once a week. This gave a total possible score ranging from 0 to 70, participant scores were then divided into quartiles.

N.B. Percentages may not add up to 100% due to rounding of values to one decimal point

Table 2. Sample Characteristics by sex: health, psycho-social factors and wear time (up to n=2,984)

	Male (up to n=1227)	**Female (up to n=1757)**	**p-value**
HEALTH FACTORS			
BMI, mean ± SD	28.3 ±4.7	28.0 ±6.2	0.07
Smoking, n (%)			
Non smoker	665 (54.2)	973 (55.4)	
Ex-smoker	378 (30.8)	522 (29.7)	0.79
Smoker	184 (15.0)	262 (14.9)	
Alcohol consumption, n (%)			
Non-drinker	91 (6.9)	176 (10.1)	
Unproblematic drinker (AUDIT: 1-4)	794 (65.9)	1322 (75.5)	<0.001
Problematic drinker (AUDIT: 5+)	340 (27.3)	254 (14.5)	
EU-SILC Disability Classification, n (%)			
None	1095 (89.2)	1448 (82.5)	
Limited to some extent	94 (7.7)	226 (12.9)	<0.001
Severely hampered	38 (3.1)	82 (4.7)	
Self-reported health, n (%)			
Poor	32 (2.6)	61 (3.5)	
Fair	145 (11.8)	184 (10.5)	
Good	316 (25.8)	448 (25.5)	0.27
Very Good	492 (40.1)	677 (38.5)	
Excellent	242 (19.7)	387 (22.0)	
SOCIAL AND PSYCHOLOGICAL FACTORS			
Father's Social Class, n (%)			
Professional or Managerial	465 (39.5)	647 (38.5)	
Skilled worker (manual/non-manual)	577 (49.0)	832 (49.5)	0.84
Partly skilled or unskilled worker	135 (11.5)	201 (12.0)	
Highest Academic Qualification, n (%)			
None	249 (20.5)	315 (18.1)	
Up to A-levels or diploma	525 (43.1)	839 (48.1)	0.03
Degree or higher	443 (36.4)	590 (33.8)	
Malaise Score, n (%)			
Low (0-3)	1013 (85.3)	1409 (83.0)	0.1
High (4+)	174 (14.7)	288 (17.0)	
Wear time (hours/day), mean ± SD	16.0 ±1.2	15.7 ±1.2	<0.001

BMI: Body Mass Index, SD: Standard Deviation, AUDIT: Alcohol Use Disorder Identification Test, EU-SILC: European Statistics of Income and Living Conditions

N.B. Percentages may not add up to 100% due to rounding of values to one decimal point

Table 3: Regression models of the association between different contexts of sport and exercise at age 16 with total PA at age 46

