Understanding movement behaviour time-use in youth from different socioeconomic backgrounds

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Understanding Movement Behaviour Time-Use in Youth from Different Socioeconomic Backgrounds

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Statement of Authorship

This thesis contains no material that has been extracted in whole or in part from a thesis that I have submitted towards the award of any other degree or diploma in any other tertiary institution. No other person's work has been used without due acknowledgment in the main text of the thesis. All research procedures reported in the thesis received the approval of the relevant Ethics/Safety Committees.

[redacted]

Katrina Louise Wilhite

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Abstract

Understanding the associations of movement behaviour time-use (i.e., physical activity, sedentary behaviour, and sleep) and youth's physical health, psychological health, and education-related outcomes has become increasingly popular in public health research. However, little is known about the differences in movement behaviour time-use across youth from different socioeconomic positions and how these differences may affect specific outcomes. This thesis furthers our knowledge of movement behaviour time-use and socioeconomic position through three studies. In the first study, a systematic review, I found that the combination of "high" levels of physical activity and sleep with "low" sedentary behaviour provided children and adolescents are generally associated with the best outcomes. In the second study I aimed to identify general and domain-specific movement trajectory profiles and whether socioeconomic position could predict profile membership. For general movement behaviours, males from different socioeconomic positions did not differ in their movement trajectory profiles, but females from lower socioeconomic position were a combination of being less physically active and more sedentary than their higher socioeconomic peers. For domain-specific movement behaviours those from lower socioeconomic backgrounds, regardless of sex, tended to spend a combination of more time in recreational screen activities and less time in education-related sedentary behaviour than their higher socioeconomic peers. In the final study I aimed to test if combinations of domain-specific movement behaviours mediated the relationship between socioeconomic position and socio- emotional outcomes in youth. Recreational screen activities had a mediating effect but combinations of domain-specific movement behaviours did not. These findings will help us better cater programs and guidelines to children from different socioeconomic backgrounds.

Chapter 1: Introduction

Movement behaviour time-use

What is movement behaviour time-use and why is it important?

Time-use refers to how time is spent in a 24 hour period and has been a widely adopted method of research for over six decades in multiple disciplines including economics, work-life balance, and social life[1]. Public health researchers have proposed using the time-use approach with movement behaviours (i.e., physical activity, sedentary behaviour, and sleep) to improve health recommendations[2–4]. Studying movement behaviours combined over a 24-hour period allows researchers to better understand how physical activity, sedentary behaviour, and sleep interact to provide the most beneficial outcomes.

Physical activity definition and benefits

The World Health Organisation defines physical activity as "any bodily movement produced by skeletal muscles that require energy expenditure."[5] Physical activity can be accumulated aerobically (e.g., running, swimming) or through resistance training (e.g., weight lifting, jumping). Aerobic physical activity can be broken up into different intensity levels, or how difficult it is. Metabolic equivalents (METs) are commonly used to measure how intense, or difficult an aerobic exercise is[6]. One MET is typically "3.5 ml/min/kg resting oxygen consumption", or in more simple terms, how much energy your body uses while at rest. The higher the metabolic equivalent, the more energy is being expended, and therefore the higher the intensity of an activity.

Light physical activity is the lowest intensity and is measured at a level between 1.5 – 2.9 metabolic equivalents (METs) and can generally be sustained for at least an hour and cause no noticeable changes in breathing rate[7]. Light physical activity is not as widely discussed as moderate-vigorous physical activity. However, light physical activity should be considered when making physical activity recommendations for more sedentary individuals as it is easier to go from an inactive lifestyle to a lower intensity of exercise rather than a higher intensity[7,8]. Moderate-vigorous physical activity combines the two higher intensities and is commonly found in health recommendations[9]. Moderate physical activity is defined between 3-6 METs, and people can typically have a conversation. Vigorous physical activity is between 6-9 METs, and conversations usually cannot be held during this exercise intensity[9]. Finally, resistance training includes loaded movements to increase bone and muscle strength, general health, and sports performance[10].

Physical activity provides children and adolescents with several physical health, psychological health, and education-related benefits. Sufficient physical activity is protective against youth developing chronic disease, obesity, diabetes, sports injuries, and mental health disorders such as low self- esteem and depression[8,10–13]. Most of these associations behave in a dose-response manner, meaning the more physically active one is, the greater benefit they will receive[8,12,13]. Physical activity is also associated with increased cardiorespiratory and muscular fitness[14]. Regarding education, physically active youth tend to have increased cognitive and executive functions, attention spans, on-task behaviours and improved academic performance[13,15–17].

Physical activity domains

Physical activity can be accumulated in many ways[18]. In this thesis, I will refer to different types of physical activities as domains. Physical activity domains include structured physical activity such as sports participation, active transportation such as walking to school, household physical activity such as chores, and leisure physical activity such as playing for enjoyment or with friends[19–21].

It is important to consider domains of physical activity that youth participate in because the domains may influence certain outcomes differently. Although all domains fall under the "physical activity" umbrella they have various benefits and magnitudes of effects on different outcomes. For example, sports participation is associated with positive academic achievement, cognitive functioning, positive psychological health, and social connectivity[22–24]. A meta-analysis in adults found that active transportation and leisure-time physical activity are positively associated with mental health while household physical activity is negatively associated with mental health[21]. Another meta-analyis found a reduction in all-cause mortality has been found for physical activity in general but when broken down by specific domain, leisure-time physical physical activity showed the greatest benefits for reducing all-cause mortality and activities of daily living had the least benefit[25]. Physical activity domains and associations with youth's physical and mental health still needs to be explored.

Physical activity guidelines

A review published in 2020 identified 50 different official national and international physical activity recommendations for children and adolescents[26]. All recommendations stated that children and adolescents should participate in at least 60 minutes of moderate-vigorous physical activity each day, one country recommended a minimum of 90 minutes per day. Seven of these recommendations mentioned that physical activity could be accumulated in bouts, or short durations of exercise. Nineteen recommendations stressed that vigorous activity must be included several times per week, typically three times. Twenty-six recommendations stated that activities that strengthen bones and muscles should be incorporated several times per week, most recommending somewhere between 2-3 times per week. Three recommendations encouraged several hours of light physical activity per day.

Specifically for Australia, youth are recommended to accumulate at least 60 minutes of moderate-vigorous activity per day (e.g., football, netball, swimming)[27]. At least three days per week, as part of the 60 minutes, children and young people should include muscle and bone strengthening activities (e.g., running, climbing, push-ups). Finally, youth should do several hours of light physical activity per day (e.g., walking to school, helping around the house).

Physical activity measurement

Physical activity can be measured both subjectively and via devices[28]. Subjective physical activity measurements include self-report questionnaires or interviews. Physical activity can be measured objectively through devices such as accelerometers, heart rate monitors, pedometers, or wearable cameras. Researchers have discussed the strengths and limitations of subjective and device-based measurement types[28,29]. For example, in subjective measurements, participants may report behaviours that align with social expectations, known as social desirability bias. Participants may also forget exactly what they did in the past which could lead to recall bias. Device-based measurements can overcome both of these biases while also providing more accurate data than subjective measurements since the data is collected in real-time. However, objective measurements cannot provide information on domain-specific movement behaviours and are less convenient for participants. Therefore, strengths of subjective measurements include higher response rates from participants, measurements are typically less intrusive, and participants do not need to remember to put on/take off devices. Depending on what information is collected, subjective measurements have the opportunity to collect domain-specific movement behaviour data. For example, questionnaires may ask about sport participation, walking or riding a bike to school, etc.

Sedentary behaviour definition and benefits

Sedentary behaviour is defined as "any waking behaviour characterised by an energy expenditure ≤ 1.5 METs, while in a sitting, reclining, or lying posture"[30]. Examples of sedentary behaviour include reading, doing homework, and laying down while watching TV. Excessive sedentary behaviour can lead to obesity, increased risk of developing mental health problems, increased all-cause mortality, poorer diets, and poor academic performance in youth[11,31–33]. It is important to target sedentary behaviour in the earlier life stages as childhood sedentary behaviour is predictive of future sedentary behaviour[34]. Too much sedentary behaviour in adults has been linked to increased all-cause mortality, cancer, cardiovascular disease, and low back pain[31,35].

Sedentary behaviour domains

Like physical activity, there are different domains, or types, of sedentary behaviours. Sedentary domains include reading, drawing, classes, studying, socialising, playing instruments, board games, or recreational screen time (e.g., watching television, video games, or using smartphones). Among these, recreational screen time is an area of interest as it has been associated with unhealthy outcomes, some of which may not be present in other sedentary behaviour domains[36]. These poor health outcomes include decreased cognitive development, increased aggressive behaviour, higher obesity prevalence, decreased self-esteem, and decreased quantity and quality of sleep[36–40]. Recreational screen time has also been associated with ingesting higher amounts of high-caloric snacks, cariogenic food, and sugar-sweetened drinks[41]. However, recreational screen time does have its benefits as well. For example, certain video games that require multiple players have been shown to increase problem solving skills, social connectivity, and creativity in youth[42]. Other domains of sedentary behavour, such as education-based sedentary behaviours (e.g., reading, homework) benefit cognitive development and academic achievement in youth[40,43].

Sedentary behaviour guidelines

The 2020 systematic review that identified physical activity recommendations also reported sedentary behaviour recommendations. Of the 50 included physical activity recommendations[26], 16 included sedentary behaviour recommendations. Generally, the recommendations for overall sedentary behaviour is not quantifiable. The recommendations ranged from, “reduce sedentary behaviour” to “sit less, move more, and break up sitting”. Twelve of the sedentary behaviour recommendations suggested minimising screen time. Ten specifically stated to reduce screen time to less than or equal to 2 hours per day.

In Australia, it is recommended that youth should limit their time spent sitting or lying down, particularly in front of screens. The Australian recommendations also state that it is important to break up long periods of sitting as often as possible[27].

In 2022, the International School-Related Sedentary Behaviour Recommendations for Children and Youth were released[44]. Briefly, the recommendations state to break up sedentary behaviour with movement breaks, incorporate movement into homework and class assignments, avoid screen-based school-related activities both in and out of school, and to replace sedentary learning activities with movement-based learning activities. See Appendix A.1 for the full recommendations.

Sedentary behaviour measurement

Similar to physical activity, sedentary behaviour can be measured subjectively and through devices[29]. Subjective measures include self-report and interview while device-based measures of sedentary behaviour include accelerometers, heart rate monitors, direct observation, or wearable cameras. Oftentimes, researchers use screen time as a proxy for sedentary behaviour. This proxy measure is likely due to the increasing concern of screen time on youth outcomes (e.g., obesity, decreased cognitive functioning)[36,39]. Although screen time has become a popular proxy for measuring sedentary behaviour it has its limitations as the measurement ignores the benefits and detriments of other sedentary behaviours (e.g., studying)[29].

Sleep definition and benefits

From a behaviour standpoint, sleep can be defined as "a reversible behavioural state of perceptual disengagement from and unresponsiveness to the environment."[45]. Sleep is complicated to study because it has many dimensions including sleep duration, sleep quality, and sleep efficiency; all of which are important for health[46]. Although all dimensions of sleep are important and have their place in health, for the purpose of this thesis, I will focus on sleep duration, or how long one sleeps.

Typically, sleep is accumulated as nighttime sleep or daytime naps. Lack of sleep has been associated with an increased risk of obesity, metabolic dysfunction, and mental health disorders[47–50]. Those with sleep disorders are more prone to adverse health effects. For example, those with obstructive sleep apnea have an increased risk of developing diabetes, metabolic syndrome, coronary artery disease, or a stroke[51]. Particularly for youth, insufficient sleep is linked to decreased academic success, motivation, cognitive functioning, well-being, attention due to daytime sleepiness, and emotional regulation[50,52–55]. Insufficient sleep also increases irritability and interpersonal conflicts in youth[50]. Naps are important to consider when studying sleep because they may be able to help counteract some negative effects of insufficient nighttime sleep. For example, independent of nighttime sleep, daytime naps benefit children's and adolescents' neurocognitive function, psychological wellness, behaviour problems, and academic achievement[56,57].

Sleep guidelines

Sleep guidelines differ by age group. Generally, guidelines for children between 6-12 years old ranges from 9-12 hours of sleep per night[26,58]. The sleep recommendations for 13-17 years old ranges between 8.5-10 hours of sleep per night[26,58]. Several of these recommendations state that the sleep needs to be “uninterrupted”.

Australia recommends that children aged 5-13 should get an uninterrupted 9-11 hours of sleep each night and young people aged 14-17 should get an uninterrupted 8-10 hours of sleep each night[27]. The Australian guidelines also recommend strategies to ensure good sleep in this population: have a consistent bedtime and wake-up time, avoid screens 1 hour before sleep, and keep screens out of the bedroom.

Sleep measurements

Sleep can also be measured by devices and subjectively. An objective measurement of sleep is polysomnography[59]. Polysomnography measures sleep by collecting data on muscle movement, respiration, and cardiovascular signals (e.g., heart rate). Although the measurement is accurate it is cumbersome, expensive, and an infeasible method in large-scale studies. Other sleep measurements include self-report, accelerometry, direct observation, bed sensors, eyelid movement sensors, and arm sensors[60,61].

Co-dependence of movement behaviours

Physical activity, sedentary behaviour, and sleep are co-dependent because time spent in one movement behaviour displaces time spent in others[62]. This means that although an appropriate amount of time may be spent doing one movement behaviour, it may be at the expense of the other behaviours. For example, a study by Olds et al. compared youth's aged 5-16 years (mean 13.4) movement behaviour time-use during structured school days versus holiday periods[63]. Youth displaced their education time with significantly less vigorous activity, more screen time, more sleep, similar eating patterns, and less sitting time during the holidays compared to school days. Despite the decreased sitting time during the holidays, their total energy expenditure was far lower than during school days. This change in movement behaviours is estimated to increase body fat by an average of ~650g in six weeks. This shows how although one movement behaviour was improved, it was at the expense of another and ultimately led to an undesirable health outcome. Therefore, a proper balance of movement behaviours, or a healthy time-use, is warranted.

How is movement behaviour time-use measured?

Movement behaviour time-use can be measured in several ways. Accelerometry data can track different intensities of physical activity, sedentary behaviour, and sleep time[29,60]. Wearable cameras can provide extensive data on the location, context, and specificity of activities with less error[2]. Researchers that are explicitly researching time-use commonly use time-use diaries[62]. Time-use diaries allow researchers to see how much time people spend on specific activities. Some time-use diaries can be used to investigate co-behaviours (e.g., standing while working) or descriptions of activities (e.g., biking to school). These details can help researchers identify trajectories and sequences of behaviours that lead to healthy or unhealthy outcomes, and can be used in assessing trends in social inequalities[62].

One study used longitudinal time-use diary data to investigate trajectories of health-related quality-of-life and socio-emotional outcomes in two cohorts of children (0-4 years, 5-9 years) based on screen time and physical activity[64]. Children who increased their physical activity and participated in low amounts of screen time had the highest health-related quality of life and socio-emotional outcomes (i.e., emotional problems, conduct problems, hyperactivity/inattention, and peer problems) compared to those in other trajectories. Health-related quality of life and socio-emotional outcomes were poorer in children who had low amounts of physical activity and increased their screen time or continued their same physical activity and screen time behaviours. Poor outcomes were especially profound in the group of children who increased their screen time.

The Multimedia Activity Recall for Children and Adolescents (MARCA) is one specific time-use diary. MARCA requires participants to recall their activities in 15-minute increments and has been shown to achieve higher validity and reliability than self-report analyses which are commonly used in measuring physical activity, sleep, and sedentary behaviour, namely screen time[65]. One study using MARCA as a means of data collection shows how the specificity found in time-use diaries can be beneficial in creating more targeted interventions across sex[66]. This study found that television viewing in girls was associated with a lower health-related quality of life compared to other forms of screen time. For boys, video gaming was strongly associated with low health-related quality of life. The same study found that the association between sport participation and quality of life was higher in girls and boys than in other forms of physical activity. These specific details found in research using time-use diaries can provide a more detailed direction with which type of physical activity and recreational screen time should be targeted in future health interventions.

In summary, physical activity, sedentary behaviour, and sleep affect many of the same outcomes in youth including physical health (e.g., obesity, diabetes), psychological health (e.g., depression, anxiety), and education (e.g., grades). Therefore, studying the interaction of movement behaviours may improve our understanding of which behaviours are causing specific effects in youth. The World Health Organization and several countries including Canada, New Zealand, Australia, and South Africa have recognised the importance of movement behaviour time-use and have updated their health recommendation to include physical activity, sedentary behaviour (including recreational screen time), and sleep[3,27,67–69].

Socioeconomic position and disparities

What is socioeconomic position and how is it measured?

Socioeconomic position, commonly used interchangeably with socioeconomic status, is the measure of an individual's status based on their social and economic position[70–72].

