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Physical activity across age and study: a guide to data in six CLOSER studies

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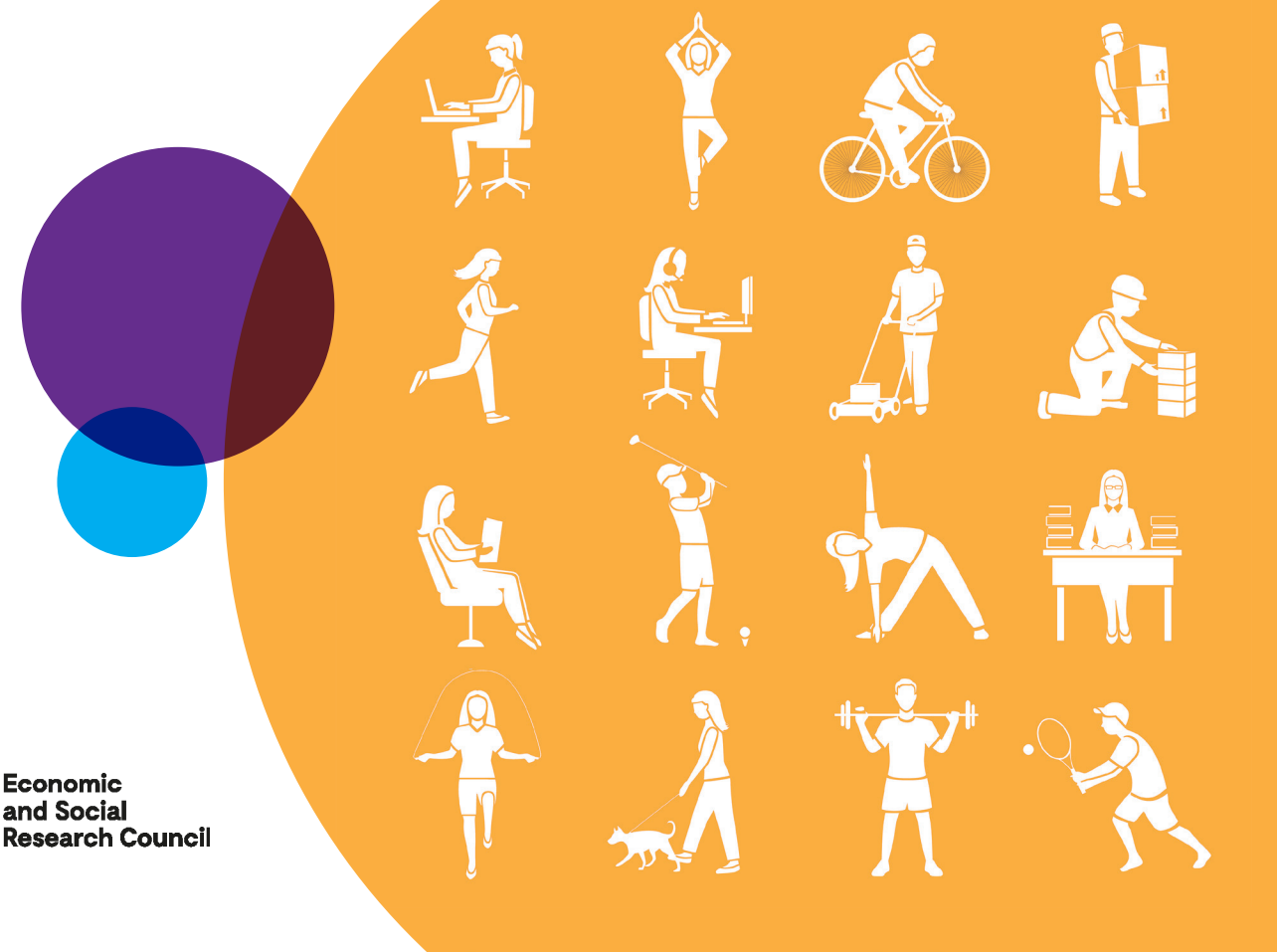

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Preface

CLOSER (Cohort & Longitudinal Studies Enhancement Resources) aims to maximise the use, value and impact of longitudinal studies, both at home and abroad. Bringing together eight leading studies, the British Library and the UK Data Service, CLOSER works to stimulate interdisciplinary research, develop shared resources, provide training, and share expertise. In this way CLOSER is helping to build the body of knowledge on how life in the UK is changing – both across generations and in comparison to the rest of the world.

CLOSER's research includes a number of work packages focused on retrospective harmonisation, their aim being to make the data from different longitudinal studies more comparable in order to find out how life in the UK is changing from generation to generation. This documentation is a meta-data guide produced as part of a CLOSER harmonisation work package.

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1. Introduction

1.1 Objective and outline of guide

Physical activity has an important role to play in addressing two of the most important public health challenges of modern times: the rising prevalence of obesity [1-3] and population ageing [4, 5]. Over 60 years, compelling research evidence has been accrued, demonstrating physical activity's myriad health benefits [6, 7]. More recently, evidence has also highlighted the adverse health consequences of sedentary behaviour [8].

Longitudinal studies are a valuable resource and many have measured physical activity. This project utilises data from six CLOSER partner studies to identify all measures of physical activity and sedentary behaviour available within each study, document these, and indicate possibilities for harmonisation. The studies are:

- MRC National Survey of Health and Development (NSHD)
- National Child Development Study (NCDS)
- 1970 British Cohort Study (BCS70)
- Avon Longitudinal Study of Parents and Children (ALSPAC)
- Millennium Cohort Study (MCS), and
- Understanding Society: The UK Household Longitudinal Study (UKHLS).

This guide will be structured in the following way. First the concept of physical activity is defined and its application in research outlined, including a literature review of the key domains of physical activity in relation to various health outcomes. Examples of the use of CLOSER longitudinal data in examining physical activity are provided. Next, each of the CLOSER studies included in this project are outlined in terms of their measurement of physical activity in the following domains: leisure time, occupational activity, active travel, domestic activities, and sedentary behaviours. Details regarding all measures of physical activity identified in this guide are presented in the searchable electronic appendix. The final section of the guide then describes and discusses the potential for cross-study

comparability in each physical activity domain. Overall, this guide is intended to be a helpful resource which future researchers can both utilise and build upon.

This guide focuses on self-reported measures of physical activity, as these are most commonly ascertained. However, we have documented the objective measures that are available in each study and the relevant sweeps.

1.2 Brief overview of Cohort and Longitudinal Studies Enhancement Resources (CLOSER)

Cohort and Longitudinal Studies Enhancement Resources (CLOSER) is a consortium of UK-based longitudinal studies, currently funded by the Economic and Social Research Council (ESRC). CLOSER aims to maximise the use, value and impact of longitudinal studies in the UK. CLOSER was formed in 2012, bringing together world-leading longitudinal studies, the British Library and the UK Data Service, to stimulate interdisciplinary longitudinal research, develop shared resources, provide training and share expertise.

In September 2020, CLOSER expanded its partnership from 8 to 19 UK-based longitudinal studies as part of a first round of expansion. The work carried out to produce this guide was completed prior to the expansion.

CLOSER is working to bring longitudinal data together in a consistent format, using data harmonisation. This process allows researchers to co-analyse and compare data from different studies, revealing how cohorts differ and how the population changes over time. Additionally, CLOSER are leading research to link data held by government to survey data collected by longitudinal studies. Linking this data enables researchers to gain rich insights into how different aspects of people's lives interrelate. CLOSER Discovery enables researchers to search and browse questionnaires and data from the UK's leading longitudinal studies to find out what data are available. CLOSER provides training and capacity building opportunities for new and experienced researchers and those running longitudinal studies. The CLOSER Learning Hub has information and resources aimed at those in academia, government and the third sector who are new to longitudinal studies,

to help them better understand the value of the studies and how to use the data. Furthermore, CLOSER fund research projects that use longitudinal data to investigate a wide range of areas of interest, including obesity, physical activity, mental health, and ageing. Finally, CLOSER is working to achieve the greatest possible impact for outputs and activities by influencing government, producing longitudinal resources for the academic community and funding research that addresses the biomedical, social, economic and environmental challenges facing the UK.

2. Physical activity

2.1 General definitions and overview

Physical activity refers to any "bodily movement produced by skeletal muscles that results in energy expenditure" (p126) [9]. While physical activity can be broadly conceptualised in terms of energy expenditure, the goal of research is often to understand and measure various qualitative and quantitative aspects of physical activity [10]. For example, a study may wish to compare the health benefits of physical activity derived from work versus during leisure time. Such contextual information can be useful for identifying the most suitable domains to focus on to promote physical activity. Another study might be interested in determining the optimal type, frequency, intensity, and duration of physical activity to develop an intervention. Understanding these aspects of physical activity are of particular importance for estimating physical activity energy expenditure and understanding physical activity within the context of cardiometabolic health [11].

The study of physical activity has given rise to several subfields of research, the most recent of which is sedentary behaviour. Sedentary behaviour refers to any behaviour where the body expends less than 1.5 metabolic equivalents (METs) of energy, such as sitting or lying down [12]. Another example includes the study of exercise science. Exercise is a subset of physical activity that involves structured forms of activity that are routinely repeated to improve or maintain physical fitness [9]. The range of methods for conceptualising physical activity make it a diverse and complex field of study.

2.2 Importance in epidemiology and other disciplines

In epidemiological research, the relationship between physical activity and disease has been well-established for many years. In 1953, Morris *et al.* demonstrated that those people in physically inactive professions such as bus drivers and telephonists, had a higher incidence of coronary heart disease than their peers with physically active jobs, such as bus conductors and postmen [13]. Since these landmark findings, a series of prospective longitudinal studies have found a consistent relationship between physical activity and the incidence of cardiovascular disease and various cardiovascular risk factors, such as blood pressure and obesity [14-17]. Findings from prospective longitudinal studies have also demonstrated that physical activity levels are related to the incidence of several other major non-communicable diseases, such as diabetes and multiple forms of cancer [17-19], regular exercise is associated with muscular skeletal benefits and promotes healthy ageing of muscle [20, 21]. Furthermore, the importance of physical activity appears to extend beyond physical health, with prospective evidence suggesting an association with the risk of various neurological and psychiatric conditions, including dementia, depression and anxiety disorders [22-24].