	Differences in total activity time over the day (mins/day) at age 46 [coefficient (95% CI)]			
Age 16 exercise/sports indicator	**Model 1:** Adjusted for sex and wear time	**Model 2:** adjusted for sex, wear time and health factors[a]	**Model 3:** adjusted for sex, wear time and psycho-social factors[b]	**Model 4:** adjusted for sex, wear time, health[a] and psycho-social[b] factors
"Compared with others – I perform exercise" (n=2468)				
Much less	REF	REF	REF	REF
Less	1.3 (-6.8, 9.5)	1.0 (-6.8, 8.9)	1.6 (-6.5, 9.7)	1.6 (-6.2, 9.4)
About the same	3.6 (-4.3, 11.5)	2.7 (-4.8, 10.3)	3.6 (-4.3, 11.4)	3.5 (-4.0, 11.1)
More	7.8 (-0.2, 15.8)	5.3 (-2.4, 13.0)	7.3 (-0.7, 15.3)	5.9 (-1.9, 13.6)
Much more	9.3 (0.4, 18.2)	7.9 (-0.7, 16.4)	9.0 (0.1, 17.9)	8.6 (-0.01, 17.1)
"I play sports at a sports club or sports centre" (n=2490)				
Rarely	REF	REF	REF	REF
Less than once a week	-0.4 (-4.7, 4.0)	-1.7 (-5.9, 2.4)	-0.5 (-4.8, 3.9)	-0.9 (-5.1, 3.2)
Once a week	1.5 (-2.9, 6.0)	-0.8 (-5.1, 3.5)	1.0 (-3.5, 5.5)	-0.1 (-4.4, 4.2)
More than once a week	2.5 (-2.3, 7.2)	2.9 (-1.7, 7.4)	2.5 (-2.2, 7.3)	3.9 (-0.7, 8.5)
"I play sports at a park playground or in the street" (n=2510)				
Rarely	REF	REF	REF	REF
Less than once a week	2.5 (-2.0, 7.1)	2.1 (-2.6, 6.8)	2.5 (-2.1, 7.0)	2.4 (-1.9, 6.8)
Once a week	1.5 (-4.0, 7.0)	4.2 (-1.2, 9.7)	1.6 (-3.8, 7.1)	2.2 (-3.0, 7.4)
More than once a week	5.7 (-0.05, 11.4)	11.2 (5.4, 17.0)	5.7 (-0.03, 11.4)	8.5 (3.0, 14.0)
Total sport participation at school (n=2343)				
Q1 (0-4)	REF	REF	REF	REF
Q2 (4-8)	1.3 (-3.2, 5.9)	-0.1 (-4.5, 4.3)	1.3 (-3.2, 5.8)	0.6 (-3.7, 5.0)
Q3 (9-13)	2.3 (-2.6, 7.2)	1.4 (-3.4, 6.1)	2.1 (-2.9, 7.0)	2.0 (-2.7, 6.8)
Q4 (14-70)	-2.4 (-7.3, 2.4)	-2.1 (-6.8, 2.5)	-2.4 (-7.3, 2.4)	-1.8 (-6.5, 2.8)
"Did you take any exercise last Saturday?" (n=2828)				
No	REF	REF	REF	REF
Yes	3.6 (0.4, 6.8)	3.4 (0.4, 6.5)	3.6 (0.2, 6.6)	3.8 (0.7, 6.9)

[a] Health factors include: BMI, smoking status, alcohol consumption, disability classification and self-rated health.

[b] Psycho-social factors include: Malaise score, father's social class, highest academic qualification