Socioeconomic position should not be confused with social class or social stratification since this terminology may be interpreted differently and they have different theoretical backgrounds than socioeconomic position[72]. Socioeconomic position is a multidimensional construct because it can be measured and researched through several means[70]. Common markers of socioeconomic position typically include income, education, and occupation[70]. However, depending on the research aims and the outcomes being measured other indicators of socioeconomic position may be used. These measurements include home ownership, neighbourhood socioeconomic position, wealth, income-to-needs ratio, poverty, or qualifying for free student lunches[70,71,73]. Composite indicators, or combining multiple measurements of socioeconomic position, can also be used[71]. Youth share the same socioeconomic position as their parents as they are dependents who do not have jobs or incomes of their own.

It is important to carefully consider which measurement of socioeconomic position should be used to answer a research question because all measurements of socioeconomic position have different strengths and limitations[71,74]. For example, income can rationalize discrepancies in resources and services, but it has higher non-response rates than other measures of socioeconomic position[74]. Education is more predictive of lifestyles and behaviours than other measures of socioeconomic position and can explain gaps in knowledge and understanding information[75]. However, education is not always linked to high health literacy. Occupation differences can account for different skills, working conditions and environments, time available to participate in various activities, and energy levels. Occupation does not account for differences in working conditions for men versus women or minority groups[74]. Consequently, no single measurement of socioeconomic position can explain every inconsistency in research or explain every disparity across different outcomes.

Physical, psychological and education-related disparities

The social gradient in health describes how people from a lower socioeconomic position tend to have poorer health conditions and shorter life expectancies than those from a higher socioeconomic position[76]. For example, youth's in the US whose parents did not complete a university degree have been found to have a 40-41% higher risk of passing away before age 25 compared to those whose parents did complete a university degree[77]. Concerning health, a systematic review across 27 high-income countries found an inverse relationship between children's and adolescents' socioeconomic background and weight status within the country[78]. A separate study of 31,523 students in the US found youth from lower socioeconomic positions had higher prevalence of bronchiolitis, urinary tract infection, asthma, and mood disorders than those from higher socioeconomic positions[79]. Youth from lower socioeconomic backgrounds also tend to have lower fitness levels than their higher socioeconomic peers. A study found youth from higher socioeconomic Australian schools were between 1.71 - 1.87 times more likely to fall in the "healthy fitness zone" for cardiorespiratory fitness than their lower socioeconomic peers[80].

Youth from lower socioeconomic backgrounds may also have poorer health in adulthood. Systematic reviews have found that low childhood socioeconomic position is associated with inflammation in adulthood and mortality from stroke, diabetes, respiratory diseases, digestive diseases, coronary heart disease, and stomach, liver and lung cancer[81–83]. A more recent study in Finland on 2,250 subjects aged 3-18 found that lower socioeconomic position in childhood was associated with an increased risk of developing metabolic syndrome, type 2 diabetes, and having impaired fasting glucose 31 years later[84].

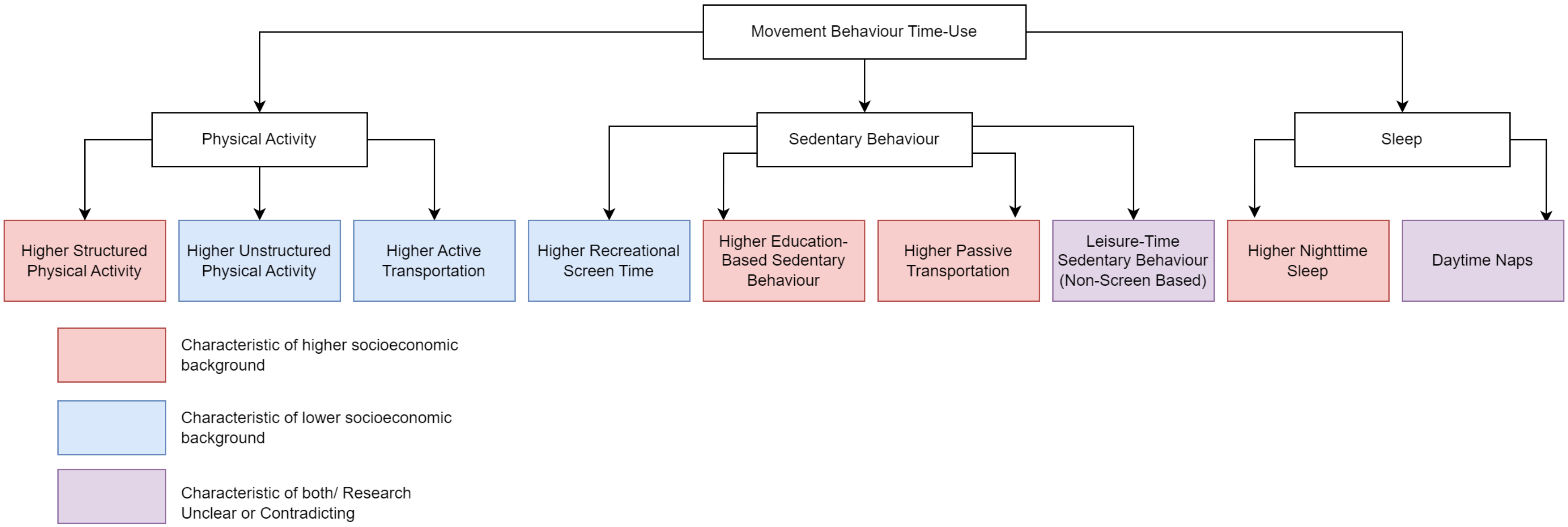
The social gradient in health applies not just to physical health but to psychological health. Several systematic reviews have found that children from lower socioeconomic backgrounds tend to display more antisocial behaviour, have higher incidences of attention-deficit/hyperactivity disorder, socio-emotional problems, and mental health problems (e.g., depression, anxiety) than their higher socioeconomic peers[85–89].

Youth from lower socioeconomic backgrounds also tend to have poorer education-related outcomes than children from higher socioeconomic backgrounds[90]. Children and adolescents from lower socioeconomic households tend to have higher overall absenteeism and absenteeism due to sickness, truancy, and suspension than their higher socioeconomic peers[91]. It has also been found that children from lower socioeconomic positions have lower levels of executive functioning, cognitive functioning, language literary, and numeracy literacy than their higher socioeconomic counterparts[90–92]. These gaps tend to start at a young age, meaning youth from low socioeconomic households are more likely to have poor academic performance (e.g., grades, standardised test scores), have a harder time remembering important information, and run the risk of falling further and further behind youth in middle- and high socioeconomic homes[90].

Movement behaviour disparities

Regarding movement behaviours, research has found discrepancies between physical activity, sedentary behaviour, screen time, sleep, and sport participation between youth from low socioeconomic position and high socioeconomic position[51,93–97]. A 2015 report from New South Wales, which includes information regarding socioeconomic position, stated that many youth did not meet physical activity, screen time, and sleep guidelines[98]. Youth from low socioeconomic position neighbourhoods were even less likely to meet physical activity and screen time recommendations than their higher socioeconomic peers.

However, few studies have encompassed all movement behaviours using the time-use perspective. Research suggests that youth from different socioeconomic backgrounds tend to be physically active and sedentary in different ways, or domains (see Figure 1.1)[93,99–102]. Therefore, when combining physical activity, sedentary behaviour, and sleep in general terms, it is unclear whether children from lower socioeconomic backgrounds have less desirable movement behaviour time-use patterns than their higher socioeconomic peers. Understanding and addressing inequalities in movement behaviours has the potential to bridge the gaps in physical health, psychological health, and education-related outcomes in youth from varying socioeconomic backgrounds.



93. Fairclough SJ, Boddy LM, Hackett AF, Stratton G. Associations between children's socioeconomic status, weight status, and sex, with screen-based sedentary behaviours and sport participation. Int J Pediatr Obes. 2009;4(4):299-305. doi:10.3109/17477160902811215

99. Smith M, Hosking J, Woodward A, et al. Systematic literature review of built environment effects on physical activity and active transport - an update and new findings on health equity. Int J Behav Nutr Phys Act. 2017;14(1):158. doi:10.1186/s12966-017-0613-9

100. Molina-García J, Queralt A. Neighborhood built environment and socioeconomic status in relation to active commuting to school in children. J Phys Act Health. 2017;14(10):761-765. doi:10.1123/jpah.2017-0033

101. Määttä S, Konttinen H, Haukkala A, Erkkola M, Roos E. Preschool children's context- specific sedentary behaviours and parental socioeconomic status in Finland: a cross- sectional study. 2017;7(11):e016690. doi:10.1136/bmjopen-2017-016690 %J BMJ Open

102. Musić Milanović S, Buoncristiano M, Križan H, et al. Socioeconomic disparities in physical activity, sedentary behavior and sleep patterns among 6- to 9-year-old children from 24 countries in the WHO European region. Obes Rev. July 2021:e13209. doi:10.1111/obr.13209

Figure 1.1 Movement Behaviour Time-Use Profiles by Socioeconomic Background

Factors influencing movement behaviour time-use in low socioeconomic position youth

Socio-ecological model

Socioeconomic position influences many aspects of youth's lives, including their movement behaviours. The socio-ecological model integrates components that influence a person's life on environmental, organisational, interpersonal, and individual levels. The socio-ecological model approach has been deemed promising in influencing health promotion, including socio-emotional health, as it is interdisciplinary and incorporates multiple theories found at each level[103,104]. Figure 1.2 uses the socio-ecological model as a conceptual model to show factors that may influence movement behaviour time-use by socioeconomic position. Investigating time-use movement behaviours may be useful in seeing how youth from different socioeconomic backgrounds spend their time and if the makeup of their day can explain health disparities in their socio-emotional health.

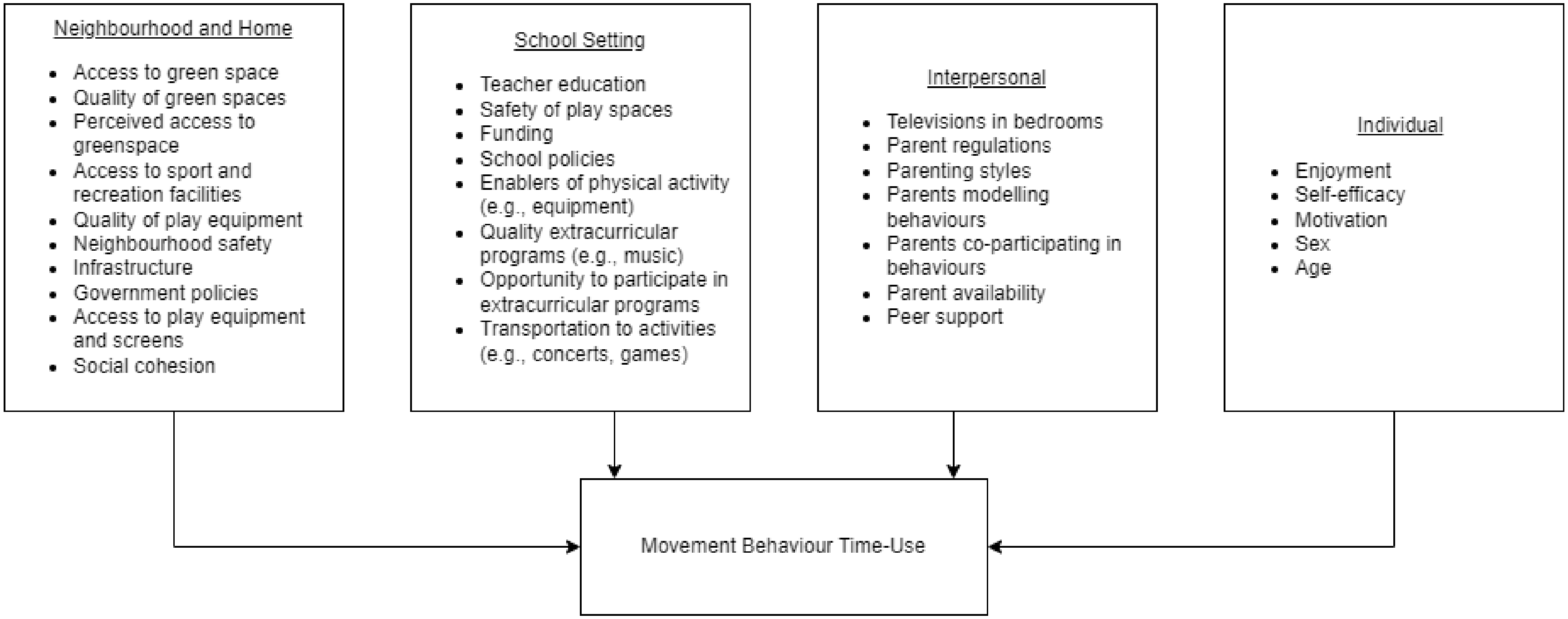
Neighbourhood and home environment

Social-disorganisation theory proposes that lower socioeconomic position neighbourhoods are exposed to more factors that lead to higher crime and delinquency rates than higher socioeconomic neighbourhoods[105]. Neighbourhoods with higher social-disorganisation (characterised by low social dynamic of a neighbourhood, high levels of violence, and poverty) have members with poorer physical and mental health[106]. Youth living in neighbourhoods with high social-disorganisation tend to have higher rates of behavioural problems (e.g, juvenile delinquency).

Green spaces (e.g., public parks) can provide opportunities for youth, especially boys, to engage in physical activity and reduce screen time[107]. Accessibility to quality green spaces can enhance psychological well-being, improve enjoyment, and increase social connectivity, recreational opportunities, and educational opportunities in an area[108]. Generally, studies have found that green spaces are less accessible and of poorer quality (e.g., less equipment and facilities, more safety concerns such as broken glass from bottles) in lower socioeconomic neighbourhoods[109–111]. One study found that green spaces and sport facilities are located within shorter distances to homes in lower socioeconomic position communities but parents may simply not have the means or funds to allow their children to be part of sports clubs[112]. Several studies have found that green spaces are less utilised in lower socioeconomic neighbourhoods due to lower perceived access, the quality of the space, and concerns about neighbourhood safety[106,113,114]. Additionally, neighbourhoods with less green space tend to have more indicators of socio-disorganisation (e.g., graffiti, abandoned buildings) which is associated with poorer sleep[115]. When possible, green spaces should be used for active play because time spent in green spaces helps children's and adolescents' socio-emotional health[116].

Neighbourhood safety can influence youth's movement behaviours. Parents and youth living in disadvantaged neighbourhoods have reported feeling anxious due to decreased road safety and higher crime rates[117]. Increased anxiety can cause parents to limit their child's time spent in outdoor play and independent mobility, or how far they are allowed to travel from home[117,118]. Other factors that restrict independent mobility are parents' perception of their child's cycling and traffic skills, the infrastructure of urban environments, and being a girl[119]. From a health perspective, outdoor time should be encouraged because it is associated with increased physical activity and mental health[120,121]. Further, physical activity mediates the relationship between outdoor play and mental and socio-emotional health[121]. Regarding sleep, decreased perception of neighbourhood safety negatively affects sleep quantity and daytime sleepiness[115].