Physical activity is measurable at a population-level and its relationship with such a broad range of outcomes makes the quantification of physical activity an important goal. Importantly, physical activity is a modifiable behaviour. Through a range of informational, social and behavioural approaches, it is possible to increase physical activity levels in people of different ages, social groups, countries and communities [25]. The consequences of promoting physical activity at a population level are significant. One report estimates that decreasing physical inactivity by 25% worldwide would prevent 1.3 million deaths each year [19]. We may also investigate causal associations of physical activity on health outcomes using emerging analysis approaches, such as bi-directional causal modelling (e.g. Mendelian randomisation) [26]. The collection of population-level physical activity data will continue to play an important role in understanding and

reducing the global burden of disease so we can chart changes by age (within individuals), period, and longitudinal study.

2.3 Physical activity domains

2.3.1 Leisure time physical activity

Leisure time physical activity includes any form of activity undertaken during leisure (non-work) time, such as exercise. Leisure time physical activity only accounts for an estimated 5-10% of total energy expenditure [27, 28], but it has been the predominant focus of epidemiological research [29, 30]. There is a particular public health interest in leisure time physical activity due to the assumption that individuals have greater autonomy over their activity levels during leisure time and such activities may improve cardiorespiratory fitness [31].

Prospective studies have found that greater levels of participation in leisure time physical activity is associated with a longer lifespan [32-34] and a lower prevalence of chronic diseases including cardiovascular disease, type-2 diabetes and multiple cancers [14, 35-38]. Further, evidence suggests that even relatively low levels of participation in leisure time physical activity may have substantial health benefits. For example, one study estimates that engaging in the equivalent of 75 minutes of brisk walking per week could increase life expectancy by 1.8 years in those aged over 40 years old, compared with no activity [33]. Engaging in more regular moderate-to-high intensity activity can improve cardiorespiratory fitness, which may have additional, independent benefits for cardiovascular health [39-41]. Cultural and socioeconomic factors may also affect leisure time physical activity. For example, leisure time physical activity has been reported to increase with age after retirement in China, but not in other countries such as Australia [42]. People with higher levels of socioeconomic position tend to report higher levels of leisure time physical activity than those with lower socioeconomic position [43].

2.3.2 Occupational activity

Occupational activity refers to any activity related to employment and may—depending on the job role—contribute substantial fractions of daily activity [27]. Early epidemiological studies examining links with health outcomes focussed on occupational activity [13], but attention shifted away following societal changes, such as increasing automation in the workplace. Recently, there has been a renewed interest in occupational activity on the back of growing concerns about sedentary behaviour, particularly in the workplace [44].

Most physical activity guidelines focus on promoting physical activity regardless of the domain, but the relationship between occupational activity and health is contentious. Certain aspects of occupational activity may not be conducive to health benefits as it can be of an insufficient intensity, over long durations without sufficient recovery periods, and involve heavy lifting or improper posture [45]. Some longitudinal studies have found that moderate-to-high levels of occupational activity have a weak association with increased cardiovascular risk [36] or increased risk of long-term sickness from work [46]. Such results could however be attributable to confounding by common causes of both highly active occupations and ill health [47, 48]. However, most studies find a dose-response relationship between all physical activity and positive health outcomes irrespective of activity domain [18, 34, 49]. Prospective studies have mostly found that high versus low occupational activity is associated with a lower risk of chronic disease, including type 2 diabetes, cardiovascular disease, cancers and all-cause mortality [14, 34, 35, 50]. While the impact of high occupational activity levels on health are unclear, there are growing concerns about the health impact of sedentary behaviour [51]. There has been a well-documented rise in sedentary behaviour in the workplace of developed nations [51]. In the UK for example, those in office-based jobs spend between 65-75% of their working hours sitting down [52, 53]. Research underlying the health concerns with sedentary behaviour are discussed below.

2.3.3 Active travel

Active travel generally refers to physical activity-based travel that is not for the purpose of leisure, such as cycling or walking to work. Engagement in active travel appears to have declined in recent years [54]. Data from Understanding Society suggest that 15% of participants who were currently employed and travelled for work engage in active travel to work from 2009 to 2011 [55].

Active travel is increasingly promoted as a potential method of increasing total physical activity [27], with several reported links to health outcomes [56]. Prospective studies suggest that active travel could reduce the risk of type 2 diabetes, cardiovascular disease, hypertension, and all-cause mortality [57, 58]. While there may be some additional risks associated with active travel, such as air pollution exposure [59], these are likely to be outweighed by the health benefits [56]. However, this is a relatively new area of research and as such there remains uncertainty in the links between active travel and health outcomes.

2.3.4 Domestic activity

Domestic activities, such as cleaning and gardening, also contribute towards total physical activity levels, and women and older adults spend a greater proportion of time in domestic activities [60]. Promoting engagement in physically demanding domestic activities are another potential method of increasing total physical activity levels in the population. One cross-sectional study in the UK estimates that domestic activity accounts for 35.6% of all daily moderate-to-vigorous physical activity [60]. However, similar to occupational activity, it is unclear whether domestic activity is associated with increased health. There is some evidence for links between higher domestic activity and reduced premature cardiovascular disease and all-cause premature mortality risk [61, 62], yet some studies report null findings [63]. A meta-analysis of prospective studies found that physical activity of daily living was associated with a lower risk of all-cause mortality [34]. However, this definition of daily living does include domestic activities as well as others such as active travel.

2.3.5 Sedentary behaviours

Early work by Morris *et al*. (1953) and the series of studies that followed it were important for highlighting the prominent role of physical activity in preventing poor health. Much of this attention has been attributed to the promotion of moderate-to-vigorous physical activity, but the rise of interest in sedentary behaviour is a relatively new area in public health. There is evidence from prospective studies to suggest that sedentary behaviour is associated with a range of adverse health outcomes, including an increased risk of cardiovascular disease, type-2 diabetes and all-cause mortality [17, 44, 64, 65]. Concerns about sedentary behaviour stem from its pervasiveness in modern lifestyles. Sedentary behaviours that include prolonged periods in a sitting, reclining or lying posture now make up a large proportion of daily life for many people, such as watching television or using a computer [66]. Such behaviours are major contributors to the rise in sedentary behaviour [67, 68] and are spread across several activity domains, including leisure time and occupational activity [44, 69]. Worryingly, some evidence suggests that the adverse health impact of sedentary behaviour may be independent of total physical activity levels or time spent in moderate-to-vigorous activity [64, 65, 70]. There is also a strong social gradient in sedentary behaviour, with a higher prevalence amongst socioeconomically disadvantaged groups [71].

In a global action plan to tackle non-communicable diseases, member states of the World Health Organisation (WHO) agreed to seek to reduce sedentary behaviour by 10% between 2013 and 2025 [72]. Despite this agreement, a 2018 report including 1.9 million participants from 168 countries suggest that sedentary behaviour has been stable between 2001 and 2016 at around 28.5% [73].

3. Data collection methods

Physical activity can be measured by self-report and/or objectively. In practice, both are likely to provide complementary value to large-scale studies. The common methods for data collections are outlined below.

3.1 Self-report

Self-report physical activity questionnaires have been a staple of population-based research for many decades due to their practicality and low-cost [74]. A variety of self-report questionnaires exist with some focussing on assessing recent physical activity trends and others that attempt to classify lifetime activity levels [11]. The International Physical Activity Questionnaire (IPAQ) is the most widely used self-report method [75]. It contains 31 questions (9 in the short-form version) on how much time people spend sitting, in light activity (e.g. walking), moderate activity (e.g. leisure cycling), and vigorous activity (e.g. running). The reference period is either the past seven days, or in a typical week. Scores on the IPAQ can then be used to estimate total energy expenditure, via converted activities to metabolic equivalents (METs).

Self-report questionnaires have some advantages that extend beyond their practicability, such as their capacity to record the context and perceived intensity of physical activity [74]. For example, by using self-report questionnaires it is possible to categorise physical activity into different domains, which can be used to better understand and promote physical activity behaviour. There are also concerns relating to the reliability of self-report questionnaires; several studies have found large differences between self-reported and objectively measured physical activity [40, 76]. While such differences are commonly attributable to reporting biases in self-reported data, they may also be due to methodological differences between the two measures. Indeed, some self-reported measures correlate highly with directly observed measures [77].

3.2 Accelerometers

Accelerometers are small electromechanical devices that allow for the objective measurement of physical activity [78]. Accelerometers are usually worn on the hip, wrist or chest and detect incidences of acceleration that are interpreted as bodily movements. Incidences of acceleration are recorded as ‘counts’. The number of counts that are recorded over a pre-specified time epoch, usually one minute, can be used to determine

the intensity of activity. Accelerometers are validated with a moderate-to-strong correlation with direct measures of oxygen consumption, such as doubly labelled water and calorimetry [79]. Modern triaxial accelerometers, such as the ActiGraph GT3X+, can record activity across three directional planes and are strongly correlated with direct measures of oxygen consumption, such as gas analysis [80]. Additionally, GPS accelerometery tracking records movement and position in the world, called 'inertia measurements'. Using these measurements, the tracker can calculate the position and moving pattern [81]. However, the use of these is limited due to governance and ethical reasons.

Accelerometers can be expensive for large-scale studies, but the cost per unit is falling, particularly with the rise in commercial grade accelerometers that also perform well against direct measures of oxygen consumption [82]. However, methods of processing and analysing accelerometer data are highly variable and the devices remain poor at estimating non-ambulatory activities, such as cycling or weight lifting [74].

4. Physical activity in CLOSER studies

The range of physical activity measures available in the CLOSER longitudinal studies have allowed studies to pursue a diversity of research questions. Several studies have sought to quantify physical activity levels in the studies to estimate broader trends in the UK population. For example, findings have been used to suggest that just half of UK children are achieving national physical activity guidelines [83] and physical activity in older adults is generally low [84, 85]. Other studies have used the data to characterise changes in activity patterns over time [86] or clustering of physical activity with other health behaviours [87]. Some studies have identified early life factors that are associated with physical activity engagement in later life, such as coordination and motor control or institutional care [88, 89]. Other studies have used this data to investigate the associations of physical activity with health-related outcomes such as body composition [90], cognitive decline [93] depression, [92] and frailty [91].