Table 4: Regression models of the association between different contexts of sport and exercise at age 16 with MVPA at age 46

	Differences in total activity time over the day (mins/day) at age 46 [coefficient (95% CI)]			
Age 16 exercise/sports indicator	**Model 1:** Adjusted for sex and wear time	**Model 2:** adjusted for sex, wear time and health factors[a]	**Model 3:** adjusted for sex, wear time and psycho-social factors[b]	**Model 4:** adjusted for sex, wear time, health[a] and psycho-social[b] factors
"Compared with others – I perform exercise" (n=2468)				
Much less	REF	REF	REF	REF
Less	0.1 (-5.1, 5.4)	-0.2 (-5.2, 4.8)	-0.1 (-5.3, 5.1)	-0.3 (-5.3, 4.7)
About the same	1.3 (-3.7, 6.4)	0.5 (-4.4, 5.3)	0.7 (-4.4, 5.7)	0.3 (-4.5, 5.2)
More	3.5 (-1.6, 8.7)	1.5 (-3.4, 6.4)	2.6 (-2.5, 7.8)	1.4 (-3.5, 6.3)
Much more	4.7 (-1.0, 10.3)	2.9 (-2.5, 8.3)	3.7 (-1.9, 9.4)	2.7 (-2.7, 8.1)
"I play sports at a sports club or sports centre" (n=2490)				
Rarely	REF	REF	REF	REF
Less than once a week	0.9 (-1.9, 3.7)	-0.3 (-3.0, 2.3)	0.1 (-2.7, 3.0)	-0.4 (-3.1, 2.3)
Once a week	1.9 (-1.0, 4.8)	-0.03 (-2.8, 2.7)	0.8 (-2.1, 3.7)	-0.2 (-3.0, 2.6)
More than once a week	0.5 (-2.6, 3.6)	0.2 (-2.8, 3.1)	-0.3 (-3.4, 2.8)	0.1 (-2.8, 3.0)
"I play sports at a park playground or in the street" (n=2510)				
Rarely	REF	REF	REF	REF
Less than once a week	1.4 (-1.5, 4.4)	1.0 (-1.9, 3.8)	1.3 (-1.7, 4.2)	1.0 (-1.8, 3.8)
Once a week	-1.1 (-4.7, 2.4)	-0.7 (-4.1, 2.6)	-1.1 (-4.6, 2.4)	-0.6 (-4.0, 2.8)
More than once a week	1.3 (-2.4, 5.0)	3.0 (-0.5, 6.5)	1.9 (-1.8, 5.6)	3.2 (-0.3, 6.8)
Total sport participation at school (n=2343)				
Q1 (0-4)	REF	REF	REF	REF
Q2 (4-8)	0.7 (-2.3, 3.6)	-0.3 (-3.1, 2.4)	-0.03 (-3.0, 2.9)	-0.4 (-3.2, 2.4)
Q3 (9-13)	2.4 (-0.8, 5.6)	1.4 (-1.6, 4.4)	1.7 (-1.5, 4.9)	1.4 (-1.7, 4.4)
Q4 (14-70)	-0.2 (-3.3, 3.0)	-0.1 (-3.1, 2.8)	-0.4 (-3.5, 2.8)	-0.1 (-3.1, 2.9)
"Did you take any exercise last Saturday?" (n=2828)				
No	REF	REF	REF	REF
Yes	1.2 (-0.8, 3.3)	1.0 (-1.0, 3.0)	0.8 (-1.3, 2.9)	0.9 (-1.0, 2.9)