Neighbourhoods' social cohesion and location also influence youth's movement behaviours. In Canada, youth in rural areas are less likely to participate in high amounts of screen-related activities than those living in large urban communities[122]. Additionally, rural



80. Peralta LR, Mihrshahi S, Bellew B, Reece LJ, Hardy LL. Influence of school-level socioeconomic status on children's physical activity, fitness, and fundamental movement skill levels. J Sch Health. 2019;89(6):460-467. doi:10.1111/josh.12761
106. Liu SR, Kia-Keating M, Santacrose DE, Modir S. Linking profiles of neighborhood elements to health and related outcomes among children across the United States. Health Place. 2018;53:203-209. doi:10.1016/j.healthplace.2018.08.013
107. Sanders T, Feng X, Fahey PP, Lonsdale C, Astell-Burt T. The influence of neighbourhood green space on children's physical activity and screen time: Findings from the longitudinal study of Australian children. Int J Behav Nutr Phys Act. 2015;12:126. doi:10.1186/s12966- 015-0288-z
108. Zhou X, Rana MP. Social benefits of urban green space : A conceptual framework of valuation and accessibility measurements. Management of Environmental Quality: An International Journal. 2012;23(2):173-189. doi:10.1108/14777831211204921
112. Bürgi R, Tomatis L, Murer K, de Bruin ED. Spatial physical activity patterns among primary school children living in neighbourhoods of varying socioeconomic status: a cross-sectional study using accelerometry and Global Positioning System. BMC Public Health. 2016;16:282-282. doi:10.1186/s12889-016-2954-8
113. Ferreira I, van der Horst K, Wendel-Vos W, Kremers S, van Lenthe FJ, Brug J. Environmental correlates of physical activity in youth - a review and update. Obes Rev. 2007;8(2):129-154. doi:10.1111/j.1467-789X.2006.00264.x
114. Jones A, Hillsdon M, Coombes E. Greenspace access, use, and physical activity: understanding the effects of area deprivation. Prev Med . 2009;49(6):500-505. doi:10.1016/j.ypmed.2009.10.012
115. Hunter JC, Hayden KM. The association of sleep with neighborhood physical and social environment. Public Health. 2018;162:126-134. doi:10.1016/j.puhe.2018.05.003
117. Weir LA, Etelson D, Brand DA. Parents' perceptions of neighborhood safety and children's physical activity. Prev Med . 2006;43(3):212-217. doi:10.1016/j.ypmed.2006.03.024
118. Carver A, Timperio A, Crawford D. Playing it safe: the influence of neighbourhood safety on children's physical activity. A review. Health Place. 2008;14(2):217-227. doi:10.1016/j.healthplace.2007.06.004
119. Ghekiere A, Deforche B, Carver A, et al. Insights into children's independent mobility for transportation cycling- which socio-ecological factors matter? J Sci Med Sport. 2017;20(3):267-272. doi:10.1016/j.jsams.2016.08.002
123. Veitch J, Hume C, Salmon J, Crawford D, Ball K. What helps children to be more active and less sedentary? Perceptions of mothers living in disadvantaged neighbourhoods. Child Care Health Dev. 2013;39(1):94-102. doi:10.1111/j.1365-2214.2011.01321.x
126. Liu J, Wu T, Liu Q, Wu S, Chen JC. Air pollution exposure and adverse sleep health across the life course: a systematic review. Environ Pollut. 2020;262:114263. doi:10.1016/j.envpol.2020.114263
127. Tainio M, Jovanovic Andersen Z, Nieuwenhuijsen MJ, et al. Air pollution, physical activity and health: a mapping review of the evidence. Environ Int. 2021;147:105954. doi:10.1016/j.envint.2020.105954
128. Caddick ZA, Gregory K, Arsintescu L, Flynn-Evans EE. A review of the environmental parameters necessary for an optimal sleep environment. Build Environ. 2018;132:11-20. doi:10.1016/j.buildenv.2018.01.020
130. Bagley EJ, Kelly RJ, Buckhalt JA, El-Sheikh M. What keeps low-SES children from sleeping well: the role of presleep worries and sleep environment. Sleep Med. 2015;16(4):496-502. doi:10.1016/j.sleep.2014.10.008
131. Olstad DL, Ancilotto R, Teychenne M, et al. Can targeted policies reduce obesity and improve obesity-related behaviours in socioeconomically disadvantaged populations? A systematic review. Obes Rev. 2017;18(7):791-807. doi:10.1111/obr.12546
136. Carlson JA, Mignano AM, Norman GJ, et al. Socioeconomic disparities in elementary school practices and children's physical activity during school. Am J Health Promot. 2014;28(suppl 3):S47-S53. doi:10.4278/ajhp.130430-QUAN-206
137. Van Dyke ME, Cheung PC, Franks P, Gazmararian JA. Socioeconomic and racial/ethnic disparities in physical activity environments in Georgia elementary schools. Am J Health Promot. 2018;32(2):453-463. doi:10.1177/0890117117717016
139. Macpherson AK, Jones J, Rothman L, Macarthur C, Howard AW. Safety standards and socioeconomic disparities in school playground injuries: a retrospective cohort study. BMC Public Health. 2010;10:542. doi:10.1186/1471-2458-10-542
140. Jaschke AC, Honing H, Scherder EJA. Longitudinal analysis of music education on executive functions in primary school children. Front Neurosci. 2018;12:103. doi:10.3389/fnins.2018.00103
143. Hoffman AR. Compelling questions about music, education, and socioeconomic status.
Music Educators Journal. 2013;100(1):63-68. doi:10.1177/0027432113494414
145. Xu H, Wen LM, Rissel C. Associations of parental influences with physical activity and screen time among young children: a systematic review. J Obes. 2015;2015:546925. doi:10.1155/2015/546925
152. Jago R, Davison KK, Brockman R, Page AS, Thompson JL, Fox KR. Parenting styles, parenting practices, and physical activity in 10- to 11-year olds. Prev Med. 2011;52(1):44-47. doi:10.1016/j.ypmed.2010.11.001
153. Langer SL, Crain AL, Senso MM, Levy RL, Sherwood NE. Predicting child physical activity and screen time: parental support for physical activity and general parenting styles. J Pediatr Psychol. 2014;39(6):633-642. doi:10.1093/jpepsy/jsu021
154. Ranum BM, Wichstrøm L, Pallesen S, Falch-Madsen J, Steinsbekk S. Persistent short sleep from childhood to adolescence: child, parent and peer predictors. Nat Sci Sleep. 2021;13:163-175. doi:10.2147/NSS.S290586
155. Lam CB, McHale SM. Developmental patterns and parental correlates of youth leisure-time physical activity. J Fam Psychol. 2015;29(1):100-107. doi:10.1037/fam0000049
156. Mutz M, Albrecht P. Parents' social status and children's daily physical activity: the role of familial socialization and support. J Child Fam Stud. 2017;26(11):3026-3035. doi:10.1007/s10826-017-0808-3
158. Seabra A, Mendonca D, Maia J, et al. Gender, weight status and socioeconomic differences in psychosocial correlates of physical activity in schoolchildren. J Sci Med Sport. 2013;16(4):320-326. doi:10.1016/j.jsams.2012.07.008
159. Park CL, Cho D, Moore PJ. How does education lead to healthier behaviours? Testing the mediational roles of perceived control, health literacy and social support. Psychol Health. 2018;33(11):1416-1429. doi:10.1080/08870446.2018.1510932
160. Craike M, Wiesner G, Hilland TA, Bengoechea EG. Interventions to improve physical activity among socioeconomically disadvantaged groups: an umbrella review. Int J Behav Nutr Phys Act. 2018;15(1):43. doi:10.1186/s12966-018-0676-2
161. Wight VR, Raley SB, Bianchi SM. Time for children, one's spouse and oneself among parents who work nonstandard hours. Soc Forces. 2008;87(1):243-271. doi:10.1353/sof.0.0092 %J Social Forces
162. Donkin A, Marmot M. Poverty and reductions in fitness levels in children and adolescents in upper middle-income countries. Br J Sports Med. 2019;53(8):462-463. doi:10.1136/bjsports-2017-098992
163. Prochaska JJ, Rodgers MW, Sallis JF. Association of parent and peer support with adolescent physical activity. Res Q Exerc Sport. 2002;73(2):206-210. doi:10.1080/02701367.2002.10609010
164. Richards R, McGee R, Williams SM, Welch D, Hancox RJ. Adolescent screen time and attachment to parents and peers. Arch Pediatr Adolesc Med. 2010;164(3):258-262. doi:10.1001/archpediatrics.2009.280
167. White RL, Bennie A, Vasconcellos D, et al. Self-determination theory in physical education: a systematic review of qualitative studies. Teaching and Teacher Education. 2021;99:103247. doi:10.1016/j.tate.2020.103247
168. B Owen K, Smith J, Lubans DR, Ng JYY, Lonsdale C. Self-determined motivation and physical activity in children and adolescents: a systematic review and meta-analysis. Prev Med. 2014;67:270-279. doi:10.1016/j.ypmed.2014.07.033

Figure 1.2 Conceptual Model: Factors Influencing Movement Behaviour Time-Use neighbourhoods show a more positive sports culture because there are more youth to play with, community support is high, and adequate space is available for youth to be more active[123]. A longitudinal study in 60 US children aged 7-9 found those involved in strong community-based music and sports programs were found to have stronger socio-emotional traits than youth that did not[124].

Environmental conditions can also influence health and movement behaviours. People from socioeconomically disadvantaged areas tend to be exposed to subpar environmental conditions such as poor air quality and high ambient noise[125]. Poor air quality and high ambient noise can negatively affect both physical activity and sleep[126–128]. Housing conditions and available resources at home can also influence youth's behaviour. Studies have found that youth from lower socioeconomic position households have less equipment available to be physically active with such as bikes, balls, or jump ropes[95,129]. They also have more electronic devices in their bedrooms which promotes sedentary behaviour, principally screen time. For sleep, youth from lower socioeconomic position households have reported less desirable sleep conditions in the home such as noise, light, and uncomfortable beds[130].

Government policies have the potential to facilitate change in socioeconomically disadvantaged neighbourhoods. A 2017 systematic review identified ten government policies that aimed to decrease obesity and obesity-related behaviours in socioeconomically disadvantaged areas[131]. Policies that directly targeted socioeconomically disadvantaged populations were more successful in narrowing health gaps than population-wide policies[131,132]. The most effective policies for youth from lower socioeconomic backgrounds were school-based and provided information and education about physical activity. Other studies have supported the notion that government policies should not only focus their efforts on socioeconomically disadvantaged communities but to also consider their location and cultural needs[133,134].

School setting

Barriers for physical activity are also found at disadvantaged schools. Despite having similar policies and certain resources, youth from lower socioeconomic position schools tend to be less active than those from higher socioeconomic schools[135]. Explanations for this physical activity disparity could be that schools from lower socioeconomic areas tend to have more barriers and fewer enables to physical activity than schools from higher socioeconomic areas[80]. Barriers to physical activity are fewer students knowing the physical activity recommendation, lack of areas to be physically active during poor weather conditions, fewer sports facilities, fewer physical activity programs, fewer physical education teachers, lower teacher expertise in exercise, less access to walking tracks and play areas, and less access to physical activity equipment during recess time[80,136,137]. Lower socioeconomic position schools have fewer enablers to promote physical activity compared to higher socioeconomic position schools, including encouraging students to lead a physically active lifestyle, communicating the promotion and importance of physical activity to the parents, leadership programs promoting physical activity, and incentive programs to be physically active[80]. Offering opportunities to be physically active, such as quality physical education programs, not only helps youth's physical health but their socio-emotional health as well[138].

School safety is another issue that comes into play with child physical activity. Children from lower socioeconomic position schools have higher rates of injuries due to unsafe play equipment[139]. These injuries could potentially discourage children from being active during their recess and lunch times. One study found that after poor playground equipment was replaced, the disparity between playground injuries across socioeconomic position was removed[139].

There are disparities in sedentary behaviours in schools as well. For example, music education positively correlates with cognitive abilities and academic performance[140]. However, schools in socioeconomically deprived areas have fewer music facilities and resources, lower quality programs, lower budgets, and lower financial and parental support for the students[141]. Even within schools, students from lower socioeconomic positions are less likely to participate in music programs than their higher socioeconomic peers[142]. Explanations for this discrepancy include the inability to afford instruments or field trip costs, lack of transportation to concerts and events, and exclusive “social groups” where you are expected to already have a specific skill level or taste in music[140,143].

Interpersonal

Social-cognitive theory states that people learn behaviours from observing others (e.g., children learning from watching their parents)[144]. A systematic review which found that parents' physical activity and screen time habits influence their children’s physical activity and screen time habits, exemplifying the importance of parents modelling behaviour for their children[145]. The family system approach recognises the importance of parents modelling and being involved in their children’s healthy habits and weight loss efforts[146]. The “Healthy Dads, Healthy Kids” program was an intervention that successfully adopted the family system approach. The intervention modified fathers’ physical activity and health habits while the dad helped to modify their child’s physical activity. The fathers in the program lost more weight, decreased their energy intake, decreased their waist circumference, and increased their physical activity more than the fathers in the control group. The children in the intervention groups lost more weight and increased their physical activity more than children in the control group. The success of this intervention suggests that parent involvement and modelling behaviours may play a crucial role in the health habits of their children[147].

There are notable differences in parenting styles across socioeconomic position. The family stress model states that economic distress in a family leads to emotional distress such as anxiety, depression, and familial conflicts[148]. This economic and emotional distress can lead to authoritarian parenting methods which consist of limited decision-making for the child, the parents demanding a lot, and harsher forms of punishment[111,149,150]. Generally, parents from more disadvantaged backgrounds tend to teach their children to be obedient and value conformity[111,151]. These characteristics are often found in jobs associated with lower socioeconomic position[111]. This style of parenting has been shown to be unfavourable in child-rearing[150]. Youth whose parents adopt these parenting styles tend to have an increased amount of screen time, are not offered as much support for physical activity and have lower sleep duration due to presleep worries and low parental emotional availability[130, 152–154].

Studies have shown that parental influence (i.e., parent modelling physical activity, co-participation in sport, belief in the importance of sport, parent support to be physically active) is a major determinant in their child's physical activity[155,156]. Parents from lower socioeconomic positions typically have a different influence on their child's movement behaviours than parents from higher socioeconomic positions. For example, parents from lower socioeconomic positions do not participate in physical activity on their own time or with their children as often as those from higher socioeconomic positions. Therefore, parents from lower socioeconomic backgrounds do not model and co-participate in physical activity as often[123]. Parents from lower socioeconomic positions also tend to watch more television with their children than parents in higher socioeconomic households[95]. However, it has been suggested that parent co-participation in children's leisure time activities is positively associated with socio-emotion well-being[157]. Regarding beliefs, parents from a lower socioeconomic position tend to not believe in the benefits of physical activity as much as those from a higher socioeconomic position[123,158]. Different education levels could explain differing beliefs in physical activity because those with lower educational attainment tend to find it more difficult to find and understand information related to leading a healthy lifestyle[159]. Consequently, parents from lower socioeconomic households may not encourage their children to be physically active nor discourage sedentary behaviour because they may not believe in or recognise its benefit[123,158]. Interestingly, a systematic review identified promising interventions for physical activity for youth in disadvantaged communities[160]. The most successful interventions were family-based with high parent involvement.

Parents from lower socioeconomic backgrounds tend to work more jobs with nonstandard working hours compared to those from higher socioeconomic backgrounds[161]. Jobs with nonstandard working hours tend to have a lower income than standard-hour jobs[161]. Income inequality is an issue with health because those with lower incomes do not always have the economic means to live a healthy lifestyle[162]. If parents work nonstandard hours and have a lower income they may not be able to facilitate (e.g., pay club fees and provide transportation to practices) sport participation in their children or provide supervision to encourage physical activity, discourage sedentary behaviour, or enforce bedtimes.

Peers also play a role in youth's movement behaviours. It has been found that physical activity is positively associated with peer support for being physically active or participating in sport[163]. Conversely, screen time is associated with poor attachment to peers[164]. However, a 2016 report from the World Health Organisation shows that children from lower socioeconomic positions spend less time with their friends and feel less peer support than children from higher socioeconomic positions[165].

Individual

Individuals have different goals and participate in various behaviours to attain them. Therefore, it is important not only to investigate the effects of a neighbourhood, school, and home environment on children's health behaviours, but the youth themselves. Self-determination theory states to develop motivation three separate needs must be met: autonomy, relatedness, and competence[166]**.** Autonomy is the need to be in control of your actions. Relatedness is the need to have a sense of belonging. Competence is the need to feel capable, or master an activity or skill. If all of these needs are satisfied, motivation should increase.

Understanding motivation is important because “motivation is perhaps the critical variable in producing maintained change.”[166] Several systematic reviews and meta-analyses have found that self-determined motivation is positively associated with physical activity, especially when there are a variety of options, novel activities, and positive peer relationships are encouraged[167,168].

Children are generally not given as much autonomy as adolescents or adults as they are younger and need more direction. However, in the education setting children have higher reported intrinsic motivation when in a more autonomous learning environment[169]. High autonomy in physical education classes is also linked to increased effort and persistence in class[170]. Although autonomy influences the motivation of an individual, factors from the school level (e.g., teacher styles, availability of equipment, etc.) and home (e.g., parenting styles) are necessary to make behaviour change possible. Autonomy tends to be different for children from different socioeconomic backgrounds. Youth whose parents have higher socioeconomic position are typically included in decisions about what they want to do (e.g., which sport they would like to try) and are encouraged to offer their opinions[111]. In lower socioeconomic position, youth are generally told to respect authority. If they are unhappy with something they may be taught to deal with it, even if it seems unfair. These parents also tend to be less encouraging toward their children, including participating in a healthy lifestyle. When they do show support it is more in the form of verbal demands which has been shown to be less effective than co-participation in or modelling an activity[171]. This could potentially weaken their child’s autonomy as parental support is not perceived positively. Therefore, it may be more difficult for children from lower socioeconomic position to fulfil the need for autonomy as they may feel obliged to always listen and not express their opinions or desires. However, this is different when discussing sleep[172]. Youth from low socioeconomic backgrounds getting less sleep may be explained by parents not believing in or understanding the importance of sufficient sleep and setting bedtimes for their children. Consequently, many youth are completely autonomous in setting their own bedtimes. This can result in later bedtimes and less overall sleep.

The relatedness need of self-determination theory may be influenced by socioeconomic position as well. Parents from lower socioeconomic position households spend less time co-participating in physical activity with their children than parents from higher socioeconomic position households[156,158]. If younger children wish to participate in a healthy time-use, but their parents do not want to be physically active they may feel disconnected and unable to relate to their parents. Additionally, youth from lower socioeconomic position households have been found to have less social skills and more behavioural problems[148]. Having fewer social skills may negatively influence children from lower socioeconomic position status to connect and feel a sense of belonging with their peers. Consequently, this population may feel less motivated to engage in sports participation or games with a group.

Competence is the final need in self-determination theory. Youth from lower socioeconomic backgrounds have been found to have similar perceived athletic competence as their higher socioeconomic backgrounds but still participate in less moderate-vigorous physical activity[173–175]. Although the need for competence was satisfied, it is likely autonomy and relatedness were not, highlighting the importance of satisfying all three needs and exploring other theories to explain physical activity discrepancies.