4.1. Developing an inventory of physical activity measures in CLOSER studies: inclusion and exclusion criteria

In order to provide an overview of the measures of physical activity available in the longitudinal studies it was necessary to systematically search all available data collections via original questionnaires. Measures were recorded on a spreadsheet, noting the study, sweep, year, age of study member, subject, informant, administrator, data collection method, questionnaire, question, response scale, physical activity domain, and whether it captured frequency, duration, and/or intensity. Since we identified physical activity variables by manually checking available questionnaires from each study, variables subsequently derived were not included.

This guide includes multiple measures of physical activity. These are categorised where possible into leisure time, occupational, active travel, and domestic domains.

Physical activity measures were included if they reported frequency, duration, and/or intensity of activity. We also include measures of sedentary behaviour (e.g. time spent watching TV). Data included in this guide is from completed data collection sweeps up to July 2019 (i.e. measures used in subsequent sweeps were not included).

Additionally, to retain a manageable scope any non-core sweeps (e.g. innovation panels and feasibility studies) were excluded. Furthermore, measures were excluded if they were about anyone other than the main study member (e.g. mothers in ALSPAC), contained physical activity preferences, or questions regarding fatigue following physical activity. Additionally, we excluded ambiguous activities that may also be categorised as sedentary behaviour such as listening to the radio (as participants could potentially also be physically active). Activities such as reading for pleasure and drawing were not counted as sedentary.

This guide identifies and describes measures of physical activity that are similar both within and across studies. This can help facilitate future cross-study comparative research. All measures of physical activity identified are available in the searchable electronic appendix that accompanies this guide. This appendix (a complete inventory of

the measures available as of the time of writing) can be filtered and sorted on different characteristics of the measures or their administration, including study, year, sweep, respondent, activity domain, and subdomain, and whether frequency, duration and intensity of the activity was ascertained. Original variable names are included so data users may easily find these variables within datasets. Measures are coded ('Yes'/'No') in terms of whether intensity, duration, and frequency were ascertained. The full inventory of measures is available in this appendix.

In the following sections, each of the studies are introduced and a summary of the physical activity measures for each respective study is provided. A later section focuses on opportunities for comparison across studies.

5. Physical activity in NSHD

5.1 Longitudinal study description

The Medical Research Council (MRC) National Survey of Health and Development (NSHD) is the first national birth study in Britain. Initially it was a maternity survey of 13,687 of all recorded births of singletons in one week of March 1946 in England, Scotland, and Wales. The follow-up study is based on a socially stratified sample of 5,362 babies born to married parents. A total of 24 sweeps of data have been collected on participants who are now in their 70s. During childhood, data collection involved interviews with mothers and teachers, child tests, and school medical examinations, and from early teenage years study members themselves started to provide information. In adult sweeps, data were increasingly collected by research nurses who administered questionnaires and carried out physical assessments including biomedical measures. Other adult sweeps involved postal questionnaires. The latest sweep of data was collected at 68-59y with a total of 2,638 of the original study members taking part [94-96].

5.2 Physical activity overview (23 to 69y)

No data on physical activity were ascertained in childhood or adolescence in the NSHD. Self-reported measures across each physical activity domain were ascertained across adulthood from 23 to 69y. Leisure time physical activity was measured at ages 31, 36, 43, 53, 60-64, and 68-69y. Occupational activity was measured at ages 36, 43, and 60-64y. Active travel was measured at ages 36 and 60-64y. Domestic activities were measured at ages 36, 43, 53, and 60-64y. Finally, sedentary behaviour was measured at 60-64y.

In terms of comparability within this longitudinal study, leisure time physical activity (LTPA) was measured the most frequently; age 36y was based on the Minnesota LTPA questionnaire [97], while the age 60-64y was based on a modified version of the EPAQ-2 (EPIC Physical Activity Questionnaire) [98]. Each measure reports the past 4 weeks of physical activity engagement, and previous work in NSHD has compared across each age by categorising those reporting no activity as inactive; those participating one to four times as moderately active; and those participating five or more as most active [99]. Occurrence of occupational physical activity was reported, and frequency may be compared although scales vary slightly. Measures of preferred travel methods and frequency (days/week) are comparable across ages 36 and 43y, although response scales for distance and duration are not comparable. Overall engagement in domestic activity is comparable across ages, although duration-related questions involve different timelines and are therefore difficult to compare (i.e. hour/month in the last month vs hours in the last year) while others do not specify the timespan of recall. Frequency of domestic activity is comparable across ages on the monthly scale with ages 30-40 specifying past 4 weeks and age 60y specifying past 12 months. Finally, measures of sedentary behaviour duration were recorded from ages 60-64y and therefore have no earlier ages to compare to.

Additionally, objective measures of daily activity were captured at ages 60-64y using the ActiHeart (chest-worn device that measures movement and heart rate) and, at ages 68-69y using the GCDC X15-1c triaxial accelerometer (Gulf Coast Data Concepts, Waveland, Mississippi), the latter as part of the VIBE study [100].

5.3 Data access

NSHD data are freely accessible to bona fide researchers by applying through the NSHD data sharing website. More information on NSHD is available on the NSHD website.

6. Physical activity in NCDS

6.1 Longitudinal study description

The National Child Development Study (NCDS) was originally known as the Perinatal Mortality Study and was initially developed in response to concerns about levels of stillbirths and neonatal births. It surveyed 17,415 babies born in a single week in March 1958 in England, Scotland and Wales. The study has since continued to collect data throughout the life course, at ages 7, 11, 16, 23, 33, 42, 44, 46, 50 and 55y. Data collection at 62y is ongoing at the time of writing. Although the study was initially focused on child health, it has evolved to incorporate many other important domains and outcomes. In childhood, parents (typically mothers) were the main reporters, but also teachers and schools have provided data, and children completed tests and underwent medical examinations. From the age of 16y and throughout adulthood, study members have provided data through interviews, self-completed questionnaires, tests of skills and ability, and biomedical and physical assessments have also been carried out. The most recent sweep was in 2013 when study members were aged 55y, with a total of 9,137 participating [101].

6.2 Physical activity overview (11 to 55y)

NCDS contains childhood and adult self-reported measures across each physical activity domain (from 11-55y). Leisure time physical activity was measured at ages 11, 16, 23, 33, 42, 44, 50, and 55y, with leisure time variables at age 44 based on a modified version of the EPAQ-2 (EPIC physical activity questionnaire) [98]. Occupational physical activity was measured at ages 33, 44, 50 and 55y. Active travel was measured at ages 44 and 46y.

Domestic activities were measured at ages 33, 44, and 50y. Finally, sedentary behaviour was measured at ages 11, 16, 23, and 44y.

In terms of comparability across time within this longitudinal study, leisure time physical activity can be compared in terms of intensity and frequency of engagement on the weekly/non weekly level. Occupational activity can be compared by intensity in earlier ages, although only engagement in specific activities (i.e. standing) can be compared across ages 33, 44, 50, and 55y. Active travel measures only appear in ages 44-46y and can therefore not be compared longitudinally. Frequency of domestic activities may be compared on the weekly level, although there are some slight differences in wording; this domain may also be comparable based on type of activity. Sedentary behaviour in childhood, while again slightly different, may be comparable on frequency. Finally, sedentary behaviour in adulthood is not directly comparable as measures vary from frequency to duration.

6.3 Data access

NCDS data are freely accessible to bona fide researchers by applying through the UK Data Service. More information on NCDS is available on the CLS website.

7. Physical activity in BCS70

7.1 Longitudinal study description

The 1970 British Cohort Study (BCS70) began as The British Births Survey and was later renamed Child Health and Education Study before settling on its current name. The initial birth survey involved 17,198 babies born in a single week in April in 1970. Like the older NCDS study, it was initiated with a strong focus on child health, before later including many other areas such as social, psychological, educational and economic outcomes. A total of ten main sweeps of data collection have been carried out, with follow-ups after

the birth survey at ages 5, 10, 16, 26, 30, 34, 38, 42 and 46y. In childhood, parents were main reporters on their children, with teachers also providing information, in addition to child tests and school medical examinations.

Study members themselves first completed questionnaires at age 16y, and in adulthood they participated through in-person or telephone interviews, or postal surveys. The most recent BCS70 sweep, which included a full range of biomeasures, was completed in 2018 at age 46-48y and achieved a total of 8,581 participating study members. At the time of writing, data collection at 50y is being planned [102].

7.2 Physical activity overview (5 to 42y)

BCS70 contains childhood and adult self-reported measures across physical activity domains (from 5-42y). Leisure time was measured at ages 5, 10, 16, 30, 34, and 42y; active travel was measured at age 34y; domestic activities were measured at age 16y; and sedentary behaviour measured at ages 5, 10, 16, and 42y.

In terms of comparability across sweeps in this longitudinal study, overall engagement in leisure time can be compared across ages 5, 10, 16, 30, 34, and 42y while intensity can be compared across ages where information was collected on specific activities/sports (i.e. ages 30, 43, 52y). Additional questions with frequency and duration responses varied somewhat between questions. Active travel and domestic activities were only measured at one age each and therefore cannot be compared across sweeps. Finally, sedentary behaviour provided comparable measures of duration (hr/day) in childhood and adulthood (ages 5, 10, 16 and 42y).

Additionally, objective measures of activity expenditure (kJ/kg/day) were captured at ages 46-48y using the ActivPal accelerometer (PAL technologies Ltd, Glasgow, Scotland).

7.3 Data access

BCS70 data are freely accessible to bona fide researchers by applying through the UK Data Service. More information on BCS70 is available on the CLS website.