[a] Health factors include: BMI, smoking status, alcohol consumption, disability classification and self-rated health.

[b] Psycho-social factors include: Malaise score, father's social class, highest academic qualification

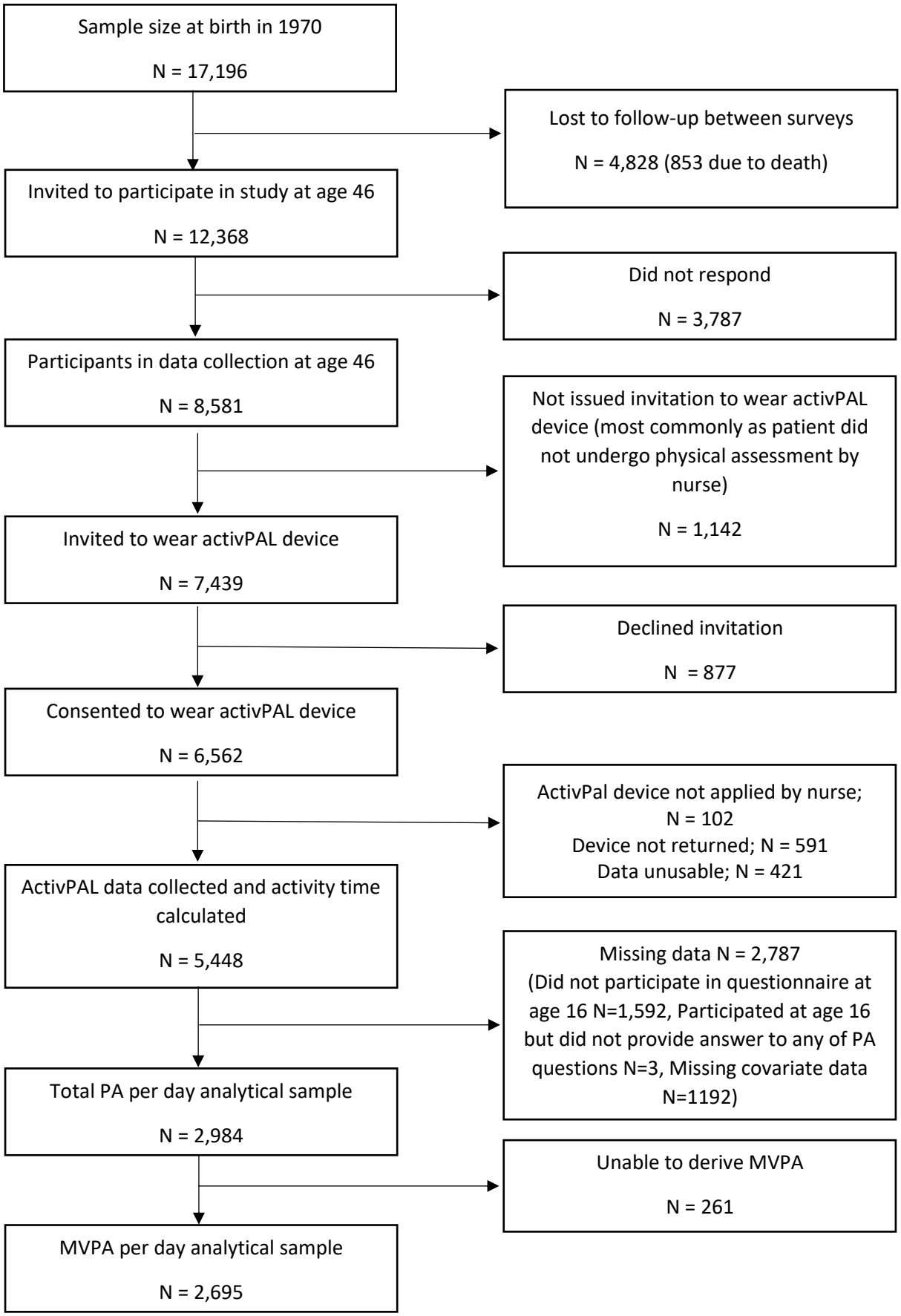

Figure 1. Participation flow diagram describing sample size and reasons for exclusion at age 46 and 16

SUPPLEMENTAL FILES

Supplemental Table 1. Age 16 survey question on sport participation in school

	During the past year which of the following sports did you play when they were in season and how often? In school:	
Team Activities	At least once a week	At least once a month
Baseball		
Basketball		
Cricket		
Football		
Hockey		
Netball		
Rounders		
Rugby		
Volleyball		
Other (please state)		
Individual Activities		
Aerobics		
Track/field events		
Badminton		
Canoeing		
Cross-country		
Cycling		
Dancing		
Gymnastics		
Horse Riding		
Jogging		
Fitness exercises		
Motorcycling		
Roller or ice-skating		
Rowing		
Sailing		
Scrambling		
Skiing		
Squash		
Swimming		
Table Tennis		
Tennis		
Walking		
Water-skiing		
Weight-training		
Wind-surfing		
Other (please state)		

Supplemental Table 2. Mean resting heart rate across each indicator of age 16 sport or exercise (to indicate reliability of the measure)

	Resting heart rate, mean±SD	Mean difference between lowest and highest group (95% CI)
"Compared with others – I perform exercise"		
Much less	74.8±9.2	
Less	74.8±10.4	
About the same	73.7±9.3	3.7 (1.9, 5.6)
More	72.8±10.0	
Much more	71.1±9.8	
"I play sports at a sports club or sports centre"		
Rarely	74.5±9.8	
Less than once a week	73.5±9.3	3.8 (2.8, 4.8)
Once a week	72.9±9.7	
More than once a week	70.7±9.9	
"I play sports at a park playground or in the street"		
Rarely	74.0±9.6	
Less than once a week	73.2±9.8	2.9 (1.8,4.0)
Once a week	72.3±9.9	
More than once a week	71.1±10.4	
Total sport participation at school		
Q1 (0-3)	74.5±9.9	
Q2 (4-8)	73.3±9.6	1.8 (0.8, 2.9)
Q3 (9-13)	72.9±9.6	
Q4 (14+)	72.7±10.1	
"Did you take any exercise last Saturday?"		
Yes	73.0±9.8	-1.46 (-21.13, -0.79)
No	74.4±9.7	