Self-efficacy is a major determinant in physical activity[160]. A systematic review assessing correlates of physical activity in disadvantaged groups found that self-efficacy was beneficial, but few interventions have used the theory to increase physical activity. Strategies to increase self-efficacy include goal setting, role models, praise, encouragement, and creating a positive environment[176].

Research problems and research questions

Research problem

In summary, movement behaviours (i.e., physical activity, sedentary behaviour, and sleep) are co-dependent and affect many of the same physical, psychological, and education-related outcomes in youth. Therefore, public health researchers are recommending that movement behaviours be studied in combination over a 24-hour period rather than in isolation. Consequently, research exploring associations between children's and adolescent's movement behaviour combinations and their physical, psychological, and education-related outcomes has increased. Combinations of movement behaviours and health indicators in youth has been systematically reviewed but since this review, research in the area has increased ten-fold[177]. Additionally, combinations of movement behaviours with children and adolescents' psychological health and education-related outcomes have been less studied and should be systematically reviewed since rates of depression and anxiety in children and adolescents have been rising[178,179].

Movement behaviours can be split up by domain, or type, which may have important implications for youth from different socioeconomic backgrounds. It is important to consider youth's socioeconomic background because there are concerning disparities between youth's physical, psychological, and education-related outcomes. However, from a 24-hour perspective, it is unclear whether youth from different socioeconomic backgrounds actually move differently in a day. Further, it is unknown whether youth's movement behaviours can explain disparities between their socioeconomic background and childhood outcomes.

Research questions

In this thesis, I present three studies that aim to address the following questions:

1. What are the associations of different combinations of physical activity, sedentary behaviour, and sleep in physical health, psychological health, and education-related outcomes in children and adolescents?
2. What are the different general movement trajectory profiles regarding the overall quantity of physical activity, sedentary behaviour, and sleep among youth?
3. What are the domain-specific movement trajectory profiles among youth?
4. Does socioeconomic position predict profile membership in youth's general movement trajectory profiles regarding overall physical activity, sedentary behaviour, and sleep?
5. Does socioeconomic position predict profile membership in youth's domain-specific movement trajectory profiles?
6. Does domain-specific movement trajectory profile membership mediate the relationship between socioeconomic position and socio-emotional outcomes in youth?
7. Do general movement behaviours (individual and combinations) mediate the relationship between socioeconomic position and socio-emotional outcomes in youth?
8. Do domain-specific movement behaviours (individual and combinations) mediate the relationship between socioeconomic position and socio-emotional outcomes in youth?

Chapter 2: Combinations of Physical Activity, Sedentary Behaviour, and Sleep and their Associations with Physical, Psychological, and Educational Outcomes in Children and Adolescents: A Systematic Review

Preface

This study has been accepted for publication (citation below) in the *American Journal of Epidemiology* (Impact Factor = 5.363). I was the first author and did 70% of the work. I have followed the PRISMA and AMSTAR 2 guidelines to create a high-quality study and have prospectively registered this systematic review on PROSPERO (ID: CRD42020181097).

To meet thesis submission guidelines, the language of this chapter has been updated from American English to British English, the supporting Web Material has been changed to appendices, and I have changed the writing to first person.

Wilhite, K, Booker, B, Ho-Huei, B, et al. Combinations of physical activity, sedentary behavior, and sleep and their associations with physical, psychological, and educational outcomes in children and adolescents: a systematic review. *Am J Epidemiol.* (In press).

Abstract

I conducted a systematic review to evaluate combinations of physical activity, sedentary behaviour, and sleep duration and their associations with physical, psychological and educational outcomes in children and adolescents. MEDLINE, CINAHL, PsychINFO, SPORTDiscus, PubMed, EMBASE, and ERIC were searched in June 2020. Included studies needed to 1) quantitatively analyse the association of two or more movement behaviours with an outcome, 2) analyse a population between 5-17 years old, and 3) include at least an English abstract. I included 141 studies. Most studies included the combination of physical activity and sedentary behaviour in their analyses. Sleep was studied less frequently. In combination, high physical activity and low sedentary behaviour were associated with the best physical health, psychological health, and education-related outcomes. Sleep was often in the combination that was associated with the most favourable outcomes. Sedentary behaviour had a stronger influence in adolescents than children and tended to be associated more negatively with outcomes when it was defined as screen time than overall time spent being sedentary. More initiatives and guidelines combining all three movement behaviours will benefit adiposity, cardiometabolic risk factors, cardiorespiratory fitness, muscular physical fitness, well-being, health-related quality of life, mental health, academic performance, and cognitive/executive function.

Introduction

Child and adolescent movement behaviours (i.e., physical activity, sedentary behaviour, sleep) are individually associated with many similar physical (e.g., adiposity)[8,12,15,47,180,181], psychological (e.g., mental health)[11,17,182], and educational (e.g., academic performance)[15–17,52,53,180,183,184]. Spending time in one movement behaviour displaces time spent in others, which may explain the overlap in associations with outcomes. However, these overlaps make it difficult to disentangle which behaviours are associated with specific outcomes. Therefore, researchers have started studying combinations of movement behaviours instead of in isolation.

A systematic review by Saunders et al. included 14 studies from 2011-2015 and found that combinations of a) high physical activity with low sedentary behaviour, b) high physical activity with high sleep, and c) high physical activity, low sedentary behaviour and high sleep, were associated with the most desirable physical health outcomes[177]. This review informed several international health recommendations[27,67,68,185], including the Canadian 24-hour Movement Behaviour Guidelines for Children and Youth[69]. Due to the popularity of these recommendations and introduction of new analytical methods, such as compositional data analysis[186], research on movement behaviours has increased substantially. Therefore, an update to the previous review is needed.

While the associations between combinations of movement behaviours and physical health outcomes are known, many psychological and educational outcomes have yet to be systematically reviewed. With rising rates of depression and anxiety among children and adolescents[178,179], psychological and educational outcomes are a growing concern and should be synthesised. Reporting associations for combinations of movement behaviours with psychological and educational outcomes may inspire a wider range of professionals (e.g., teachers, clinical psychologists) to adopt interventions addressing multiple movement behaviours. In turn, these professionals may provide valuable input to alter guidelines to suit a broader range of outcomes. Therefore, I aimed to update and expand on the Saunders et al. review.

Methods

Search strategy and selection criteria

I prospectively registered this systematic review on PROSPERO (ID: CRD42020181097) and reported the findings in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA[187].

To be included, studies needed to quantitatively analyse the association of at least two movement behaviours (i.e., physical activity, sedentary behaviour, sleep duration) with any outcome (i.e., physical, psychological, or educational) in youth (mean age between 5-17 years old). I modified the exclusion criteria from the previous review by not excluding studies based on sample size or type of physical activity measurement, whereas Saunders et al. required a minimum sample size of 300. I placed no exclusion criteria based on study design, setting, publication status, or publication date. I included studies in any language, provided they had an abstract in English with quantitative results.

I searched the following electronic databases in June 2020: MEDLINE, CINAHL, PsychINFO, SPORTDiscus, PubMed, EMBASE, and ERIC. I included more databases than the previous review, such as ERIC, to capture studies exploring a wider range of outcomes. The search strategy can be found in Appendix B.1. I revised the previous search strategy to include the combination of any two movement behaviours and to cater the search strategy to more databases.

Study selection, data extraction, and quality assessment

I uploaded all relevant articles to Covidence review management software (www.covidence.org) and removed duplicates. Two independent reviewers screened titles and abstracts. Two reviewers independently screened full-texts for studies that passed title/abstract screening. We resolved conflicts by consensus. One reviewer conducted bi-directional screening using the 14 articles from the Saunders et al. review and one additional recent article. Bi-directional screening is a method where a reviewer screens all references within an article and any articles that cited the article[188], providing a more thorough literature search.

Two independent reviewers completed data extraction and quality assessment. Data items included lead author, publication date, sample size, combination of movement behaviours evaluated, outcomes measured, methods of measurement, and results. Preliminary searches and the Saunders et al. review indicated that mainly observational studies would be included. Therefore, I evaluated study quality using an adapted version of the 'Strengthening the Reporting of Observational Studies in Epidemiology' (STROBE) Checklist[189]. As per previous reviews[190,191], I rated studies on nine criteria derived from STROBE items since the absence of these items could potentially introduce bias. Studies were considered high quality if they met seven or more criteria.

Data synthesis

There was substantial methodological heterogeneity across the studies, preventing a meta-analysis. Specifically, movement behaviours were categorised inconsistently. For example, some studies dichotomised movement behaviours (e.g., meeting/not meeting guidelines), others used sample-specific median splits, and others used compositional data analysis. While some studies could have been meta-analysed (e.g., only those with isotemporal substitution), most would have been excluded, risking systematically biased results. Accordingly, I narratively compared combinations of movement behaviours relative to other combinations within the same study. Per Cochrane, comparisons were based on the direction of associations, not statistical significance. Exemplar studies were described to provide potential associations.

Sedentary behaviour was defined differently across studies (e.g., “screen time”, “sitting”). In this review, I have generally used the term “sedentary behaviour”. I used “screen time” when I synthesised studies that all used “screen time” as their original definition of sedentary behaviour. I noted instances when the definition of sedentary behaviour influenced the results.

Due to the high number of studies that investigated different combinations of meeting the Canadian 24-hour Movement Behaviour Guidelines for Children and Youth (Appendix B.2), I refer to these recommendations as “movement behaviour guidelines” in the synthesis. I synthesised data separately for children (mean age 5-13 years) and adolescents (mean age 14-17 years). These age ranges were chosen based on current guidelines that separate sleep recommendations for children and adolescents[27,69]. I also analysed whether objective versus subjective measures of physical activity influenced the results. Finally, “sleep” refers to sleep duration.

Table 2.1 provides a concise summary of the results. This table highlights general trends in the included studies based on age group, outcome, and if the studies investigated the combination physical activity and sedentary behaviour exclusively or if the combinations of all three movement behaviours were included. The combination of physical activity and sedentary behaviour was addressed in the table as studies evaluating this combination made up a majority of the studies in this review.

Results

Description of studies

I imported 44,917 references into Covidence. After removing duplicates, 21,559 studies remained for title/abstract screening and 1,182 studies moved forward to full-text screening. Ten studies could not be retrieved after searching in academic libraries and requesting inter-library loans. Three additional studies were added for full-text screening from the bi-directional screening process. The total for data extraction included 141 studies (including two conference abstracts), all of which had an English version available (see Figure 2.1). A list of excluded studies can be found in Appendix B.3.

Fifty-seven countries were represented across the studies, primarily from the United States (k=29), Canada (k=21), and Australia (k=19). Most studies (119/141) were high-quality (see Appendix B.4) with a mean score of 7.4/9. The least reported items were, “Describe any efforts to address potential sources of bias” and “Describe any methods used to examine subgroups and interactions”. Study characteristics can be found in Appendix B.5.

Total physical activity, at any time of day or location, was primarily reported. Four studies reported sub-domains (e.g., sports). When studies were evaluated separately based on being measured objectively or subjectively, the trends were the same. This was also true for study quality. The dataset generated and analysed during the current study is available in the Open Science Framework repository, [https://osf.io/jq8xh].

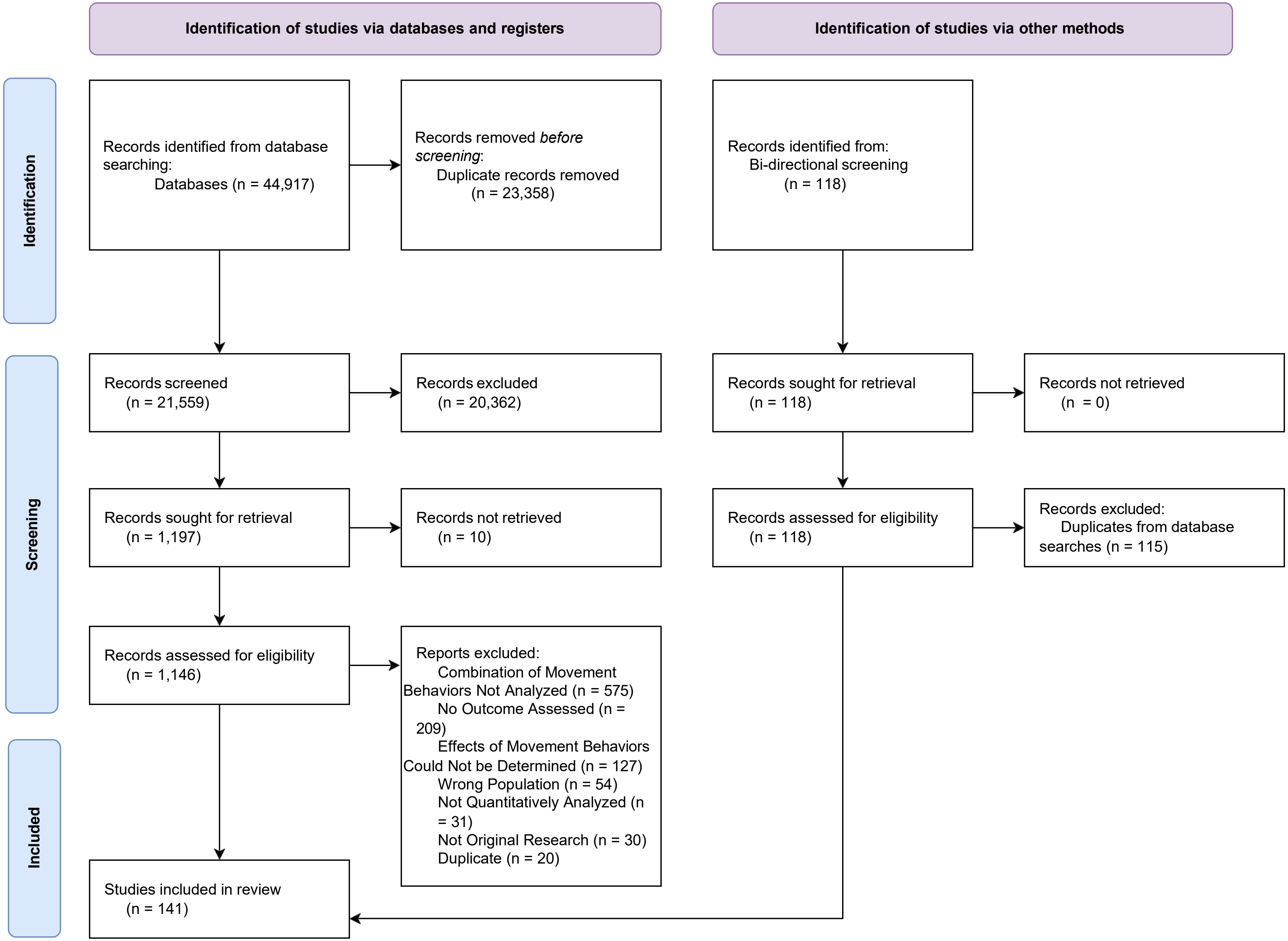


Figure 2.1 PRISMA Flow Chart; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Physical health-related outcomes

Adiposity.

Ten longitudinal and 79 cross-sectional studies investigated adiposity. Adiposity was measured by BMI, waist circumference, waist-to-height ratio, skinfold measurements, body fat percentages, visceral adipose tissue, and the fat mass index. Overall, participants with higher physical activity and lower sedentary behaviour had lower adiposity than those with other combinations of these two behaviours. Results differed slightly by age group. For children, the most optimal combination was generally high physical activity and low sedentary behaviour. For adolescents, lower sedentary behaviour was associated with lower adiposity, especially in girls. These results were consistent when sedentary behaviour was measured as screen time or by total sedentary behaviour. When sleep was analysed, combinations with high sleep were associated with lower adiposity.

Ten longitudinal and 51 cross-sectional studies investigated the relationship between physical activity and sedentary behaviour with adiposity. The majority (six longitudinal[192–197] and 32 cross-sectional studies[198–229]) concluded that high physical activity and low sedentary behaviour was associated with the best adiposity outcomes among children and adolescents. For example, in one longitudinal study of 9,155 children and adolescents, those with five bouts of moderate-vigorous physical activity per week and 4 hours of screen time per week had 25% lower odds of obesity 5 years later compared to those with 3 bouts of moderate-vigorous physical activity and 25 hours of screen time per week. The remaining results differed by age[203–206,209–211,219–221,223,224,230–238]. Eleven studies used isotemporal substitution (two longitudinal[239,240] and nine cross-sectional[206,241–248]), all of which found substituting sedentary behaviour with moderate-vigorous physical activity was associated with lower adiposity.

Sixteen cross-sectional studies investigated the combinations of all three movement behaviours. All found those with higher sleep had lower adiposity than their peers[208,228,249–262]. In eleven of these studies, high physical activity, low sedentary behaviour, and high sleep had the best association with adiposity[208,228,249–255,258,259], with the remaining five studies finding mixed results[252,256,257,260,261]. An additional twelve cross-sectional studies used isotemporal substitution[239,243,248,263–271] and found that substituting sedentary behaviour with moderate-vigorous physical activity was associated with lower adiposity. There were mixed results on substituting sedentary behaviour with sleep.