8. Physical activity in ALSPAC

8.1 Longitudinal study description

The Avon Longitudinal Study of Parents and Children (ALSPAC) is also known as Children of the 90s. The study recruited 14,541 women with expected deliveries from April 1991 to December 1992 in the Avon area of South West England. The aim of the study was to understand the influence of environmental and genetic factors on the health and development of parents and children. Women completed questionnaires during their pregnancy and have continued to provide data on themselves and their children in over twenty questionnaires in addition to clinic assessments. Partners, teachers, and school age children themselves have provided questionnaire data. Data have been collected on a yearly basis from one or several of these respondents and have included health and biometric data, as well as social and psychological measures. The most recent sweep at age 25y, completed in 2018/2019, involved 6,929 main carers and 4,398 index offspring [103, 104]. To give an idea of data type and scale now, the sample now includes 11992 G0 mothers, 3394 fathers and 11381 G1 with known address. Original parents (G0) and their children (G1) have been followed up using questionnaires and face-to-face clinics, with biological samples, exposure and outcome measures.

8.2 Physical activity overview (3 to 22y)

ALSPAC contains childhood and adult self-reported measures across physical activity domains (from 5-22y). Leisure time was measured at ages 4, 5, 6, 8, 9, 11, 13, 16, 18, and 22y; active travel was measured at ages 3, 4, 5, 6, 8, 13, 16, and 22y; and sedentary behaviour was measured at ages 3, 4, 5, 6, 8, 9, 11, 13, 16, and 22y.

In terms of comparability, measures of leisure time reporting frequency or type of activity (intensity) are comparable across ages. Overall, the method of active travel can be compared across ages, and duration (min/day) is commonly measured in childhood. Additionally, there are some measures of distance (km) in very early childhood although there are no common measures in adulthood. Finally, measures of sedentary behaviour are comparable in duration (hr/day) across all ages, and in some cases additionally asking for differences in weekdays and weekends.

Objective measures of physical activity (minutes of sedentary, light and moderate to vigorous intensity physical activity) were assessed at ages 12, 14, 16 (sub-set 25) using sing the Actigraph accelerometer (Actigraph, Pensacola, Florida).

8.3 Data access

ALSPAC data is accessible to bona fide researchers for a fee by applying through the ALSPAC online proposal system. More information is available on the ALSPAC website.

9. Physical activity in MCS

9.1 Longitudinal study description

The Millennium Cohort Study (MCS) is the youngest of the current UK national longitudinal studies and involves 19,243 families with babies born around the millennium (Sep 2000-Jan 2002) in England, Wales, Scotland and Northern Ireland. The study was set up to be multidisciplinary, focusing on a range of experiences and outcomes of children and their families, including physical and mental health, whilst collecting rich social, economic and demographic data on participants to understand how these shape outcomes. The first sweep was carried out when study children were around 9 months old and they have since been followed up at age 3, 5, 7, 11, 14y and recently at age 17y. In childhood, main carers (mainly mothers) have provided information through interviews, and if present their

partners have also taken part. Teachers have provided data in some sweeps. Physical measurements and assessments of children's skills and abilities have been carried out, and from age 11y study children have completed their own questionnaires. Fieldwork for the age 17y sweep was completed in 2019 with data originally scheduled for release in the spring of 2020 [105], since delayed until Autumn of that year.

9.2 Physical activity overview (3 to 14y)

MCS contains childhood self-reported measures across physical activity domains (from 3-14y). Leisure time was measured at ages 3, 5, 7, 11, and 14y; active travel was measured at ages 5, 7, 11, and 14y; and sedentary behaviour measured at age 3, 5, 7, 11 and 14y.

With regard to comparability across time, overall engagement in leisure time activities are comparable in duration (weekly), while those indicating specific activity/sport are comparable in intensity. Form of active travel used is comparable across ages. Finally, measures of sedentary behaviour duration (hrs/day) while using TV, video games, and smartphones are comparable across ages.

At age 14y, participants also completed time-use diaries that included physical activity data from one weekday and one weekend day collected through paper forms, a mobile application, or online form. Data was recorded in 10-minute slots throughout the day from 4am

Additionally, objective measures of activity expenditure (kJ/kg/day) were captured at age 7y using the Actigraph GT1M accelerometer (Actigraph, Pensacola, Florida); and at age 14y using the GENEActiv accelerometer (Activinsights, Kimbolton, England).

9.3 Data access

MCS data are freely accessible to bona fide researchers by applying through the UK Data Service. More information on MCS is available on the CLS website.

10. Physical activity in UKHLS

10.1 Longitudinal study description

Understanding Society: The UK Household Longitudinal Study (UKHLS) commenced in 2009 with an initial sample of 39,802 households in England, Scotland, Wales and Northern Ireland. Unlike the other studies covered by this guide, which are birth cohort studies by design, UKHLS is a panel study. UKHLS expands on and incorporates the British Household Panel Survey which began in 1991 with 5,500 households. The primary objective of UKHLS is to obtain longitudinal data on domains such as health, work, education, income, family and social life, to help inform policies and interventions. Data is collected annually and all individuals in the household are followed, also after they leave the household, and similarly any new household members get to join the study. A total of 10 annual sweeps have been completed with sweep 11 under way. One person completes the household questionnaire. Each person aged 16 or older completes the individual adult interview, including a self-completion questionnaire. Young people aged 10 to 15y are asked to respond to a paper self-completion questionnaire. Information on children under 10 is obtained from parents. A range of measures are collected from participants, including behaviours and attitudes, life events, employment, and health and wellbeing. Biomedical and objective health measures have been obtained in some sweeps. The most recent survey (wave 8) completed in 2016-2018 involved a total number of 26,083 households and 35,417 individuals.

10.2 Physical activity overview (Young people: 10 to 15y)

Using the young person questionnaire (ages 10-15), leisure time activity was measured at waves 1, 2, 4, 6, 8, 9 and 10. Waves 1, 2, 4, 6, 8 and 9 asked the number of days in a normal week individuals played sports or other keep-fit activities. Waves 2, 4, 6 8 and 9 collected information on type of exercise participants engaged in; while waves 2, 4, 6, 8 and 10 collected information on attending classes outside of school including dance and sport.

Active travel was collected at waves 1, 2, 4, 6, and 8 on the main method of travel to school (walk, bike, bus/tube, car, train, other). Sedentary behaviour (hr/day) engaging in a range of activities such as television watching, pc use, and gaming was measured in all sweeps (waves 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10); finally, domestic activity (hr/week) will be included for the first time in Understanding society at wave 10.

10.3 Physical activity overview (Adults: 16y+)

In the mainstage questionnaire (ages 16+), leisure time was measured at waves 2, 5, 7 and 8. Waves 2 and 5 collected information on frequency of specific sports in the past 12 months. Waves 7 and 8 asked questions, derived from the IPAQ [75], on vigorous and moderate physical activities in the last 7 days. Occupational activities were captured at waves 2 and 5, asking individuals to rate how physically active their occupation is (very, fairly, not very, not at all). Method of active travel was measured at waves 1, 2, 3, 4, 6, 8. At waves 1, 2, 3, 4, 8, participants were asked about their mode of transport to work (cycling or walking); while in waves 1, 3, 6, 8, and 10 participants were asked how frequently they cycle (weekly to yearly). Domestic activities (hr/week) were measured at wave 1; was sedentary behaviour (hr/day) while watching television was measured at waves 3, 6, and 9.

UKHLS is well designed for comparability of variables across time, with typically the exact same question wording and response scale used at different waves, providing direct comparability. For example, in adulthood, specific sports frequency at waves 2 and 5 are directly comparable. Similarly, waves 7 and 8 ask about past week vigorous and moderate exercise are directly comparable. To compare across all waves of LTPA (2, 5, 7, and 8), specific sports from waves 2 and 5 may be categorised by intensity and compared on the weekly/ non-weekly level. Generally, elsewhere, in regards to occupation, active travel, domestic, and sedentary behaviour each variable should have a corresponding variable in a following wave with which direct comparisons can be undertaken.

10.4 Data access

Understanding Society data are freely accessible to bona fide researchers by applying through the UK Data Service. More information on Understanding Society is available on the Understanding Society website.

11. Discussion and tables of comparable variables

The following sections summarise and compare the self-reported physical activity measures across five of the CLOSER partner studies: NSHD, NCDS, BCS70, ALSPAC, and MCS. We have not included UKHLS in our comparability section given its different study design as age cannot be separated out. Each study has collected a wealth of physical activity data across different domains, although the ages of collections and frequency of collections differs (see Table 1). We will summarise the study data available in childhood and adulthood in each domain: leisure, occupational, active travel, domestic, and sedentary behaviour. This will be followed by a discussion on the cross-study comparability of the variables at similar ages. This is intended to be illustrative rather than definitive or exhaustive; interested readers may well choose to make cross or within-study comparisons using different measures—see the electronic appendix for further detail.

Where questions and response scales are sufficiently comparable, it is possible to compare the absolute levels of activity between studies—this is noted in the text below. In most instances however, due to differences in question wording, the measures are likely only comparable in terms of rank ordering, such that the relative ranking of participants from inactive to most active may be comparable across studies. While this does not enable comparison of absolute levels across studies, it may form the basis for cross-study comparisons of associations, where physical activity levels are the exposure or outcome of interest.

Table 1. A high-level summary of physical activity measures across selected CLOSER partner studies

Age range of measure	Physical activity measure					
	Leisure time activity	Occupational activity	Active travel	Domestic activity	Sedentary behaviour	Accelerometry
4-6y	BCS70, ALSPAC, MCS		ALSPAC, MCS		ALSPAC, MCS	
7-10y	BCS70, ALSPAC, MCS		ALSPAC, MCS		ALSPAC, MCS	MCS
11-13y	NCDS, BCS70, ALSPAC, MCS		ALSPAC, MCS		BCS70, ALSPAC, MCS	ALSPAC
14-16y	NCDS, BCS70, ALSPAC, MCS		ALSPAC, MCS	BCS70	BCS70, ALSPAC, MCS	ALSPAC, MCS
23-26y	NCDS, ALSPAC		ALSPAC		NCDS, ALSPAC	MCS
33-36y	NSHD, NCDS, BCS70	NSHD, NCDS	NCDS, NSHD	NSHD, NCDS		
42-46y	NSHD, NCDS, BCS70	NCDS	NCDS	NSHD, NCDS	NCDS, BCS70	BCS70
50-55y	NSHD, NCDS	NCDS		NSHD, NCDS		
60-64y	NSHD	NSHD	NSHD	NSHD	NSHD	NSHD
68-70y	NSHD					NSHD

Notes: NSHD: MRC National Survey of Health and Development (1946); NCDS: National Child Development Study (1958); BCS70: British Cohort Study 1970; ALSPAC: Avon Longitudinal Study of Parents and Children (1991-1992); MCS: Millennium Cohort Study (2001).