Supplemental Table 3. Characteristics of included vs non-included participants

	Analytical sample (up to n=2984)	**Participated at age 46; no accelerometer data** (up to n=3012)	**Participated at age 16; did not participate at age 46** (up to n=4871)	**P-value**
SEX, n(%) Female	1 755 (58.8)	1174 (51.6)	2232 (45.8)	<0.001
Male	1 229 (41.2)	1103 (48.4)	2639 (54.2)	
AGE 16 SPORT AND EXERCISE PARTICIPATION				
"Compared with others – I perform exercise" n (%)				
Much less	117 (4.7)	78 (7.2)	124 (6.7)	
Less	535 (21.7)	206 (19.1)	358 (19.2)	
About the same	871 (35.3)	422 (39.2)	647 (34.7)	<0.001
More	672 (27.2)	255 (23.7)	489 (26.2)	
Much more	273 (11.1)	117 (10.9)	248 (13.3)	
"I play sports at a sports club or sports centre" n (%)				
Rarely	1120 (45.0)	497 (45.8)	873 (46.2)	
Less than once a week	487 (19.6)	235 (21.7)	336 (17.8)	0.02
Once a week	466 (18.7)	180 (16.6)	317 (16.8)	
More than once a week	417 (16.8)	173 (15.9)	365 (19.3)	
"I play sports at a park playground or in the street" n (%)				
Rarely	1589 (63.3)	677 (62.3)	1148 (60.0)	
Less than once a week	395 (15.7)	177 (16.3)	301 (15.7)	0.01
Once a week	271 (10.8)	96 (8.8)	205 (10.7)	
More than once a week	255 (10.2)	136 (12.5)	258 (13.5)	
Total sport participation at school: n (%)[a]				
Q1 (0-3)	609 (26.0)	289 (27.4)	531 (28.4)	
Q2 (4-8)	699 (29.8)	302 (28.7)	515 (27.6)	0.12
Q3 (9-13)	499 (21.3)	196 (18.6)	359 (19.2)	
Q4 (14+)	536 (22.9)	267 (25.3)	463 (24.8)	
"Did you take any exercise last Saturday?" n (%)				
Yes	1798 (63.6)	771 (62.1)	1335 (61.3)	0.24
No	1030 (36.4)	470 (37.9)	843 (38.7)	
AGE 46 HEALTH FACTORS				
BMI, mean ± SD	28.1±5.7	29.2±6.5	-	<0.001
Smoking, n (%)				
Non smoker	1638 (54.9)	1331 (44.2)	-	
Ex-smoker	900 (30.2)	903 (30.0)	-	<0.001
Smoker	446 (15.0)	775 (25.8)	-	
Alcohol consumption, n (%)				
Non-drinker	267 (9.0)	426 (14.4)	-	
Unproblematic drinker (AUDIT: 1-4)	2116 (71.1)	1781 (60.4)	-	<0.001
Problematic drinker (AUDIT: 5+)	594 (20.0)	743 (25.2)	-	
EU-SILC Disability Classification, n (%)				
None	2543 (85.3)	2362 (78.6)	-	
Limited to some extent	320 (10.7)	349 (11.6)	-	<0.001
Severely hampered	120 (4.0)	296 (9.8)	-	
Self-reported health, n (%)				
Poor	93 (3.1)	265 (8.8)	-	

	Analytical sample (up to n=2984)	**Participated at age 46; no accelerometer data** (up to n=3012)	**Participated at age 16; did not participate at age 46** (up to n=4871)	**P-value**
Fair	329 (11.0)	489 (16.3)	-	
Good	764 (25.6)	915 (30.4)	-	<0.001
Very Good	1169 (39.2)	918 (30.5)	-	
Excellent	629 (21.1)	420 (14.0)	-	
SOCIAL AND PSYCHOLOGICAL FACTORS				
Age 16 Father's Social Class, n (%)				
Professional or Managerial	1112 (39.0)	814 (31.1)	1147 (26.9)	
Skilled worker (manual/non-manual)	1409 (49.3)	1359 (51.8)	2315 (54.2)	<0.001
Partly skilled or unskilled worker	336 (11.8)	449 (17.1)	810 (19.0)	
Age 46 Highest Academic Qualification, n (%)				
None	564 (19.1)	991 (33.6)	-	
Up to A-levels or diploma	1364 (46.1)	1301 (44.1)	-	<0.001
Degree or higher	1033 (34.9)	657 (22.3)	-	
Age 46 Malaise Score, n (%)				
Low (0-3)	2422 (84.0)	1920 (77.3)	-	<0.001
High (4+)	462 (16.0)	565 (22.7)	-	

BMI: Body Mass Index, SD: Standard Deviation, AUDIT: Alcohol Use Disorder Identification Test, EU-SILC: European Statistics of Income and Living Conditions

N.B. Percentages may not add up to 100% due to rounding of values to one decimal point