Cardiometabolic risk factors.

Three longitudinal and 18 cross-sectional studies evaluated cardiometabolic risk factors. Cardiometabolic risk factors included systolic and diastolic blood pressure, insulin-related measures, triglycerides, cholesterol, and C-reactive protein. Overall, active children with high sleep had the most desirable cardiometabolic risk factors. For adolescents, the combination of high physical activity and low sedentary behaviour was associated with desirable cardiometabolic risk factors.

Two longitudinal and 12 cross-sectional studies evaluated the combination of physical activity and sedentary behaviour with cardiometabolic risk factors. All studies agreed that high physical activity and low sedentary behaviour was associated with the best outcomes for cardiometabolic risk[210,224,226,234,236–238,272–278]. For example, one longitudinal study (n = 3,717) conducted a cluster analysis and found those with higher physical activity and lower sedentary behaviour than their peers with lower physical activity but similar sedentary behaviour had 13% lower odds of developing diabetes over a 5 year period[278]. Five separate studies generally agreed that substituting sedentary behaviour with moderate-vigorous activity was associated with the most desirable cardiometabolic outcomes[243,247,248,270,279]. One of these studies included sleep in their analysis and found mixed results, depending on the specific outcome, of substituting sedentary behaviour with sleep[243,247,248,270,279]. Findings from two studies (one longitudinal[251] and one cross-sectional[280]), both in children, concluded that the addition of high sleep in combination with low screen time and/or physical activity yielded the most favourable cardiometabolic outcomes. No studies included sleep in adolescents.

Cardiorespiratory fitness.

One longitudinal and 17 cross-sectional studies investigated cardiorespiratory fitness. Overall, combinations with high moderate-vigorous physical activity were associated with higher cardiorespiratory fitness. Specifically for adolescents, lower sedentary behaviour was associated with higher cardiorespiratory fitness. Additionally, sleep was associated with higher cardiorespiratory fitness in children.

One longitudinal study (n = 315) in children found that substituting 30 minutes of sedentary behaviour with vigorous-intensity physical activity yielded a positive association with cardiorespiratory fitness ($\beta = .307$)[281]. Six cross-sectional studies supported the finding of the longitudinal study by concluding that substituting sedentary behaviour with moderate-vigorous physical activity was positively associated with cardiorespiratory fitness for children and adolescents[242,244,246,264,270,282] An additional six cross-sectional studies found that children with higher physical activity than their peers, regardless of sedentary behaviour, had higher cardiorespiratory fitness[199,200,283–286]. However, in adolescents, three cross-sectional studies found that those who were more active and less sedentary than their peers had the highest cardiorespiratory fitness[209,226,287]. Two studies that included all three movement behaviours found that children who were more active and slept longer than their peers had higher cardiorespiratory fitness[251,288]. No studies included sleep for adolescents.

Muscular fitness.

Three cross-sectional studies investigated children's muscular fitness and found a positive association for those with high physical activity, low sedentary behaviour, and high sleep.

Two cross-sectional studies determined children spending more time in physical activity and less time in sedentary behaviour was associated with better muscular fitness outcomes[232,241]. For example, a study in 2,506 children found those with >=60 minutes of moderate-vigorous physical activity/day and low sedentary behaviour (characterised by a median split), were 2.5 times more likely to fall in the "healthy zone" for flexibility compared to those with <60 minutes of moderate-vigorous physical activity/day and high sedentary behaviour[232]. The final study (n = 243) evaluated children meeting different combinations of movement behaviour guidelines. Generally, children meeting physical activity and sleep recommendations had higher muscular strength, muscular endurance, and flexibility compared to children meeting any other combination[288].

Psychological outcomes

Well-being and socio-emotional outcomes.

Two longitudinal studies and ten cross-sectional studies investigated well-being and socio-emotional outcomes. The combination of high physical activity, low sedentary behaviour, and high sleep had the most favourable outcomes with life satisfaction, happiness, stress, positive affect, negative affect, angriness, confusion, prosocial behaviour, emotional health, peer problems, and hyperactivity.

Both longitudinal studies[64,289] and six cross-sectional studies[290–295] found that children and adolescents who were more active and less sedentary than their peers had better socio-emotional outcomes. For example, a longitudinal study over six years in 3,979 children found those who maintained low levels of physical activity and screen time or maintained physical activity levels but increased screen time had more socio-emotional problems than those who increased their physical activity and maintained low levels of screen time (β = .46 - .74)[64]. Four studies included sleep in their analysis. All found positive associations for the combination of high physical activity, low sedentary behaviour, and high sleep with well-being[194,251,262,270].

Health-related quality of life.

Three longitudinal studies and six cross-sectional studies investigated health-related quality of life. The combination of high physical activity and low sedentary behaviour (particularly screen time) was associated with the best outcomes. The addition of sleep appeared to improve outcomes.

All studies investigating physical activity and sedentary behaviour (three longitudinal[64,289,296] and five cross-sectional[246,297–300]) concluded that high physical activity and low sedentary behaviour had the most positive association with health-related quality of life. The longitudinal study with the largest sample size (n = 3,979) found children who maintained low levels of physical activity and screen time or maintained physical activity levels but increased screen time over six years had lower health-related quality of life than those who increased their physical activity and maintained low levels of screen time (β = -2.29 - -1.4)[64]. Only one study included sleep in their analysis and found that those meeting all movement behaviour guidelines had the best health-related quality of life[301].

Mental Health.

Twelve cross-sectional studies examined depression and anxiety. Appropriate amounts of all three movement behaviours were associated with better mental health, but sleep appeared to have the most consistent positive associations.

Seven studies found that participants who were more active and less sedentary than their peers had better mental health[292,302–307]. All five studies that included sleep in their analysis suggested high sleep may have a protective association on mental health since combinations that included high sleep usually had the most desirable outcomes[303,308–311]. For example, a study in 20,078 adolescents found that those who met all movement behaviour recommendations had the lowest odds of having anxiety or depression[308]. However, combinations not including sleep were associated with the highest odds of having anxiety or depression (OR = 3.92 - 37.14).

Education-related outcomes

Academic performance.

One longitudinal and eight cross-sectional studies investigated academic performance. High physical activity with low screen time or high physical activity with high total sedentary behaviour was associated with the best academic performance for children and adolescents. Sufficient sleep seemed to be beneficial for academic performance.

Studies that measured sedentary behaviour as screen time (one longitudinal[312] and two cross-sectional[313,314]) found that those who were more active with less screen time than their peers had the best academic performance. The longitudinal study (n = 261) found children who participated in >=60 minutes of moderate-vigorous physical activity/day and <=2 hours of screen time/day were 2.75 times more likely to have better grades than children with <60 minutes of moderate-vigorous physical activity/day and >2 hours of screen time/day. However, children who engaged in more non-screen-based sedentary behaviour (e.g., reading) had higher overall academic performance than their peers who spent less time in non-screen-based sedentary behaviour, regardless of physical activity[229,314–318]. One study (n = 285) found children with high physical activity and high total sedentary behaviour had the best-standardised test scores (504 vs. 471-502). One study investigated combinations of all three movement behaviours on academic performance and found meeting all movement behaviour guidelines was the most beneficial[319]. Furthermore, all combinations that included meeting the sleep recommendation were associated with higher academic performances than only meeting the combination of physical activity and screen time recommendations.

Cognitive/executive function.

Three cross-sectional studies examined associations with combinations of movement behaviours with cognitive and executive functioning in children. The combination of low screen time and long sleep duration was most beneficial.

One study found children who were more active with less screen time than their peers had the highest executive functioning[320]. Two additional studies included sleep in their analysis. Both studies found that children meeting the screen time and sleep guidelines had the most desirable associations with cognition and impulsivity compared to all other combinations[321,322]. For example, the association of low screen time and high sleep on cognition was between β = 3.21 - 5.37[323].

Additional outcomes

The remaining studies investigated non-alcoholic fatty liver disease, insomnia, and gross motor skills in children. They also studied Vitamin D concentration, bone mineral content, hormone levels, and DNA methylation in adolescents with different combinations of physical activity, sedentary behaviour, and sleep[275,292,324–328]. There were only one or two studies reported for each of the outcomes above. Generally, researchers have found that children and adolescents who are more active and less sedentary than their peers have the most favourable outcomes.

Although most studies found those who were the most active, least sedentary, and slept the longest had the most optimal outcomes overall, I have found a few considerations based on outcome and age group. See Table 2.1 for a summary of findings.

Discussion

This systematic review aimed to improve our understanding of different combinations of physical activity, sedentary behaviour, and sleep duration with physical, psychological, and educational outcomes in children and adolescents. Overall, I found that those who were more active, less sedentary, and slept longer than their peers appeared to have the most favourable outcomes. Additionally, this review highlights the importance of sleep, both in practice and in future research. On several occasions, when only physical activity and sedentary behaviour were considered in studies, I found that high physical activity and low sedentary behaviour was the “best” combination. However, studies that included sleep found that combinations including high sleep were usually the superior option. For example, all combinations that included high sleep duration were associated with desirable mental health outcomes. Yet, out of 141 eligible

Table 2.1 Summary of Combinations of Movement Behaviours by Age Group and Outcome

<table>
<tr><th></th><th colspan="2">Physical activity and sedentary behaviour</th><th colspan="2">Physical activity, sedentary behaviour, and sleep</th></tr>
<tr><th>Outcome</th><th>Children</th><th>Adolescents</th><th>Children</th><th>Adolescents</th></tr>
<tr><td rowspan="2">Adiposity</td><td rowspan="2">High physical activity and low sedentary behaviour most beneficial</td><td>High physical activity and low sedentary behaviour most beneficial</td><td colspan="2" rowspan="2">High physical activity, low sedentary behaviour, and high sleep most beneficial</td></tr>
<tr><td>Evidence suggests that sedentary behaviour is more important during adolescence than childhood</td></tr>
<tr><td>Cardiometabolic risk factors</td><td colspan="2">High physical activity and low sedentary behaviour most beneficial</td><td>High physical activity and high sleep most beneficial</td><td>No studies included sleep</td></tr>
<tr><td>Cardiorespiratory fitness</td><td>High physical activity important, regardless of sedentary behaviour</td><td>High physical activity and low sedentary behaviour most beneficial</td><td>High physical activity and high sleep most beneficial</td><td>No studies included sleep</td></tr>
<tr><td>Muscular physical fitness</td><td>High physical activity and low sedentary most beneficial</td><td>No studies included adolescents</td><td>High physical activity and high sleep most beneficial</td><td>No studies included adolescents</td></tr>
</table>

<table>
<tr><td>Well-being and socio-emotional outcomes</td><td colspan="2">High physical activity and low sedentary behaviour most beneficial</td><td colspan="2">High physical activity, low sedentary behaviour, and high sleep most beneficial</td></tr>
<tr><td rowspan="2">Health-related quality of life</td><td colspan="2">High physical activity and low sedentary behaviour most beneficial</td><td rowspan="2">High physical activity, low sedentary behaviour, and high sleep was most beneficial</td><td rowspan="2">No studies included sleep</td></tr>
<tr><td colspan="2">Regarding sedentary behaviour, screen time should particularly be addressed</td></tr>
<tr><td>Mental ill-health</td><td colspan="2">High physical activity and low sedentary behaviour most beneficial</td><td colspan="2">High physical activity, low sedentary behaviour, and high sleep was most beneficial</td></tr>
<tr><td rowspan="2">Academic performance</td><td colspan="2">High physical activity and high sedentary behaviour associated with positive academic performance</td><td colspan="2" rowspan="2">High physical activity, low sedentary behaviour, and high sleep was most beneficial</td></tr>
<tr><td colspan="2">High physical activity and low screen time associated with positive academic performance</td></tr>
<tr><td>Cognitive and executive function</td><td>High physical activity and low screen time most beneficial</td><td>No studies included adolescents</td><td>Low screen time and high sleep most beneficial</td><td>No studies included sleep</td></tr>
</table>

studies, only 41 included sleep in their analysis. Fewer sleep studies were available for adolescents than children. Possible explanations could be that researchers may study sleep more in children since the onset of some disorders (e.g., ADHD) start at a younger age[329] or adolescent data was not available in the analysed datasets[241,288,301,321,322].

Compromising on any movement behaviour had consequences. Lower physical activity appeared to be associated with the most negative changes for physical health. Too much sedentary behaviour, particularly screen time, was typically associated with poorer psychological health. Shorter sleep duration negatively affected all types of outcomes. For this reason, we cannot target one movement behaviour without acknowledging the importance of the others. Including sleep into more longitudinal and intervention research could help make stronger inferences about the associations of different combinations of movement behaviours.

Limiting sedentary behaviour appears especially important in adolescents. Low sedentary behaviour in combination with high physical activity and/or sleep seemed crucial to achieve the most favourable adolescent physical health outcomes (e.g., adiposity). However, for children, studies found that low sedentary behaviour did not appear important as long as physical activity and sleep were high. This may be explained by a potential association with total sitting time and poor dietary habits in adolescents[330]. Additionally, the definition of sedentary behaviour was important. For example, when sedentary behaviour was defined as non-screen-based, its association with academic performance was positive. This suggests not all sedentary behaviour is “bad”. Further, not all domains, or types, of physical activity may yield the same results. The most ideal combination for cognitive/executive functioning did not include high physical activity. Research shows physical activity may be beneficial for cognitive development[331], but these associations may only be positive when accumulated through sports[23]. Therefore, future studies should consider exploring domain-specific movement behaviours and replicate findings on the less well-explored outcomes (e.g., executive function).

I synthesised data from 141 studies on 16 outcomes from 57 countries, making the review more reliable and generalisable than previous syntheses. However, limitations in the review should be considered when interpreting the data. First, I decided not to conduct a meta-analysis due to high heterogeneity in how studies categorised, analysed, and reported movement behaviours. For example, of the three studies on muscular fitness, one used isotemporal substitution, one considered whether or not children met all guidelines simultaneously, and one used sample-specific sedentary behaviour median splits. As a result, I could not quantify the size of the pooled associations for each combination of movement behaviours on each outcome. More consistent reporting of associations across studies would facilitate meta-analyses. Alternatively, the wider availability of primary data would facilitate secondary analyses such as individual participant meta-analyses[332].

Finally, the included studies made some common methodological decisions that impaired my ability to make firm conclusions. Many studies dichotomised movement behaviours using the current recommendations. This means children who participated in 3 min/day of moderate-vigorous physical activity were analysed the same as children who participated in 59 min/day of moderate-vigorous physical activity, as both fail to meet the 60 min/day recommendation. Thus, the likely dose-response relationship of physical activity (and, potentially other behaviours) could not be considered[8,181,333,334]. Studies should explore isotemporal substitution or compositional data analysis because these methods analyse the trade-offs in movement behaviours while accounting for dose-response associations. Further, the physical activity recommendation states that, “muscle and bone strengthening activities should each be incorporated at least 3 days per week”, but this was not included in any of the studies’ definition of meeting physical activity recommendations. Future research should account for this component of the guidelines because resistance training has been shown to improve physical and mental health[335,336].

Conclusion

The evidence suggests that physical activity, sedentary behaviour, and sleep should be investigated in combination, not in isolation. Due to the consistent positive associations of sleep on a range of outcomes, I encourage researchers to consider sleep in their studies of movement behaviours. Guidelines, interventions and public health campaigns should look beyond promoting single movement behaviours and move toward targeting all three. The needs of children and adolescents could better be considered. Finally, children, adolescents, parents, and schools should be informed that physical activity, sedentary behaviour, and sleep affect more than just children's physical health, but also their psychological health and educational development.

Chapter 3: Impact of Socioeconomic Position on Youth's Movement Trajectories

Preface

This chapter has been submitted to and is under review at the *International Journal of Behavioral Nutrition and Physical Activity* (Impact Factor = 8.915). In the interest of following high-quality and open science principles, I prospectively registered this study (protocol available at https://osf.io/j6uvz) and made all analysis code public (https://github.com/katrina-wilhite/Study_2). For this study, I am the first author and did 72% of the work.

To meet thesis submission guidelines, the language of this chapter has been updated from American English to British English and the supporting Web Material has been changed to appendices.

My systematic review identified four major considerations for future research: more longitudinal studies that explore movement behaviours are necessary, methods should look at combinations of movement behaviours from a 24-hour perspective rather than dichotomising or categorising movement behaviours, that the definition of specific movement behaviours probably matters (e.g., sedentary behaviour vs. recreational screen time), and sleep should be considered in analyses. To address these gaps, in this chapter, I present a longitudinal study using continuous data exploring general and domain-specific movement trajectory profiles in youth from different socioeconomic positions.