Accelerometry: MCS: 7y: Actigraph GT1M accelerometer, 14y: GENEActiv accelerometer; ALSPAC 12, 14, 16, 25y Actigraph accelerometer; BCS70 46-48y ActivPal accelerometer; NSHD: 68-69y: ActiHeart accelerometer, 68-69y GCDC X15-1c triaxial accelerometer.

Only main study members are included, parents/carer information or other family members are excluded (e.g. ALSPAC mothers).

11.1 Leisure time physical activity

Leisure time physical activity (LTPA) is the most frequently measured domain, with data collected from ages 4-69y across ALSPAC, MCS, BCS70, NCDS, and NSHD (see Tables 2-5 for details on these variables). For exercise-related questions, participants were often asked to indicate from a show card what activities they typically engaged in, and the duration and frequency of these. Additional LTPA questions captured participation in sports classes, involvement in sports clubs and teams, and use of recreational areas such as parks and playgrounds.

LTPA participation, Table 2:

- ALSPAC 13y and BCS70 16y ask similar questions about sports engagement over the past weekend (ALSPAC: "Which activities did you do last weekend?"; BCS70: "Did you take any exercise last Saturday?") with responses comparable on the activities engaged in (i.e. swimming, cycling, walking). These may therefore be comparable in terms of absolute physical activity levels. Since the MCS 14y question was on a different scale, it is only likely comparable in terms of relative ranking of activity levels (MCS: “On how many days in the last week did you do a total of at least an hour of moderate to vigorous physical activity?")
- BCS70 30y, NSHD 31y, and NCDS 33y ask similar questions on general physical activity engagement (BCS70/NCDS: "Do you regularly take part in exercise/sport activities?" How often do you take part in these exercise/sports activities? When you take part in these exercise/sports activities, do you get out of breath or sweaty?; NSHD: "Please ring the codes below indicating any sports or keep fit activities you take part in and showing how often you do these things (during the season).") with responses of frequency (monthly/weekly) and specific activities engaged in comparable across measures.
- NCDS 42y and NSHD 43y each ask similar questions on general LTPA engagement (NCDS: "Do you regularly take part in exercise/sport activities?" How often do you take part in these exercise/sports activities? When you take part in these exercise/sports activities, do you get out of breath or sweaty?"; NSHD: "Do you regularly take part in

any sports or vigorous leisure activities or do any exercises? (If yes please list) "How often do you do this? On average how long do you spend doing this?") with responses of frequency (monthly/weekly) and intensity of specific activity engaged in comparable across measures. In contrast, BCS70 42y also asks a general question on LTPA engagement, but uses a different question and response scale (BCS70: "On how many days in a typical week do you do 30 minutes or more of exercise"; responses: none, less often, 2-3x month, 1x week, 1x week, 2-3x week, 4-5x week, daily).

- BCS70 42y and NCDS 44y ask similar questions on specific activities in the past year (BCS70: "How often have you done each of the following sporting activities in the last 12 months?"; NCDS: "How often on average, did you do this last year?" "Average time per episode?") with responses of frequency (monthly/weekly/daily) and specific activities engaged in comparable across measures.
- NSHD 53y and NCDS 55y ask similar questions comparing the frequency (occurrences/week) of physical activity (NSHD: "In the last 4 weeks, have you taken part in any sports or vigorous leisure activities or done any exercises in your spare time, not including getting to and from work, for 30 minutes or more?"; NCDS: "Whether you take part in the following activities and frequently 1) Play sport or go walking or swimming; 2) Attend leisure activity groups such as evening classes, keep fit, yoga etc.")

Use of parks and/or recreation facilities, Table 3:

- ALSPAC 5y, 6y and MCS 5y, 7y, ask similar questions on park and recreational use (ALSPAC: "About how often does your child do the following… go to public park or playground"; MCS: "(How often do you..) ..take [^Cohort child's name] to the park or to an outdoor playground?") and can be compared in frequency (never, yearly, monthly, weekly, daily). These may therefore be comparable in terms of absolute physical activity levels.
- BCS70 16y asks about past year trips ("Been in sports-community centre in last year? Number of times?") and ALSPAC 18y ("In the last four weeks, have you been to or used the following things - Parks and other open spaces?") may be compared in incidence of visiting recreational areas over the past month or year.

Participation in sports classes, Table 4:

- ALSPAC 4y, 5y, 6y, 7y, 8y, 9y, 11y and MCS 5y, 7y, 11y ask similar questions about attending sports clubs and classes (ALSPAC: "About how often does your child do the following during term time… go to special classes or clubs for some activity (e.g. dancing, judo, sports)"; MCS: "On average how many days a week does [^Cohort child's name] go to a club or class to do sport or any other physical activity like swimming, gymnastics, football, dancing etc?") and may be compared in frequency (weekly/non-weekly; occurrences/week) levels.

Participation in sports clubs/teams, Table 5:

- MCS 11y and ALSPAC 16y both ask questions on sports participation (MCS: "How often does she usually go out to youth, sports clubs or groups? What kind of club? What sports does she do?"; ALSPAC: "How often does she usually go out to youth, sports clubs or groups? What kind of club? What sports does she do?") and are comparable in frequency (weekly/ non weekly). Since the NCDS 11y question was on a different scale, it is only likely comparable in terms of relative ranking of activity levels (NCDS: "Playing outdoor games or taking part in sports outside school hours", responses: never or hardly ever, sometimes, often).

Table 2. LTPA and/or exercise participation—comparable questions across childhood and adulthood from selected CLOSER partner studies

Age	Study	Variable name	Question wording	Response scale(s)	Included activities	Timespan of recall
13	ALSPAC	ccp430 ccp450 - ccp443 ccp463	"Which activities did you do last weekend?"	yes/no	swimming, walk, cycled, played in football (or other) match	past weekend
14	MCS	FCPHEX00	"On how many days in the last week did you do a total of at least an hour of moderate to vigorous physical activity?"	never, 1-2, 3-4, 5-6, everyday	*	past week
16	BCS70	F20A1 - f20b43	"In past year, participation in a range of individual activities, in school or out of school…"	none, 1x monthly, 1x weekly	baseball, basketball, cricket, football, hockey, netball, rounders, rugby, volleyball, individual activities (aerobics, tennis etc.), other	past 12 months
16	BCS70	jc22 - jc22a9	"Did you take any exercise last Saturday?"	yes/no	walking >1 mile, running, jogging >1 mile, cycling >1mile, swimming >4 lengths, dancing, indoor sports, outdoor sports, exercise/keep fit, other	last Saturday
30	BCS70	exercise breathls sweat	"Do you regularly take part in exercise/sport activities?" How often do you take part in these exercise/sports activities? When you take part in these exercise/sports	never, 2-3x month, 1x week, 2-3x week, 4-5x week, daily	take part in competitive sport of any kind, go to 'keep fit' or aerobics classes, go running or jogging, go swimming, go cycling, go for walks, take part in water sports, take part in outdoor sports, go dancing, take part in any other sport or leisure activity which involves physical exercise	not specified

			activities, do you get out of breath or sweaty?			
31	NSHD	SWIM77 CYCL77 SQUAS77 KFIT77 OACTS77	"Please ring the codes below indicating any sports or keep fit activities you take part in and showing how often you do these things (during the season)."	never, several times a year, 1x month, 1x week	swimming, cycling, squash/tennis/badminton, keep fit, other	not specified
33	NCDS	N504362 N504363	"Do you regularly take part in exercise/sport activities?" How often do you take part in these exercise/sports activities? When you take part in these exercise/sports activities, do you get out of breath or sweaty?	never, 2-3x month, 1x week, 2-3x week, 4-5x week, daily	take part in competitive sport of any kind, go to 'keep fit' or aerobics classes, go running or jogging, go swimming, go cycling, go for walks, take part in water sports, take part in outdoor sports, go dancing, take part in any other sport or leisure activity which involves physical exercise	not specified
34	BCS70	b7exerse b7breals	"Do you regularly take part in exercise/sport activities?" How often do you take part in these exercise/sports activities? When you take part in these exercise/sports activities, do you get out of breath or sweaty?	never, 2-3x month, 1x week, 2-3x week, 4-5x week, daily	take part in competitive sport of any kind, go to 'keep fit' or aerobics classes, go running or jogging, go swimming, go cycling, go for walks, take part in water sports, take part in outdoor sports, go dancing, take part in any other sport or leisure activity which involves physical exercise	not specified

36	NSHD	BADSN82 BADSH82 - ACT2N82 ACT2H82	"(In your spare time) Have you taken part in any of these sports or outdoor activities in the last 4 weeks?"	occurrences/week	badminton, bowls, cricket, exercises, golf, hill or mountain climbing, jogging, rowing, running or athletics, sailing, squash or rackets, swimming, table tennis, tennis, yoga, water skiing, volleyball, scuba diving, basketball, fishing, riding, movement to music, weight training, ballroom dancing, other	past 4 weeks
42	BCS70	B9EXERSE	"On how many days in a typical week do you do 30 minutes or more of exercise where you are working hard enough to raise your heart rate and break into a sweat?"	30 min or more 0-7 days	*	past week
42	NCDS	exercise breathls sweat	"Do you regularly take part in exercise/sport activities? How often do you take part in these exercise/sports activities? When you take part in these exercise/sports activities, do you get out of breath or sweaty?	less often, 2-3x month, 1x week, 2-3x week, 4-5x week, daily	take part in competitive sport of any kind, go to 'keep fit' or aerobics classes, go running or jogging, go swimming, go cycling, go for walks, take part in water sports, take part in outdoor sports, go dancing, take part in any other sport or leisure activity which involves physical exercise	not specified
42	BCS70	b9scq2a-b9scq2o	"How often have you done each of the following sporting activities in the last 12 months?"	none, less often, 2-3x month, 1x week, 1x week, 2-3x week, 4-5x week, daily	health/fitness/gym/conditioning activities, swimming or diving, cycling, dancing, jogging, walking for pleasure/rambling, racquet sports (tennis etc.), team sports (football), martial arts, water sports (rowing etc.), horse riding, yoga/pilates, golf, skiing, other	past 12 months

43	NSHD	EXER89 - EX4SW89	"Do you regularly take part in any sports or vigorous leisure activities or do any exercises? (If yes please list) "How often do you do this? On average how long do you spend doing this?	minutes; hours; < 1x month, < 1x week, 1x week, >1x week		not specified
44/45	NCDS	swimslo swimsloh swimslom - exoth2 exoth2h exoth2m	"How often on average, did you do this last year?" "Average time per episode?"	minutes; hours none, <1x month, 2-3x month, 1x week, 2-3x week, 2-4x week, daily	leisurely swimming; competitive swimming; walking for pleasure; backpacking, hill walking, or mountain climbing; cycling for pleasure ; racing or rough terrain cycling ; high impact aerobics, step aerobics ; other aerobics; exercises with weights; conditioning exercises (“e.g., using an exercise bike or rowing machine”); floor exercises (“e.g., stretching, bending, keep fit”); dancing (“e.g. ballroom, disco”); competitive running; jogging; bowling; tennis or badminton; squash; table tennis; golf; football, rugby or hockey; cricket; rowing; netball, volleyball, basketball; fishing; horse riding; snooker, billiards, darts; musical instrument playing; ice skating; sailing, windsurfing, boating; winter sports (“e.g., skiing”); martial arts/boxing/wrestling; other exercises (“please specify”)	past 12 months
46	NCDS	n7exers1 n7breals n7sweat	"Do you regularly take part in exercise/sport activities? How often do you take part in any activity of this	less often, 2-3x month, 1x week, 2-3x week, 4-5x week, daily	take part in competitive sport of any kind, go to ‘keep fit’ or aerobics classes, go running or jogging, go swimming, go cycling, go for walks, take part in water	not specified

			type? When you participate in any activity of this type, would you say you got out of breath or sweaty		sports, take part in outdoor sports, go dancing, take part in any other sport or leisure activity which involves physical exercise	
50	NCDS	N8EXERSE N8BREALS N8SWEAT	"Do you regularly take part in any physical activities or exercise? How often do you take part in any activity of this type? When you participate in any activity of this type, would you say you got out of breath or sweaty	less often, 2-3x month, 1x week, 2-3x week, 4-5x week, daily	competitive sport of any kind, 'keep fit' or aerobics classes, running or jogging, swimming, cycling, walks, water sports, outdoor sports, dancing, other leisure activity which involves physical exercise	not specified
53	NSHD	EXER EXERN	"In the last 4 weeks, have you taken part in any sports or vigorous leisure activities or done any exercises in your spare time, not including getting to and from work, for 30 minutes or more?"	30 min or more occurrences/week	*	past 4 weeks
55	NCDS	N9LEIS01 N9LEIS05	"Whether you take part in the following activities and frequently 1) Play sport or go walking or swimming; 2) Attend leisure activity groups such as evening classes, keep fit, yoga etc"	never, several times a year, 1x month, 1x week	play sport or go walking or swimming. Attend leisure activity groups such as evening classes, keep fit, yoga etc.	not specified

**participation in individual activities was not recorded*

Table 3. LTPA/use of park or recreational areas—comparable questions across childhood and adulthood from selected CLOSER partner studies

Study	Age	Name	Question wording	Response scale	Timespan of recall
BCS70	5	e242	"In the past 7 days has CM been went to a park, recreation ground, adventure playground?"	yes/no	past week
ALSPAC	5	kn3123	"About how often does your child do the following… go to public park or playground "	never, 1-2x year, few times year, 1x month, 1x week, 2-5x week, daily	not specified
MCS	5	cmwalk	"(How often do you..) ..take ^Cohort child's name to the park or to an outdoor playground?"	never, less often, 1-2x month, 1-2x week, several times a week, daily	not specified
ALSPAC	6	kp6073	"About how often does your child do the following… go to public park or playground"	never, 1-2x year, few times year, 1x month, 1x week, 2-5x week, daily	not specified
MCS	7	dmwalk	"(How often do you..) ..take ^Cohort child's name to the park or to an outdoor playground?"	never, less often, 1-2x month, 1-2x week, several times a week, daily	not specified
BCS70	16	jc23	"Been in sports-community centre in last year? Number of times?"	occasionally, 1-2x past month, 1x week, >1x week	past year
ALSPAC	18	cct1001	"In the last four weeks, have you been to or used the following things - Parks and other open spaces?"	yes/no	past 4 weeks

Table 4. LTPA/participation in sports classes frequency—comparable questions across childhood from selected CLOSER partner studies

Study	Age	Name	Question wording	Response scale	Included activities
ALSPAC	4	kl447	"About how often does your child do the following during term time…? Go to special classes or clubs for some activity (e.g. dancing, judo, sports)"	never, yearly, monthly, once a week, 2-6x week, daily	sports classes
ALSPAC	5	km4354	"About how often does your child do the following during term time…? Go to special classes or clubs for some activity (e.g. dancing, judo, sports)"	never, yearly, monthly, once a week, 2-6x week, daily	sports classes
MCS	5	cmseho	"On average how many days a week does ^Cohort child's name go to a club or class to do sport or any other physical activity like swimming, gymnastics, football, dancing etc.?"	never, 1x week, 2x week, 3x week, 4x week, 5+ week	sports classes
ALSPAC	6	kq564	"About how often does your child do the following? Go to special classes or clubs for some activity (e.g. dancing, judo, sports)"	never, yearly, monthly, once a week, 2-5x week, daily	sports classes
MCS	7	SEHO	"On average how many days a week does ^Cohort child's name go to a club or class to do sport or any other physical activity like swimming, gymnastics, football, dancing etc.?"	never, <1x week, 1x week, 2x week, 3x week, 4x week, 5+ week	sports classes
ALSPAC	8	kt3006	"About how often does your child do the following go to special classes or clubs for some activity (e.g. dancing, judo, sports)"	never, yearly, monthly, once a week, 2-5x week, daily	sports classes
ALSPAC	9	ku525	"About how often does your child do the following…? Go to special classes or clubs for some activity (e.g. dancing, judo, sports)"	never, <monthly, 1-3x month, 1x week, 2-5x week, daily	sports classes

ALSPAC	11	kw9005	"About how often does your child do the following…? Go to special classes or clubs for some activity (e.g. dancing, judo, football, other sports)"	never, <monthly, 1-3x month, 1x week, 2-5x week, daily	sports classes
MCS	11	EPSEHO00	"On average how many days a week does ^Cohort child's name go to a club or class to do sport or any other physical activity like swimming, gymnastics, football, dancing etc.?"	never, <1x week, 1x week, 2x week, 3x week, 4x week, 5+ week	sports classes

Table 5. LTPA/participation frequency in sports teams and clubs—comparable questions across adulthood from selected CLOSER partner studies

Study	Age	Name	Question wording	Response scale	Included activities	Timespan of recall
NCDS	11	N941	"Playing outdoor games or taking part in sports outside school hours "	never or hardly ever, sometimes, often	*	not specified
MCS	11	ECQ03X00	"How often do you play sports or active games inside or outside, not at school?"	never, < 1x month, 1x month, 1x week, daily	*	not specified
ALSPAC	16	tc3031 - tc3061	"How often does she usually go out to youth, sports clubs or groups? What kind of club? What sports does she do?"	never, < 1x week, 1x week, most evenings	keep fit, aerobics or dancing classes, tennis, swimming, wrestling, gymnastics, martial arts, football, boxing, netball, weight training, hockey, other	not specified

**participation in individual activities was not recorded*

11.2 Occupational activity

Occupational activity is the most sparsely measured domain, with data collected only across NSHD and NCDS from ages 33-55y (Table 6). Participants indicated a number of work-related activities they regularly engaged in, including sitting, standing, taking stairs, walking, and moving/pushing heavy objects.

Occupational activity, Table 6:

- NCDS 33y asks about general physical activity at work ("how much physical effort is involved in your job") while NSHD 36y asks about frequency of specific activities ("Time spent a) sitting b) walking, c) lifting during course of work"), although both use the same response options (none, a little, some, a lot)).
- NSHD 43y and NCDS 44y ask questions similar about activities engaged in at work (NSHD: "At work do you regularly do any heavy lifting, carrying, or digging or other strenuous activities?"; NCDS: "Have you done each activity at work in the last year?") and the included activities can be compared (NSHD: heavy lifting and carrying objects, NCDS: moving/pushing heavy objects).

Table 6. Physical effort at work —comparable questions across adulthood from selected CLOSER partner studies

Study	Age	Name	Question wording	Response scale(s)	Included activities	Timespan of recall
NCDS	33	N504361	"how much physical effort is involved in your job"	none, a little, some, a lot	*	not specified
NSHD	36	SIT82 WALK82 LIFT82	"Time spent a)sitting b)walking, c)lifting during course of work"	little, very little, moderate, a lot none, less than half, about half, > half, practically all the time	walking, sitting, heavy objects	not specified
NSHD	43	LIFT89	"At work do you regularly do any heavy lifting, carrying, or digging or other strenuous activities?"	not at all, < 1 hr a day, 1-2 hr a day, up to half a day, > half the day	heavy lifting, carrying, digging, strenuous activities	not specified
NCDS	44	sitlt sitlthr - movob movobhr	"Have you done each activity at work in the last year?"	light, moderate, heavy hours/week	sitting, standing, walking, moving/pushing heaving objects, other activities	in past year
NCDS	44	wkstair wkladd	"At work, how many times a day do you normally: a)Climb up a flight of stairs (10 steps) , b)Climb up a ladder"	occurrences/day	stairs, ladder	not specified

NCDS	50	N8PHYSWK	"Physical activities involved in your work. Which option best correspond to your present activities?"	sitting, standing, physical work, heavy manual work	not specified
NCDS	55	N9PHYSWK	"Physical activities involved in your work. Which option best correspond to your present activities?"	sitting, standing, physical work, heavy manual work	not specified

**participation in individual activities was not recorded*

11.3 Active travel

Active travel was measured many times across the longitudinal studies from ages 4y to 60-64y, with data collected in ALPAC, MCS, BCS70, NCDS, and NSHD (tables 7-9). Largely, there were three different themes of active travel including (1) travel to school/ childcare/ and college, (2) travel to work, and (3) general and/or other nonspecific travel. Typically, active travel responses were either in walking or cycling, but in one case (ALSPAC age 13y) responses of skateboarding and scooter were also provided.