Abstract

Combinations of movement behaviours (i.e., physical activity, sedentary behaviour, sleep) are associated with health and developmental outcomes in children. Youth vary in how they accumulate these behaviours, both in volume and in specific domains (e.g., sedentary time spent on recreational screen activities vs homework). This study aimed to examine how youth's movement trajectory profiles differ by socioeconomic position. I conducted a longitudinal, group-based multi-trajectory analysis to identify general and domain-specific movement trajectory profiles for 2457 children (mean baseline age: 10 years) from the Longitudinal Study of Australian Children from 2014-2018. I used multinomial logistic regression to test if socioeconomic position could predict profile membership. I identified three general movement behaviour profiles for males, five general movement behaviour profiles for females, four domain-specific profiles for males, and five for females. Socioeconomic position predicted general movement behaviour profile membership for females but not males, and predicted domain-specific profiles for both sexes. Youth from lower socioeconomic positions were less likely to spend time in education-based sedentary behaviour and more likely to spend time in recreational screen activities than their higher socioeconomic position peers. Females from lower socioeconomic positions are less active and more sedentary than females from higher socioeconomic positions but males show similar patterns of physical activity, sedentary time, and sleep. The domains in which youth accumulate movement behaviours differ. The results indicate that observational research should consider the domain when measuring movement behaviours and that movement behaviour interventions should target specific domains for lower socioeconomic groups.

Introduction

The effects of movement behaviours (i.e., physical activity, sedentary behaviour, and sleep) on youth have been well researched[262,317,337]. Recently, several countries and the World Health Organisation have updated their health recommendations to combine all these movement behaviours in a 24-hour time frame, instead of in isolation[68,338]. Time spent in one movement behaviour displaces time spent in others[62]. Consequently, there is likely an association between 24-hour movement behaviour profiles and how they influence youth's physical, psychological, and educational outcomes[2,62,64]. Isotemporal substitution and compositional data analysis are methods used to better understand the interactions of movement behaviours with outcomes[186,339]. These methods address the limitation of "combining" individually measured movements to create a "day" that may add up to be greater than or less than 24 hours. However, isotemporal substitution and compositional data analysis only provide estimations and many of the studies are cross-sectional[268,340]. Therefore, other methods using longitudinal data are needed.

Domain-specific, or type, of movement behaviours, should be considered because how movement behaviours are accumulated may influence their associations with outcomes in important ways. For example, a meta-analysis found that, when compared with household physical activity, leisure-time physical activity and active transportation were more positively associated with mental health[21]. Sedentary time spent reading benefits cognitive development[43], but high volumes of sedentary screen time may be associated with increased depressive symptoms, higher adiposity, and lower quality of life[36,341]. Studies show that insufficient nighttime sleep duration leads to increased odds of obesity, metabolic dysfunction, and can be detrimental to youth's academic success, motivation, and attention[47,53,177,342]. However, some studies suggest that daytime naps, independent of nighttime sleep, benefit children's and adolescents' neurocognitive function, psychological wellness, behaviour problems, and academic achievement[56,57]. Therefore, it is important to include domain-specific sleep (i.e., naps vs nighttime sleep) in sleep analyses and further explore its effects on children and adolescents. Ultimately, the direction and magnitude of an association with an outcome may differ depending on the explored domain-specific movement behaviour.

When physical activity is studied in isolation, research shows that youth from families of lower socioeconomic position are less physically active than those from higher socioeconomic position families[80]. Studies show contradictory evidence on whether youth from higher or lower socioeconomic position families spend more time in sedentary behaviour[101,343]. Youth from lower socioeconomic position families have reported poorer sleep[344]. However, these conclusions were based mainly on cross-sectional studies, and none of them examined combinations of movement behaviours. Whether youth from different socioeconomic backgrounds spend their time differently when investigating movement behaviour profiles is, therefore, unknown[345].

Also unknown is the role of socioeconomic position in predicting how youth accumulate their domain-specific movement behaviours. When measuring movement behaviours in isolation, youth from higher socioeconomic position families participate in more sports[93] while those from lower socioeconomic position families participate in more unstructured physical activity and active transportation[99,100]. Lower socioeconomic position youth engage in more screen time compared to those from higher socioeconomic positions[101,102], while those from higher socioeconomic families spend more time reading and playing music than lower socioeconomic position youth[36,346]. Youth from lower socioeconomic classes have longer nap durations than those from higher socioeconomic class families[347].

It is unclear whether youth from different socioeconomic position families differ in how they spend their 24-hour day regarding movement or how their movement changes over time. Properly understanding the differences in how youth from different socioeconomic positions spend their day may inform future guidelines and interventions to help those who would benefit most. Therefore, this study aims to answer four questions:

1. What are the different general movement trajectory profiles regarding the overall quantity of physical activity, sedentary behaviour, and sleep among youth?
2. What are the domain-specific movement trajectory profiles among youth?
3. Does socioeconomic position predict profile membership in youth's general movement trajectory profiles regarding overall physical activity, sedentary behaviour, and sleep?
4. Does socioeconomic position predict profile membership in youth's domain-specific movement trajectory profiles?

Methods

Dataset

I analysed data from *The Longitudinal Study of Australian Children* (LSAC)[348]. Data has been collected on two nationally representative cohorts of children every two years since 2004. On average, data was collected at the same time of year[349]. I used data from the three most recent waves (Waves 6-8, 2014-2018) of the younger cohort when the participants were aged 10-11, 12-13, and 14-15 years. Data from earlier waves were not included due to a change in data collection procedures in the time-use diaries (e.g., parents used to make the entries, 15-minute increments were used)[350].

Movement behaviour time-use

Each participant completed a time-use diary including the start time of each activity (increments were no longer used), who accompanied them, where they were, and any concurrent activities they were performing[350]. I calculated the time each participant spent in a given activity by subtracting the start time of an activity from the start time of the following activity. For the day's final activity, I subtracted the last activity's start time from the participants' "sleep time". Participants filled out their time-use diary on the same day of the week at each timepoint[349].

I assigned the pre-coded time-use diary activities general and domain-specific movement behaviours (see Table 3.1). A list of coded activities can be found in Appendix C.1. For moderate-vigorous activity, LSAC had already coded certain activities (e.g., ball sports, dancing) as structured (e.g., with a trainer) or unstructured (e.g., casually). Domain-specific categories were based on categories defined by previous studies[19–21]. In cases where concurrent activities were recorded, typically the main activity was coded. In instances where it was likely that a concurrent activity took precedence regarding movement, the concurrent activity was coded. For example, if the main activity “babysitting" was paired with “watching television”, the activity would be assigned to the domain-specific movement behaviour of “recreational screen activity” since the participant was sedentary. Time spent at school was coded as “education-based sedentary behaviour” for the entire length as participants were not instructed to record specific periods during school time that may have been physical active (e.g., physical education classes).

To be included in the study, participants had to have (a) a valid time-use diary at Wave 6 (i.e., no typos, missing information, or misordered events), (b) recorded their sleep and wake times, and (c) included their socioeconomic position data. Outliers were excluded if the time-use diary entries appeared to be for an atypical day (e.g., passive transportation >= 8 hours, self-care >= 4 hours). Decision rules for outliers can be found in Appendix C.2. A sensitivity analysis was run to include outliers. I handled missing follow-up data through multiple imputation with the mice package, version 3.14.0, in R[351]. I used five imputed datasets.

I analysed male and female participants separately due to previously reported differences in their daily activities[352]. Only weekday data was analysed due to the limited data available for weekend participants.

Table 3.1 Movement Behaviour Categories

General movement behaviours	Domain-specific movement behaviours
Light physical activity	Active transportation
	Leisure-time
	Work/Household
Moderate-vigorous physical activity	Structured
	Unstructured
Sleep	Nighttime sleep
	Daytime naps
Sedentary behaviour	Education-based
	Leisure-time (non-screen based)
	Passive transportation
	Recreational screen activities
	Self-care
	Social-based

Socioeconomic position

I measured socioeconomic position through LSAC's socioeconomic position variable. The socioeconomic position variable is a normalised variable that was developed by LSAC to rank each family relative to other families in the study[353]. Each family was given a score by combining both parents' income, education completed by each parent, the occupational status of each parent, and whether the participant's family was a single or two-parent home and then ranked. This ranking was then standardised.

Data analysis

I used the data from Waves 6-8 to perform group-based multi-trajectory analysis with the gbmt package in R to find movement behaviour trajectory profiles between the ages of 10-14 years[354]. The test was run separately for general movement behaviours and for domain-specific movement behaviours. To determine the most appropriate number of groups to use for each analysis, I used the fit-criteria assessment plot tool to compare the Bayesian information criterion (BIC), average posterior probability, and odds of correct classification[355]. The model with the lowest BIC, average posterior probability (minimum .70), and odds of correct classification (minimum 5.0) was chosen. If two models had similar results, I plotted both to visually determine if extra groups provided novel information.

I used the nnet package, version 7.3.16, in R[356] to run a multinomial logistic regression test to evaluate if the socioeconomic position variable predicted profile membership. I chose a reference group with the highest health benefits potential in each analysis. Thus, I selected the group with the trajectory that was most similar to the following pattern: participants increased their moderate-vigorous physical activity, light physical activity, and sleep, but decreased their sedentary behaviour, provided the quantity of these behaviours was likely to be associated with the most desirable outcomes[69].

Results

Subject characteristics

In Wave 6, 3764 B-Cohort participants completed data collection. Of these, 3460 completed time-use diaries. I excluded 145 time-use diaries due to incorrect times being recorded in the diary, 26 due to missing socioeconomic position data, and six due to missing sleep data. I removed 140 participants as outliers. This resulted in 3143 participants, 2457 providing weekday data. Of these participants, 1251 were male and 1206 were female. Subject descriptive characteristics can be found in Table 3.2. Included participants did not differ from excluded participants in remoteness (determined by the Australian Standard Geographic Classification[357]), sex, or Indigenous background.

General movement trajectory profiles

For general movement behaviours, the fit-criteria assessment plots (see Appendix C.3) indicated that the three-group model was most appropriate for males (BIC = 16938, average posterior probability = .93, odds of correct classification = 80.69) and that the 5-group model was most appropriate for females (BIC = 13067, average posterior probability = .87, odds of correct classification = 376.23). Figures 3.1 and 3.2 show the general movement trajectory profiles. Male and females had “Highly actives”, “Inactive-sitters”, and “Decreasing activity” profiles. Females also had “High sleepers” and “Lightly actives” profiles. All groups decreased their sleep and increased their sedentary behaviour. The “Highly actives” were characterised by fairly stable light physical activity and increasing or stable moderate-vigorous physical activity. Male “Highly actives” had relatively low sedentary behaviour compared to other profiles.

Table 3.2 Descriptive Statistics

	Male (N=1251)	**Female (N=1206)**	**Overall (N=2457)**
Subject Details			
Age	10 (± 0.49)	10 (± 0.49)	10 (± 0.49)
Indigenous			
Not Aboriginal	1216 (97 %)	1173 (97 %)	2389 (97 %)
Aboriginal	29 (2 %)	29 (2 %)	58 (2 %)
Torres Strait Islander	4 (0 %)	2 (0 %)	6 (0 %)
Both	2 (0 %)	2 (0 %)	4 (0 %)
Remoteness			
Highly Accessible	642 (51 %)	606 (50 %)	1248 (51 %)
Accessible	349 (28 %)	357 (30 %)	706 (29 %)
Moderately Accessible	217 (17 %)	199 (17 %)	416 (17 %)
Remote	25 (2 %)	19 (2 %)	44 (2 %)
Very Remote	12 (1 %)	17 (1 %)	29 (1 %)
Not determined	6 (0 %)	8 (1 %)	14 (1 %)
Socioeconomic Position	0.034 (± 0.99)	0.022 (± 1.0)	0.028 (± 1.0)
Domain-Specific Movement Behaviours			

Active Transport (10)	11 (± 29)	11 (± 25)	11 (± 27)
Active Transport (12)	13 (± 29)	13 (± 25)	13 (± 27)
Active Transport (14)	17 (± 33)	15 (± 30)	16 (± 31)
Daytime Naps (10)	2.7 (± 20)	3.7 (± 20)	3.2 (± 20)
Daytime Naps (12)	6.0 (± 27)	7.0 (± 34)	6.5 (± 30)
Daytime Naps (14)	9.8 (± 45)	9.1 (± 41)	9.4 (± 43)
Education Based Sedentary Behaviour (10)	210 (± 160)	220 (± 160)	220 (± 160)
Education Based Sedentary Behaviour (12)	210 (± 170)	210 (± 180)	210 (± 180)
Education Based Sedentary Behaviour (14)	200 (± 180)	220 (± 190)	210 (± 180)
Leisure Time Sedentary Behaviour (10)	140 (± 100)	150 (± 100)	150 (± 100)
Leisure Time Sedentary Behaviour (12)	130 (± 110)	140 (± 110)	140 (± 110)
Leisure Time Sedentary Behaviour (14)	99 (± 100)	110 (± 110)	100 (± 100)
Nighttime Sleep (10)	580 (± 63)	590 (± 64)	590 (± 64)
Nighttime Sleep (12)	570 (± 78)	570 (± 82)	570 (± 80)
Nighttime Sleep (14)	550 (± 95)	550 (± 86)	550 (± 91)
Passive Transport (10)	54 (± 52)	58 (± 51)	56 (± 52)
Passive Transport (12)	60 (± 54)	64 (± 56)	62 (± 55)
Passive Transport (14)	59 (± 57)	66 (± 62)	62 (± 60)

Recreational Screen Time (10)	190 (± 160)	140 (± 130)	170 (± 150)
Recreational Screen Time (12)	210 (± 170)	160 (± 140)	190 (± 160)
Recreational Screen Time (14)	260 (± 180)	210 (± 170)	240 (± 180)
Self-Care Sedentary Behaviour (10)	13 (± 16)	15 (± 18)	14 (± 17)
Self-Care Sedentary Behaviour (12)	1.6 (± 9.0)	1.7 (± 8.8)	1.7 (± 8.9)
Self-Care Sedentary Behaviour (14)	0.82 (± 5.6)	1.7 (± 9.5)	1.2 (± 7.7)
Social-Based Sedentary Behaviour (10)	44 (± 72)	55 (± 77)	50 (± 75)
Social-Based Sedentary Behaviour (12)	56 (± 84)	84 (± 100)	70 (± 94)
Social-Based Sedentary Behaviour (14)	79 (± 93)	97 (± 100)	88 (± 98)
Structured Moderate-Vigorous Physical Activity (10)	28 (± 51)	27 (± 53)	27 (± 52)
Structured Moderate-Vigorous Physical Activity (12)	28 (± 54)	30 (± 60)	29 (± 57)
Structured Moderate-Vigorous Physical Activity (14)	34 (± 60)	29 (± 58)	32 (± 59)
Unstructured Light Physical Activity (10)	59 (± 74)	64 (± 81)	61 (± 77)
Unstructured Light Physical Activity (12)	44 (± 73)	48 (± 74)	46 (± 73)
Unstructured Light Physical Activity (14)	29 (± 58)	35 (± 67)	32 (± 62)
Unstructured Moderate-Vigorous Physical Activity (10)	34 (± 55)	17 (± 36)	25 (± 48)
Unstructured Moderate-Vigorous Physical Activity (12)	27 (± 53)	14 (± 37)	20 (± 46)
Unstructured Moderate-Vigorous Physical Activity (14)	27 (± 54)	12 (± 38)	20 (± 48)

Work and Household Light Physical Activity (10)	55 (± 54)	69 (± 57)	62 (± 56)
Work and Household Light Physical Activity (12)	73 (± 68)	91 (± 68)	82 (± 69)
Work and Household Light Physical Activity (14)	75 (± 71)	89 (± 71)	82 (± 71)
General Movement Behaviours			
Light Physical Activity (10)	120 (± 95)	140 (± 99)	130 (± 97)
Light Physical Activity (12)	130 (± 100)	150 (± 100)	140 (± 100)
Light Physical Activity (14)	120 (± 96)	140 (± 100)	130 (± 100)
Moderate-Vigorous Physical Activity (10)	62 (± 74)	44 (± 64)	53 (± 70)
Moderate-Vigorous Physical Activity (12)	55 (± 74)	44 (± 69)	49 (± 72)
Moderate-Vigorous Physical Activity (14)	61 (± 79)	41 (± 68)	51 (± 74)
Sedentary Behaviour (10)	660 (± 120)	650 (± 120)	650 (± 120)
Sedentary Behaviour (12)	670 (± 150)	660 (± 140)	660 (± 140)
Sedentary Behaviour (14)	690 (± 150)	700 (± 150)	690 (± 150)
Sleep (10)	590 (± 63)	590 (± 64)	590 (± 63)
Sleep (12)	580 (± 81)	580 (± 88)	580 (± 84)
Sleep (14)	560 (± 99)	560 (± 89)	560 (± 95)

Values represent mean (SD) or count (%); Age is measured in years; Socioeconomic Position is a composite score of income, educational attainment, and occupational status. The variable is standardized so, the mean is 0 and standard deviation is 1.; Movement Behaviours are measured in minutes; (10) = at age 10; (12) = at age 12; (14) = at age 14

The “Inactive-sitters” had fairly low light physical activity, decreased moderate-vigorous physical activity, and had high sedentary behaviour. The “Decreasing activity” profile had the lowest time spent in light physical activity and started with comparable moderate-vigorous physical activity as the “Highly actives” but decreased this movement behaviour. The female “High sleepers” profile had a trajectory that minimally decreased their sleep and ended up with the most sleep compared to all other profiles. The “Lightly actives” profile had the most time spent in light physical activity and was the only group to increase this movement behaviour. Sensitivity analysis can be found in Appendix C.4.

Domain-specific movement trajectory profiles

For the domain-specific movement trajectory profiles (see Appendix C.4), the fit-criteria assessment plots indicated a four-group model was most appropriate for males (BIC = 69540, average posterior probability = .82, odds of correct classification = 21.07) and a five-group model for females (BIC = 67590, average posterior probability = .72, odds of correct classification = 30.05). Plots for these models can be found in Figures 3.3-3.8 (see Table 3.3 for profile characteristics). Generally, males spent more time in moderate-vigorous physical activity and recreational screen activities than females while females generally spent more time in work and household light physical activity, education-based sedentary behaviour, passive transport, and self-care.

For light physical activity, typically all groups increased their active transport and work/household physical activity but decreased leisure-time light physical activity. Unstructured moderate-vigorous physical activity decreased for all but two groups (one male, one female) while structured moderate-vigorous physical activity decreased for all but three groups (two male, one female). Nighttime sleep decreased for all groups and daytime naps increased for all groups. Education-based sedentary behaviour generally decreased. Leisure time (non-screen based) and self-care sedentary behaviour decreased for all groups while recreational screen time, social-based sedentary behaviour, and passive transport generally increased across groups.

Socioeconomic position as a predictor of movement trajectory profile membership

Socioeconomic position did not predict general movement trajectory profile membership for males but did predict domain-specific movement trajectory profile membership (see Table 3.4). Participants from lower socioeconomic households were less likely to be in the “All-rounders” groups. Lower socioeconomic male youth tended to spend more time in unstructured and structured moderate-to-vigorous physical activity, napping, and recreational screen activities but less time in education-based sedentary behaviour than their higher socioeconomic peers.

For females, socioeconomic position predicted that those from a lower socioeconomic position were in the “Decreasing activity” profile for general movement trajectory profiles. For domain-specific movement trajectory profiles, members from lower socioeconomic households were more likely to be in “Increasingly studious screenies” and “Low social-time nappers” profiles than the “Napping actives” profile. Compared to their “Napping actives” peers, females from lower socioeconomic position families tended to spend less time in structured moderate-vigorous physical activity, napping, and passive transport but more time in recreational screen time.

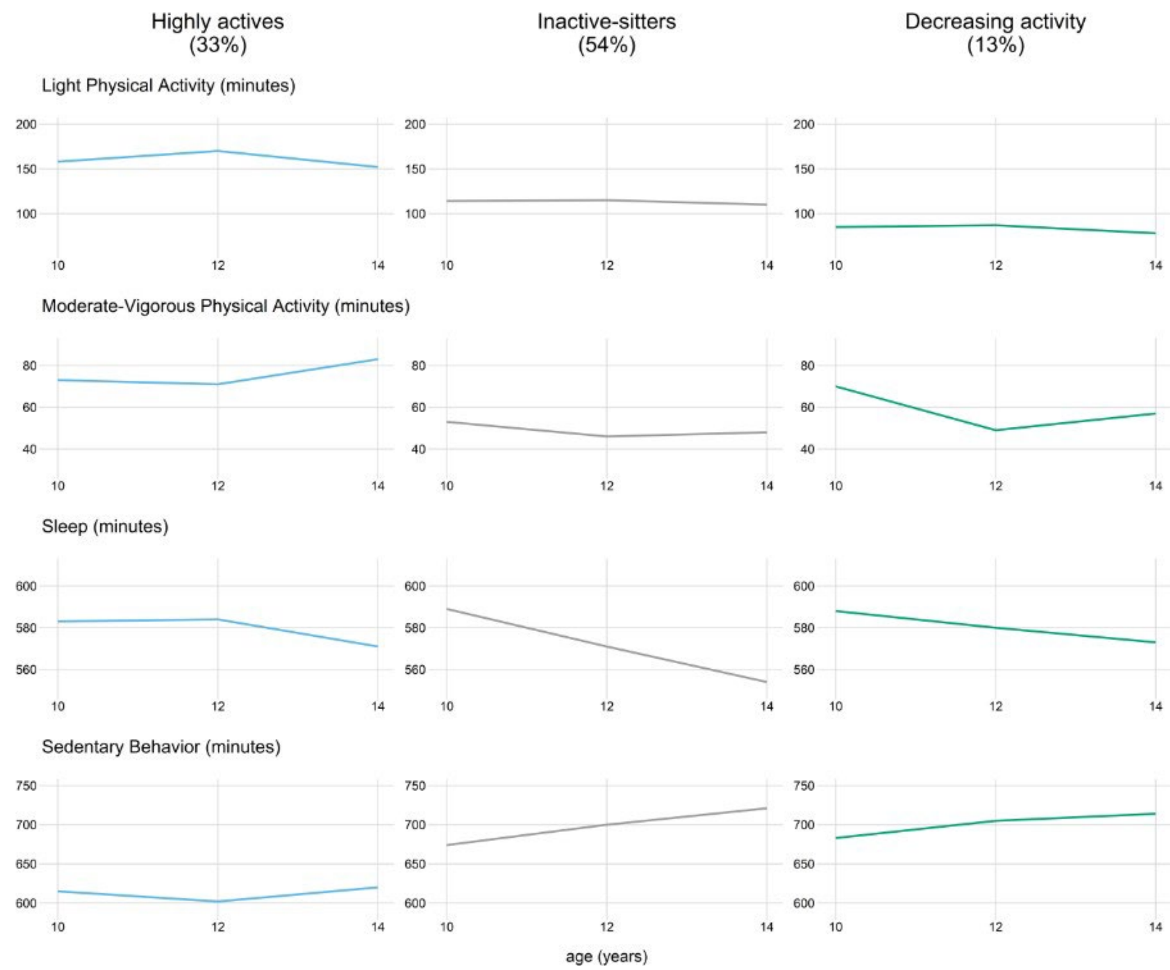


Figure 3.1 Male General Movement Trajectory Profiles

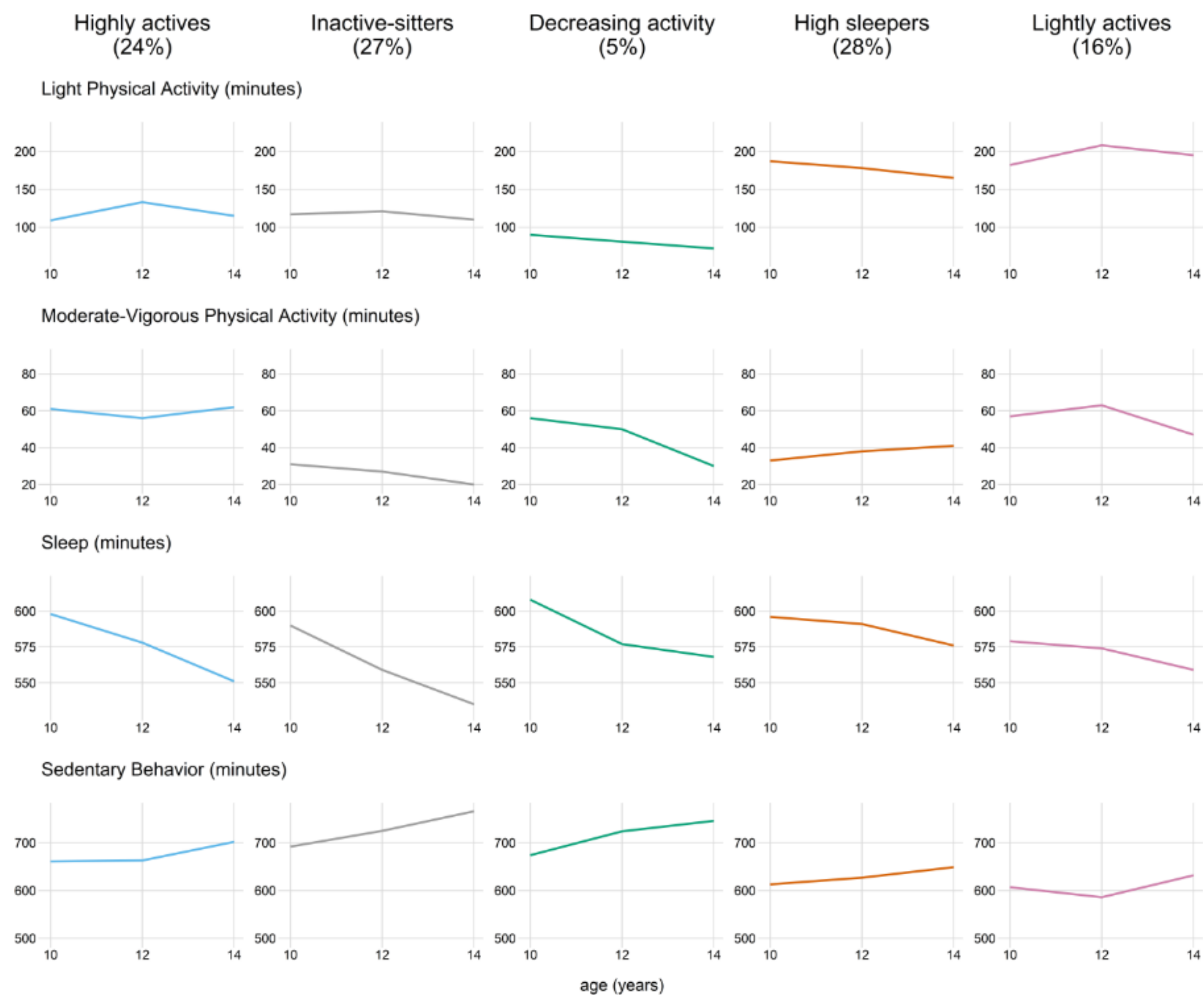


Figure 3.2 Female General Movement Trajectory Profiles

Table 3.3 Domain-specific Movement Trajectory Profile Characteristics

Profile group	Characteristics
Males	
High sleep screenies	● Least amount of time in work and household light physical activity compared to other profiles ● Steepest drop in structured moderate-to-vigorous physical activity ● Most time in nighttime sleep compared to other profiles ● Some napping ● Relatively low time in education-based sedentary behaviour ● Least amount of time in passive transport compared to other profiles
Low screen workers	● Most time spent in work and household light physical activity ● Slight decrease in unstructured but slight increase in structured moderate-to-vigorous intensity physical activity ● Steepest decrease in nighttime sleep ● Some napping ● Most time spent in education-based sedentary behaviour and passive transport compared to other profiles ● Least time spent in screen time compared to other profiles
Increasingly active nappers	● Increased structured and unstructured moderate-vigorous physical activity ● Most time spent napping compared to all other profiles ● Least time spent in education-based sedentary behaviour compared to all other groups ● High amount of recreational screen activities
All-rounders	● Slight decrease in unstructured but slight increase in structured moderate-to-vigorous intensity physical activity ● Minimal napping ● Moderate amount of work and household light physical activity, nighttime sleep, education-based sedentary behaviour, passive

	transport, and recreational screen activities compared to all other profiles
Females	
Low screen studious	• Low unstructured moderate-vigorous physical activity • Minimal naps • Increased education-based sedentary behaviour (most time spent compared to all other profiles) • Least time spent in recreational screen activities compared to all other profiles • Relatively high passive transport
Napping actives	• Low unstructured moderate-to-vigorous physical activity but increase in structured moderate-to-vigorous physical activity (most time compared to all other profiles) • Most time spent napping compared to all other profiles • Relatively high passive transport • Relatively low recreational screen time
Increasingly studious screenies	• Some napping • Increased education-based sedentary behaviour (spend the least time compared to all other profiles) • Relatively high recreational screen activities
Low social-time nappers	• Fairly stable structured and unstructured moderate-vigorous physical activity • Some napping • Only group with stable social-based sedentary behaviour (least amount of time compared to all other groups)
Working screenies	• Most time in work and household physical activity compared to all other profiles • Limited napping • Only group to decrease passive transport • Relatively high recreational screen activities

Table 3.4 Odds Ratios of Socioeconomic Position Predicting Movement Trajectory Membership

Group	Unadjusted OR	p	Adjusted OR	p	AME
Male General Movement Behaviours					
Highly actives	Reference		Reference		
Inactive-sitters	0.97 (0.86 - 1.1)	0.67	1 (0.88 - 1.13)	0.97	0 (-0.03 - 0.03)
Decreasing activity	0.94 (0.79 - 1.12)	0.52	0.96 (0.8 - 1.14)	0.61	-0.01 (-0.02 - 0.01)
Male Domain-Specific Movement Behaviours					
All-rounders	Reference		Reference		
High sleep screenies	0.94 (0.79 - 1.12)	0.49	0.94 (0.79 - 1.13)	0.53	-0.01 (-0.03 - 0.01)
Low screen workers	1.29 (1.1 - 1.51)	<0.01	1.32 (1.11 - 1.55)	<0.01	0.05 (0.02 - 0.07)
Increasingly active nappers	0.81 (0.7 - 0.94)	0.01	0.82 (0.7 - 0.96)	0.01	-0.04 (-0.06 - -0.02)
Female General Movement Behaviours					
Highly actives	Reference		Reference		
High sleepers	1.07 (0.91 - 1.25)	0.41	1.09 (0.93 - 1.28)	0.29	0.02 (0 - 0.05)
Decreasing activity	0.76 (0.58 - 0.99)	0.04	0.75 (0.58 - 0.99)	0.04	-0.01 (-0.03 - 0)
Inactive-sitters	1.03 (0.88 - 1.21)	0.73	1.02 (0.87 - 1.2)	0.82	0.02 (0 - 0.05)
Lightly actives	0.95 (0.79 - 1.14)	0.56	0.96 (0.8 - 1.16)	0.71	-0.01 (-0.03 - 0)
Female Domain-Specific Movement Behaviours					
Napping actives	Reference		Reference		
Low screen studious	0.85 (0.71 - 1.02)	0.08	0.87 (0.72 - 1.04)	0.13	0 (-0.03 - 0.02)
Increasingly studious screenies	0.73 (0.59 - 0.91)	<0.01	0.75 (0.6 - 0.92)	0.01	-0.02 (-0.04 - 0)
Low social-time nappers	0.81 (0.66 - 0.98)	0.03	0.82 (0.67 - 1)	0.05	-0.01 (-0.03 - 0.01)
Working screenies	0.85 (0.72 - 1.01)	0.07	0.88 (0.74 - 1.05)	0.15	0 (-0.02 - 0.03)

Note:
Note: Values are expressed as odds ratios and 95% confidence intervals. Trajectories were adjusted for remoteness and Indigenous status.
AME = Average Marginal Effects.

Discussion

This study shows how youth from different socioeconomic positions move in a day. From a general movement behaviour perspective, I found that there are no differences in how males from different socioeconomic positions spend their time but girls from a lower socioeconomic position tend to be less active and more sedentary than their higher socioeconomic peers. A domain-specific analysis provides deeper insight into how youth from different socioeconomic positions accumulate their physical activity, sedentary behaviour, and sleep. In line with previous research, all general movement trajectories, showed children decreased their sleep and increased their sedentary behaviour as they grew older[358,359]. Males showed no differences in their general movement trajectories but females from lower socioeconomic positions tended to be less physically active and more sedentary than their higher socioeconomic counterparts.

Domain-specific movement trajectories showed differences in how youth from different socioeconomic positions accumulated their movements. Lower socioeconomic position males tended to spend more time in "fun" activities such as structured and unstructured moderate-to-vigorous physical activity and recreational screen activities rather than the education-based sedentary behaviour observed in their higher socioeconomic peers. Females from lower socioeconomic positions tended to displace time in healthy behaviours, such as moderate-to-vigorous physical activity and napping, with recreational screen time. These differences in domain-specific behaviours align with research on individual movement behaviours that found youth from higher socioeconomic backgrounds spend more time in passive transportation, education-related activities, and structured physical activity[102,360] while those from lower socioeconomic backgrounds spend more time in recreational screen time[360]. However, contrary to previous research, there was little difference in active transport, unstructured moderate-to-vigorous physical activity and leisure-time (non-screen-based) sedentary behaviour for females, structured and unstructured moderate-vigorous physical activity in males[93,100,346,361]. These findings highlight the importance of studying movement behaviours in combination because although a child may participate in one healthy or unhealthy movement behaviour does not necessarily mean they participate in other healthy or unhealthy movement behaviours across a whole 24-hour day. Additionally, we cannot assume that all youth from lower socioeconomic positions only participate in unhealthy behaviours and that all youth from high socioeconomic positions participate in only healthy behaviours.