Travel to school (Table 7):

- ALSPAC 6y, 8y, 13y, 16y and MCS 5y, 7y, and 14y ask identical questions on travel to school ("how does [cohort member] get to school and back"), and the method of active travel (walking or cycling) can be compared across all measures. Additionally, responses in duration (minutes) can be compared in MCS 14y and ALSPAC 13y and 16y. These may therefore be comparable in terms of absolute physical activity levels.
- BCS70 16y asks specifically about cycling ("use of bicycle in last 2 weeks: a) to go to school") and may be compared to ALSPAC 13y, 16y and MCS 14y questions on use of cycling.

Active travel to work (Table 8):

- NSHD 36y and NCDS 44y ask similar questions on travel to work (NSHD: a) "Do you normally use a bike on your way to work, or for part of the way?" b) "On your way to work do you normally walk for five minutes of more on each journey?"; NCDS: "How do you usually travel to work?"), and activity engaged in (cycling or walking) is comparable across measures.
- NSHD 36y and NCDS 44y both measure duration, although response options are in different units (NSHD: minutes; NCDS: miles). However these could potentially be converted (e.g. using the average minutes per mile) to derive a common measure of duration.

General active travel (Table 9):

- While there appear to be no measures at similar ages, ALSPAC 22y, BCS70 34y, and NCDS 46y ask similar questions on general travel (i.e. ALSPAC: “Do you make regular journeys every day or most days”; BCS70/NCDS: “what is your main form of transport”), with comparable activities (cycling or walking) across each measure.

Table 7. Travel to school —comparable questions across childhood from selected CLOSER partner studies

Study	Age	Name	Question wording	Response scale(s)	Included activities	Timespan of recall
ALSPAC	4	kk435 kk436 kk445 kk446 km4195 km4205	"how does cm get to school/childcare and back"	every day/ some days	cycling & walking	not specified
ALSPAC	5	km4190 km4200 km4195 km4205 km4210 km4211	"how does cm get to school /childcare and back"	minutes; kilometres every day/ some days	cycling & walking	not specified
MCS	5	cmtrsc cmtrho cmtrdi	"how does cm get to school and back"		cycling & walking	not specified
ALSPAC	6	kp1080 kp1090 kp1085 kp1095 kp1100 kp1101	"how does cm get to school and back"	minutes; kilometres every day/ some days	cycling & walking	not specified
MCS	7	dmtrsc dmtrho dmtrdi	"how does cm get to school and back"		cycling & walking	not specified
ALSPAC	8	kt1010 kt1020 kt1015 kt1025 kt1030 kt1031	"how does cm get to school and back"	minutes; kilometres every day/ some days	cycling & walking	not specified
ALSPAC	13	ccp210 ccp211 ccp215 ccp217	"how does cm get to school and back"	minutes	cycling & walking & skateboard/scooter	not specified

MCS	14	FPTRSC00 FPTRHO00 TRDI FPTRDI00	"how does cm get to school and back"	minutes	cycling & walking	not specified
ALSPAC	16	ccs7000 - ccs7045	"how did you get to school/college today"	minutes	cycling & walking	today/ last time journey was made
BCS70	16	f9a1- f9a6	"use of bicycle in last 2 weeks: a)to go to school…"	yes/no	cycling	past 2 weeks

Table 8. Travel to work—comparable questions across adulthood from selected CLOSER partner studies

Study	Age	Name	Question wording	Response scale(s)	Included activities	Timespan of recall
NSHD	36	BIKE82 BIKED82 BIKEL82	"Do you normally use a bike on your way to work, or for part of the way?"	minutes days/week	cycling	not specified
NSHD	36	WALKW82 WALKWT82	"On your way to work do you normally walk for five minutes or more on each journey?"	minutes	walking	not specified
NCDS	44	wkbike wkwalk wkmiles wktrips	"How do you usually travel to work?	miles day/week	cycling & walking	not specified

Table 9. General travel—comparable questions across adulthood from selected CLOSER partner studies

Study	Age	Name	Question wording	Response scale(s)	Included activities	Timespan of recall
ALSPAC	22	YPB2000 YPB2010 YPB2020	"Do you make regular journeys every day or most days: walking	hours/week	walking	average week
ALSPAC	22	YPB2000 YPB2030	"Do you make regular journeys every day or most days: cycling"	hours/week	cycling	average week

BCS70	34	b7tranrt	"what is your main form of transport"		cycling & walking	not specified
NCDS	46	n7tranrt	"what is your main form of transport"		cycling & walking	not specified
NCDS	44	biketot bikeless bikeone biketwo bikethre bikefive bikemore	"Apart from journeys to work, number of journeys do you make in an average week: by bicycle "	miles journeys/week	cycling	average week
NCDS	44	walktot walkless walkone walktwo walkthre walkfive walkmore	"Apart from journeys to work, number of journeys do you make in an average week: walking "	miles journeys/week	walking	average week

11.4 Domestic activities

Domestic activities were measured across ages 16y to 60-64y with data collected in the BCS70, NCDS, and NSHD studies (Table 10). A range of activities were included in the questions across this domain such as housework, shopping, cleaning, and building work. However, gardening and do-it-yourself (DIY) was the activity which appeared most frequently.

Domestic activities, Table 10:

- While there was limited overlap across studies at similar ages, NSHD 43y and NCDS 44y ask questions regarding domestic activities (NSHD: (1) "Do you regularly do any heavy gardening apart from paid work?" (2) "Do you regularly do any heavy building or DIY apart from paid work?"; NCDS: "How often on average, did you do this last year?"). Both measures identify to gardening or building/DIY activities, and include similar responses categories capturing duration (minutes; hours) and frequency (monthly/weekly).

Table 10. Duration and frequency of domestic activities—comparable questions across adulthood from selected CLOSER partner studies

Study	Age	Name	Question wording	Response scale(s)	Included activities	Timespan of recall
BCS70	16	f18	"Do you help at home (e.g. Housework/gardening)"	never, sometimes, most days, everyday	housework/gardening	not specified
BCS70	16	gb12_1-gb12_12	"What kind of things do you help with at home"	never, sometimes, rarely, regularly	shopping, washing up, cleaning the house, making the beds, cooking, looking after elderly relatives / pets / younger children, washing, gardening, cleaning car, DIY	not specified
NSHD	36	BRCKN82 BRCKH82 - APPLN82 APPLH82	"Have you done any of the DIY things in the past 4 weeks?"	hours/month occurrences/month	building work (various activities listed)	past 4 weeks
NSHD	36	RUFGN82 RUFGH82 - HOEN82 HOEH82	"Have you done any of these things in the garden in the last 4 weeks?"	hours/month occurrences/month	gardening (various activities listed)	past 4 weeks
NSHD	43	HWK89 - HWKSW89	"Do you regularly do any vigorous household work or cleaning apart from paid work, how often?"	minutes; hours < monthly, < 1x weekly, 1x weekly, > 1x weekly	housework	not specified

NSHD	43	GDN89 - GDNSW89	"Do you regularly do any heavy gardening apart from paid work?"	minutes; hours < monthly, < 1x weekly, 1x weekly, > 1x weekly	gardening	not specified
NSHD	43	DIY89 - DIYSW89	"Do you regularly do any heavy building or DIY apart from paid work?"	minutes; hours < monthly, < 1x weekly, 1x weekly, > 1x weekly	building/ DIY	not specified
NCDS	44	lawnmo - diym	"How often on average, did you do this last year?"	minutes; hours none, <1x monthly, 1x month; 2-3x monthly, 1x week, 2-3x a weekly, 4-5x a weekly, daily	mowing the lawn; watering the lawn or garden in the summer; digging, shovelling or chopping wood; weeding or pruning ; DIY (e.g. “carpentry, home or car maintenance”)	not specified
NCDS	50	N8SCQ1G N8SCQ1H	"How frequently you do each one...a)Work in the garden; b)Do DIY, home maintenance or car repairs;	never, 1x year, several times a year, monthly, weekly	gardening/DIY	past 12 months

11.5 Sedentary behaviour

Sedentary behaviour was measured across ages 3y to 44y with data collected across MCS, ALSPAC, BCS70, NCDS, and NSHD (Tables 11 - 13). Sedentary behaviours were centred on engagement with electronic devices including TV/video/DVD, computer or electronic gaming, general computer use, and internet use; with recall typically divided into weekdays and weekends.

Time spent watching TV, Table 11:

- MCS 3y, 5y, 7y, 14y, ALSPAC 3y, 4y, 5y, 6y, 8y, 13y, 16y, 22y, BCS70 5y, and 16y have asked similar questions on frequency of TV consumption during childhood/early adulthood although questions vary slightly across ages (i.e. MCS 7: "On a normal week day during term time, how many hours does CM spend watching television, videos or DVDs"; ALSPAC 6: "How much time on average does s/he spend watching tv"; BCS70 5y: "Hours per day watched television Mon-Fri and Sat-Sun"). Responses are comparable in terms of duration (hours/day), with consumption differences examined from weekdays and weekends.
- BCS70 42y and NCDS 44y both ask similar questions on TV consumption in midlife (i.e. BCS70: "Time spent watching television, videos, DVDs, blue-ray (including on a computer):"; NCDS: "Time spent on average during the last year: watching TV or videos?") with responses comparable in duration (hour/day).
- ALSPAC 9y, BCS70 10y, and NCDS 11y ask similar questions on the frequency of TV watching (i.e. ALSPAC: "When she finishes school and returns home does she watch TV or video"; BCS70: "How often does your child do this in spare time: watch TV", NCDS: "Watching television after school hour") with responses comparable in frequency (ranging from never to always).

Time spent using a computer / using games, Table 12:

- ALSPAC 8y, 16y, 22y, MCS 11y, 14y, and BCS70 16y ask similar questions on the frequency of electronic gaming (i.e. MCS 14: "On a normal week day during term time, how many hours do you spend playing electronic games on a computer or games

systems, such as Wii, Nintendo D-S, X-Box or PlayStation?"; ALSPAC: "On a day when she does any of the things below, about how long altogether does she usually spend on: computer game (anyday)"; BCS70 16y: "After school yesterday, how long spent playing computer games?") with all responses comparable in duration (hours/day).

Time spent using the internet (Table 13):

- MCS 14y and ALSPAC 16y ask similar questions on internet usage (i.e. MCS: "On a normal week day during term time, how many hours do you spend using the internet?"; ALSPAC: "On a day when she does any of the things below, about how long altogether does she usually spend on: internet (for school/college), internet (non-school/college)") with responses comparable in duration (hours/day).

Table 11. Duration of time spent sedentary (TV/video/DVD) —comparable items across childhood and adulthood from selected CLOSER partner studies

Study	Age	Name	Question wording	Response scale	Included activities	Timespan of recall
MCS	3	bmtvho	"Typically, how many hours a day does child watch television or videos?"	hours/ day: none, <1, 1+, <3, 4+	TV, video	not specified
ALSPAC	3	kg272 kg276	"How much time on average does she spend each day watching tv"	hours/day: none, <1, 1-2, 3+	TV	weekday & weekends
ALSPAC	4	kk331 kk331a kk332 kk332a kk333	"How much time on average does she spend each day watching tv"	hours/day: none, <1, 1-2, 3+	TV	weekday & weekends
ALSPAC	5	km3063 km3073	"How much time on average does she spend each day watching tv"	hours/day: none, <1, 1-2, 3+	TV	weekday, weekends & school holidays
ALSPAC	9	ku206	"When she finishes school and returns home does she watch TV or video"	never, sometimes, usually, always	TV, video	not specified
BCS70	5	e117 e118	"Hours per day watched television Mon-Fri and Sat-Sun"	hours/day: none, <1,- 7	TV	weekday & weekends
MCS	5	cmtvho	"On a normal week day during term time, how many hours does CM spend watching TV, videos or DVDs"	hours/day: none, <1, 1-<3, 3-5, 5-<7, 7+	TV, video, DVD	weekday
ALSPAC	6	kp5023 kp5043 kp5063	"How much time on average does she spend watching tv"	hours/day: none, <1, 1-2, 3+	TV	weekday, weekends & school holidays

MCS	7	dmtvho	"On a normal week day during term time, how many hours does CM spend watching television, videos or DVDs"	hours/day: none, <1, 1-<3, 3-5, 5-<7, 7+	TV, video, DVD	weekday
ALSPAC	8	kt1153 kt1173	"How much time on average does she spend watching TV?"	hours/day: none, <1, 1-2, 3+	TV	weekday, weekends & school holidays
BCS70	10	M88	"How often does your child do this in spare time: watch TV"	never/hardly, sometimes, often	TV	not specified
MCS	11	EPTVHO00	"On a normal week day during term time, how many hours does CM spend watching television programmes or films? "	hours/day: none, <1, 1<2, 1-<3, 3-<5, 5-<7, 7+	TV	not specified
NCDS	11	N949	"Watching television after school hour"	never/hardly ever, sometimes, often/nearly every day	TV	weekday during term time
ALSPAC	13	ccq103	"How much time on average do you spend each day watching TV?"	hours/day: none, <1, 1-2, 3+	TV	weekday, weekends & school holidays
MCS	14	FCTVHO00	"On a normal week day during term time, how many hours do you spend watching television programmes or films?"	Hours/day: none, <1, 1<2, 1-<3, 3-<5, 5-<7, 7+	TV	weekday during term time
ALSPAC	16	tc3002 - tc3005	"On a day when she does any of the things below, about how long altogether does she usually spend: TV (weekdays/ weekends) DVD (anyday)	hours/ day: never, <30m, 30m-1, 1-2, 2-4, 4-6, 6+	TV, DVD	weekday during term time- specified in question
ALSPAC	16	ccs1003	"How much time on average do you spend each day watching TV? "	hours/day: none, <1, 1-2, 3+	TV	weekday & weekends
BCS70	16	f13 f14	"After school yesterday, how long spent watching TV/ watching video?"	hours/day: none, <1, >1, >2, >3, >4, >5	TV, video	weekday

NCDS	16	N2868	"Frequency of watching TV in spare time"	would like to but don't have the chance, never, sometimes, often	TV	not specified
ALSPAC	22	YPB2060 YPB2070	"On an average weekday (weekend), how many hours per day do you: sit and watch TV?"	hours/day: none, <1, 1-2, 3-4, 5-6, 7-8, 9+	TV	weekday & weekends
BCS70	42	b9scq10a b9scq10b	"Time spent watching television, videos, DVDs, blue-ray (including on a computer):"	hours/day: none, <1, 1- <3, 3-<5, >5	TV, video, DVD	weekday & weekends
NCDS	44	tvtime	"Time spent on average during the last year: watching TV or videos?"	hours/day: none, <1, 1-2, 2-3, 3-4, >4	TV	not specified

Table 12. Duration of time spent sedentary (computer/electronic gaming) —comparable items across childhood and adulthood from selected CLOSER partner studies

Study	Age	Name	Question wording	Response scale	Included activities	Timespan of recall
ALSPAC	6	kq571	"How often does she play computer games"	not at all, rarely, monthly, once a week, 2-5x a week, daily	computer games	not specified
ALSPAC	8	kt3018	"About how often does your child play computer games"	not at all, rarely, monthly, once a week, 2-5x a week, daily	computer games	not specified
ALSPAC	8	ccd340 ccd341	"How long do you spend playing computer games"	hours/day: hardly at all, <1, 1hr, 1+	computer games	weekday, weekends & school holidays
ALSPAC	9	ku536	"About how often does your child play computer games"	not at all, < monthly, 1-3x month, 1x week, 2-5x week, daily	computer games	not specified
ALSPAC	11	kw9016	"About how often does your child play computer games"	not at all, < monthly, 1-3x month, 1x week, 2-5x week, daily	computer games	not specified

MCS	11	ECQ05X00	"How often do you play games on a computer or games console, such as a Wii, Nintendo D-S, X-Box or Play Station, not at school?"	never, < 1x a month, monthly, weekly, most days	electronic games	not specified
MCS	11	EPCOMP00	"On a normal weekday during term time, how many hours does CM spend playing electronic games on a computer or games console, such as Wii, Nintendo D-S, X-Box or Playstation?"	hours/day: none, <1, 1<2, 1-<3, 3-<5, 5-<7, 7+	electronic games	weekday during term time
MCS	14	FCCOMH00	"On a normal week day during term time, how many hours do you spend playing electronic games on a computer or games systems, such as Wii, Nintendo D-S, X-Box or PlayStation? "	hours/day: < 30min-1, 1-<2, 2-3, 3-5, 5-7, 7+	electronic games	weekday during term time
ALSPAC	16	tc3007	"On a day when she does any of the things below, about how long altogether does she usually spend on: computer game (any day)	hours/ day: never, <30m, 30m-1, 1-2, 2-4, 4-6, 6+	computer games	weekday during term time- specified in question
BCS70	16	f15	"After school yesterday, how long spent playing computer games?"	hours/day: none, <1, >1, >2, >3, >4, >5	computer games	weekday
ALSPAC	22	YPB2061 YPB2071	"On an average weekday (weekend), how many hours per day do you: play games on PC/laptop, games console?"	hours/day: none, <1, 1-2, 3-4, 5-6, 7-8, 9+	electronic games	weekday & weekends

Table 13. Duration of time spent sedentary (Internet) —comparable items across childhood from selected CLOSER partner studies

Study	Age	Name	Question wording	Response scale	Included activities	Timespan of recall
MCS	14	FCCOMH00	"On a normal week day during term time, how many hours do you spend using the internet?"	hours/day: none, <1, 1<2, 1-<3, 3-<5, 5-<7, 7+	internet (tablets, smartphones, computers, laptops)	weekday during term time
ALSPAC	16	tc3008 tc3009	"On a day when s/he does any of the things below, about how long altogether does s/he usually spend on: internet (for school/college), internet (non-school/college)"	hours/ day: never, <30m, 30m-1, 1-2, 2-4, 4-6, 6+	internet	weekday during term time- specified in question

12. Conclusion

This guide has outlined the self-report physical activity measures available (as of July 2019) across five British birth cohort studies (NSHD, NCDS, BCS70, ALSPAC, and MCS), and one British panel study (UKHLS), with additional discussion on the comparability of the measures captured by the birth cohort studies. Measures were categorised into domains (including leisure time, occupational, active travel, domestic activities, and sedentary behaviour), identifying potential comparability on responses by frequency, duration, and intensity. A comprehensive tabulation of the measures is available as an electronic appendix. This is fully searchable and can be sorted by a number of different variables including study, sweep, year, age of study member, subject, informant, administrator, data collection method, questionnaire, question, response scale, physical activity domain, and whether it captured frequency, duration, or intensity.

This guide described the available physical activity variables within each longitudinal study and highlighted comparable variables across studies. Some domains, such as leisure time, were consistently measured across multiple studies at overlapping ages; other domains were more sparsely measured making comparability across longitudinal studies difficult. As well as a resource to help facilitate use of existing physical activity data, it is hoped that this guide also serves to inform assessment decisions in future study data collections.

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