Future research can take a deeper look into how domain-specific movement trajectory profiles affect different outcomes in youth, identify particular movement behaviour combinations that require special attention, and strategies to address improving domain-specific movement trajectory profiles while accounting for different needs based on socioeconomic position. Having an understanding of how youth from various socioeconomic positions spend their time may guide us to develop more specific and targeted interventions that better consider the needs of different youth. Recognising the differing time spent in domain-specific movement behaviours is important as they may not always result in the same outcome (e.g., reading vs. violent video games). Therefore, addressing appropriate domain-specific movement behaviours by socioeconomic position could have the potential to alleviate some socioeconomic disparities youth face (e.g., differences in academic performance, physical health, and socio-emotional problems).

Although this study provided new insight into how youth from different socioeconomic positions move in a day, some limitations should be considered when interpreting the findings. First, the time-use diaries did not instruct participants to record physical education classes as part of their time-use diaries. Therefore, physical activity may have been underreported across all profiles. Next, the time-use data only captured one day out of the entire week. Consequently, this may not give the most accurate representation of the participants' week. Finally, the sample size for weekend participants was not sufficient to run a group-based multi-trajectory analysis. Therefore, the results are only generalisable for weekdays.

Despite these limitations, the study had several strengths. To my knowledge, this is the first study to use group-based multi-trajectory analysis to identify profiles of youth based on their general movement behaviours and domain-specific movement behaviours and to test if socioeconomic position could predict a youth's profile membership. The analysis allowed me to use continuous data which overcame the limitation of dichotomizing or categorising behaviours based on a specific cut-off point. Additionally, I gained longitudinal insight into youth's movement behaviour patterns in combination. Further, I was able to provide novel insight into a youth's day based on their domain-specific movement behaviours instead of just their general movement behaviours. Finally, I used child-reported time-use diaries which, compared with parent-reported diaries, can reduce overreporting physical activity and underreporting screen time[362,363].

Conclusion

The socioeconomic position of a child's family predicted males' and females' domain-specific movement behaviour profiles and general movement behaviour profiles for females. Youth from lower socioeconomic position families tended to participate in a combination of more recreational screen activities and low education-based sedentary behaviour for males and low structured physical activity and education-based sedentary behaviour for females, activity patterns which may lead to unfavourable outcomes. However, there were limited differences in moderate-vigorous physical activity in males and nighttime sleep in both sexes. This insight highlights the need to continue to study domain-specific movement behaviours in combination. In the future, interventions and policies should consider targeting domain-specific movement behaviours in combination. Further, the habits, needs, and resources of youth from different socioeconomic positions should be considered when developing recommendations for different socioeconomic position groups.

Chapter 4: Movement mediates the relationship between socioeconomic position and socio-emotional outcomes

Preface

My second study established that youth from different socioeconomic backgrounds tend to spend a combination of less time in education-based sedentary behaviour and more time in recreational screen activities than youth from higher socioeconomic backgrounds. The next logical step is to test if these differences in how youth spend their time can explain discrepancies in their outcomes. In my systematic review, I identified that there is less movement behaviour research in psychological health and education-related outcomes than physical health. Therefore, my final study will investigate if domain-specific movement behaviours mediate the relationship between youth's socioeconomic position and socio-emotional outcomes.

This chapter was written in a traditional PhD thesis style.

Abstract

Youth from lower socioeconomic positions tend to have poorer socio-emotional outcomes than their higher socioeconomic peers. Known mechanisms do not fully explain this disparity. One potentially under-explored mechanism could be differences in how youth from different socioeconomic backgrounds accumulate their time regarding movement. The objective of this study was to test if movement behaviours mediate the relationship between socioeconomic position and socio-emotional outcomes. I used socioeconomic position data, scores from Strengths and Difficulties Questionnaires, and time-use diaries from 980 females and 1014 males aged 10-14 from the Longitudinal Study of Australian Children from 2014-2018. I conducted a mediation analysis using domain-specific movement trajectory profiles derived from the time-use diaries to evaluate if profile membership could explain the relationship between socioeconomic position and socio-emotional outcomes in youth. I also used lasso-based mediation to test if single movement behaviours and interactions of movement behaviours could explain disparities in socio-emotional outcomes across youth from different socioeconomic backgrounds. I found that youth from lower socioeconomic positions participated in less moderate-vigorous physical activity and more recreational screen activities than their lower socioeconomic peers, with mediation analyses showing that these differences led to poorer socio-emotional outcomes. Opportunities for cost-effective moderate-vigorous physical activities should be implemented and promoted. Strategies to reduce recreational screen activities and provide more opportunities to displace recreational screen activities in youth from lower socioeconomic backgrounds should be researched and practised. Future research should explore other mechanisms that may explain why youth from lower socioeconomic positions have poorer socio-emotional outcomes than their higher socioeconomic peers.

Introduction

Childhood socioeconomic background may influence socio-emotional outcomes

Socio-emotional health refers to how people handle social situations and emotions[364]. Understanding how to improve socio-emotional outcomes in youth is important because they are associated with academic achievement, life satisfaction, their ability to adapt to their environment, and delinquency[365–367]. Youth's socioeconomic position seems to influence these socio-emotional outcomes. Youth from lower socioeconomic backgrounds tend to have poorer socio-emotional outcomes than their higher socioeconomic peers[85,88,368,369]. This disparity can partially be explained by resource differences, parenting styles, and exposure to adverse events and stressful circumstances[88,367,368]. However, these factors do not fully explain why youth from lower socioeconomic positions tend to have poorer socio-emotional outcomes than their higher socioeconomic peers[88]. Therefore, more mechanisms explaining why youth from lower socioeconomic backgrounds have poorer socio-emotional outcomes are necessary.

Movement behaviours may explain differences in socio-emotional outcomes

In my systematic review, I found that participating in proper combinations of movement behaviours (i.e., high physical activity, low sedentary behaviour, and high sleep) improve physical, psychological, and education-related outcomes in children and adolescents. Children who are more active, less sedentary, and sleep more than their peers not only have better physical outcomes but also have better socio-emotional outcomes[177,262,319]. For example, a study of over 17,000 Canadian youth, aged 10-17, who met Canadian 24-hour Movement Behaviour guidelines for physical activity, sedentary behaviour, and sleep guidelines had fewer emotional problems than those who only met one or two of these guidelines[262]. A more recent study in over 3,000 Spanish youth, aged 4-14, found that those who met between 0-2 out of the guidelines were between1.4-1.92 times more likely to have socioemotional problems than those who met all three movement behaviour guidelines[370].

Socioeconomic background influences movement behaviour time-use

Although the benefits of participating in an appropriate amount of physical activity, sedentary behaviour, and sleep are known, there are disparities in movement behaviour participation across youth from different socioeconomic backgrounds. Youth from lower socioeconomic status families tend to be less physically active, participate in more screen-based sedentary time, and sleep less than their higher socioeconomic peers when studied in isolation[51,80,96,102,371,372]. However, when comparing movement behaviours in combination across socioeconomic backgrounds, this may not be true. In my second study, I identified,

1) different general movement trajectory profiles regarding the overall quantity of general physical activity, sedentary behaviour, and sleep among youth that differed by sex,

2) different domain-specific movement trajectory profiles (e.g., structured moderate-to-vigorous physical activity, recreational screen activities, daytime naps) that differed by sex,

3) socioeconomic position predicted general movement trajectory profile membership for females but not for males, and

4) socioeconomic position predicted domain-specific movement trajectory profile membership for both sexes.

Females from a lower socioeconomic position were a combination of less active and more sedentary than their higher socioeconomic peers. Socioeconomic background could predict domain-specific movement trajectory profile membership for both males and females. Movement behaviour patterns of males from lower socioeconomic backgrounds were:

1. more time in structured moderate-vigorous physical activity,
2. more time napping,
3. more time in recreational screen activities, and
4. less time in education-based sedentary behaviour.

Movement behaviour patterns of females from low socioeconomic backgrounds were:

1. less time in structured moderate-vigorous physical activity,
2. less time napping,

3. less time in passive transport, and
4. more time in recreational screen activities.

The above profiles show a clear difference in how youth from different socioeconomic backgrounds spend their time regarding domain-specific movement. Therefore, it is logical to expect that these profiles, while appropriately controlling for confounding variables, may produce different outcomes, including socio-emotional outcomes (see Figure 4.1).

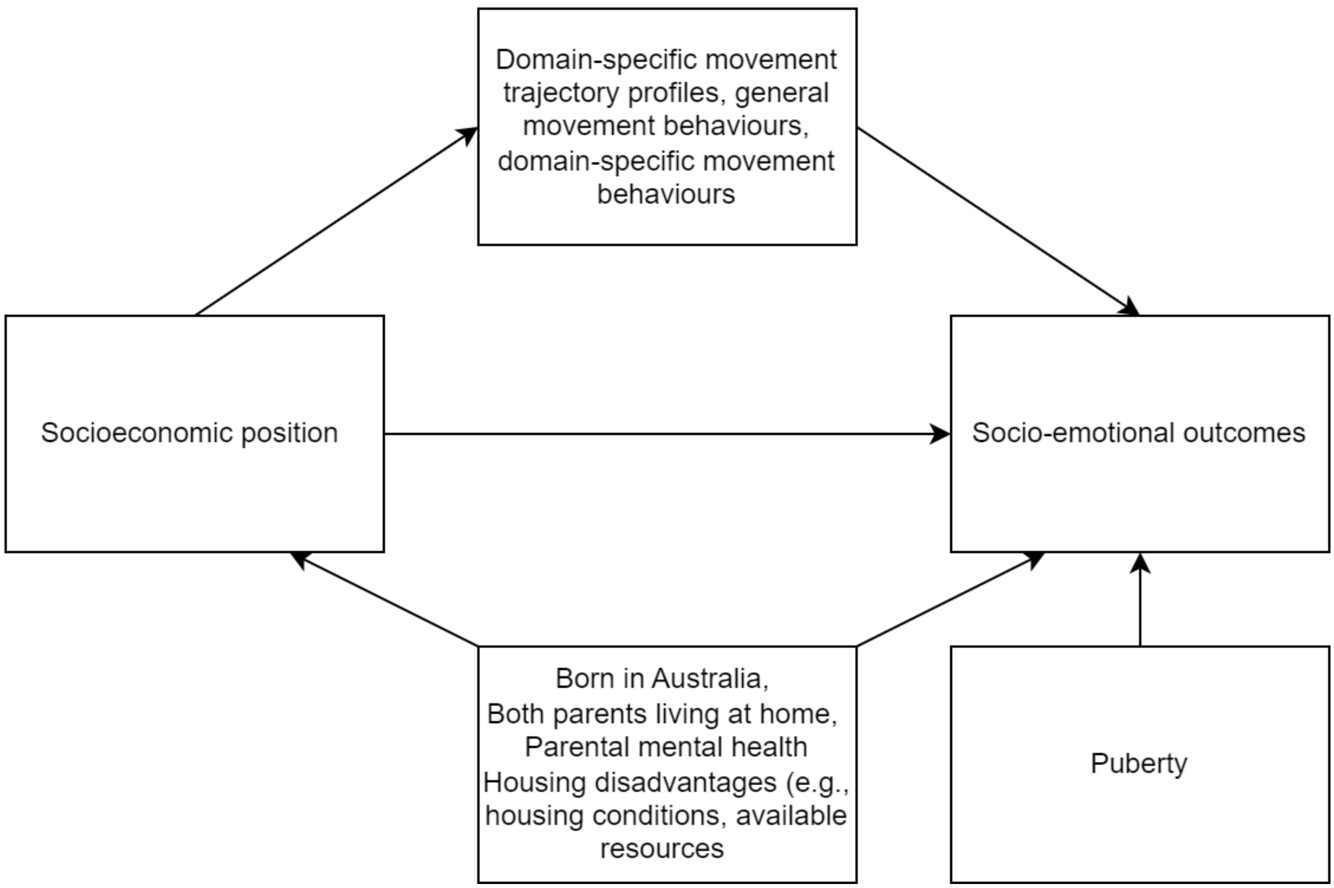


Figure 4.1 Hypothesised Mediation Pathway

Youth from lower socioeconomic backgrounds have poorer socio-emotional outcomes than their high socioeconomic peers, but all the mechanisms explaining this difference are not fully understood[85,88,368]. One potential mechanism could be differences in how youth from different socioeconomic backgrounds generally move or their domain-specific movement trajectory profile membership. However, since there are several behaviours to consider, it is difficult to disentangle which specific behaviours are causing the effects. Therefore, there are three purposes of this study.

1. The first objective is to determine if different domain-specific movement trajectory profiles mediate the relationship between socioeconomic position and socio-emotional outcomes.
2. The second objective is to investigate if general movement behaviours (individual and combinations) mediate the relationship between socioeconomic position and socio-emotional outcomes.
3. The third objective is to investigate if domain-specific movement behaviours (individual and combinations) mediate the relationship between socioeconomic position and socio-emotional outcomes.

Methods

Dataset

For this study, I used data from *The Longitudinal Study of Australian Children* (LSAC)[348]. LSAC has been collecting data on two cohorts of children every two years since 2004. On average, data was collected at the same time of year[349]. As I did in Study 2, I used the data from Waves 6-8 of the B-cohort when the participants were aged 10- 11, 12-13, and 14-15. I did not use the K-cohort data because these participants were already adolescents at this time. Earlier time points were not included due to a change in data collection procedures in the time-use diaries used to measure movement behaviours[350]. In Waves 1-5,

time-use diaries were filled in for one weekday and one weekend day by the participants' parents and 15-minute time blocks were used. This procedure is different from Wave 6 onward. In Wave 6, the participant filled out the time-use diary directly, data from only one day of the week was recorded, and the exact duration of activities was reported.

Socioeconomic position

Socioeconomic position was measured through LSAC's socioeconomic position variable. The socioeconomic position variable is a normalised variable developed by LSAC to rank the socioeconomic position of each family relative to other families in the study[353]. Each family was given a score by combining both parents' income, education completed by each parent, the occupational status of each parent, and whether the participant's family was a single or two-parent home and then ranked. This ranking was then standardised.

Domain-specific movement trajectory profiles

In my second study, I derived four domain-specific movement trajectory profiles for males and five for females. These profiles were used for the mediation analysis in this study. The process of how the profiles were identified is described below.

In the LSAC, participants were asked to fill out a time-use diary describing what they did for a given day. The participants provided information on what day of the week they filled in the diary, the main activity they did, the start time of the activity, who accompanied them, where they were, and any secondary activities they did. LSAC then coded the time-use diaries[350]. To code the diaries for the purpose of this study, I calculated the time each participant spent in an activity by subtracting the start time of an activity from the start time of the following activity. For example, if a participant was "doing homework" at 19:30 and then "watching TV" at 20:20, the participant was recorded as doing homework for 50 minutes. For the final activity of the day, I subtracted the last activity's start time from the "sleep time" variable which was the time the participant reported falling asleep. Of important note, participants were randomly assigned to days and filled out their time-use diary the same day of the week at all follow-up time points[350]. So, if a participant filled out their time-use diary on a Monday during Wave 6, they also filled out their time-use diary on a Monday during Waves 7 and 8.

Next, I assigned the pre-coded time-use diary activities general and domain-specific movement behaviours (see Table 4.1). A list of coded activities can be found in Appendix C.1. Domain-specific categories were based on categories defined by previous studies[19–21]. In cases where concurrent activities were recorded, typically the main activity was coded. The concurrent activity was coded when it was likely that a concurrent activity took precedence regarding movement. For example, if the main activity “babysitting" was paired with “watching television”, the activity would be assigned to the domain-specific movement behaviour of “recreational screen activity” since the participant was sedentary.

After activities were coded, I used the gbmt package in R to identify movement trajectory profiles[354]. Models were selected based on the highest Bayesian Information Criterion (BIC), highest average posterior probability, and the highest odds of correct classification[373].

Socio-emotional outcomes

I used information from the Strengths and Difficulties Questionnaire at Wave 8 to measure the participants’ socio-emotional outcomes. The Strengths and Difficulties Questionnaire is a validated tool that tests a child’s prosociality, hyperactivity-inattention, emotional symptoms, peer problems, and conduct problems[374]. Each subscale can range from 0 – 10. The total score is the sum of hyperactivity-inattention, emotional symptions, peer problems, and conduct problems and therefore ranges from 0 – 40. Prosociality is not included in the sum. I analysed the subscales and total scores.

Data analysis

The purpose of a mediation analysis is to test if there is an indirect effect between an exposure and an outcome[375]. If an exposure affects an outcome then there may be mechanisms, or reasons, why the exposure affects the outcome in a specific way. These mechanisms are called mediators. In the case of this study, I tested whether the domain-specific movement trajectory profiles of participants from different socioeconomic backgrounds at Wave 6 could explain why, or mediates, different socio-emotional outcomes among these participants at Wave 8 (see Figure 4.2).

Table 4.1 Movement Behaviour Categories

General movement behaviours	Domain-specific movement behaviours
Light-intensity physical activity	Active transportation
	Leisure-time
	Work/Household
Moderate-vigorous-intensity physical activity	Structured
	Unstructured
Sleep	Nighttime sleep
	Daytime naps
Sedentary behaviour	Education-based
	Leisure-time (non-screen based)
	Passive transportation
	Recreational screen activities
	Self-care
	Social-based

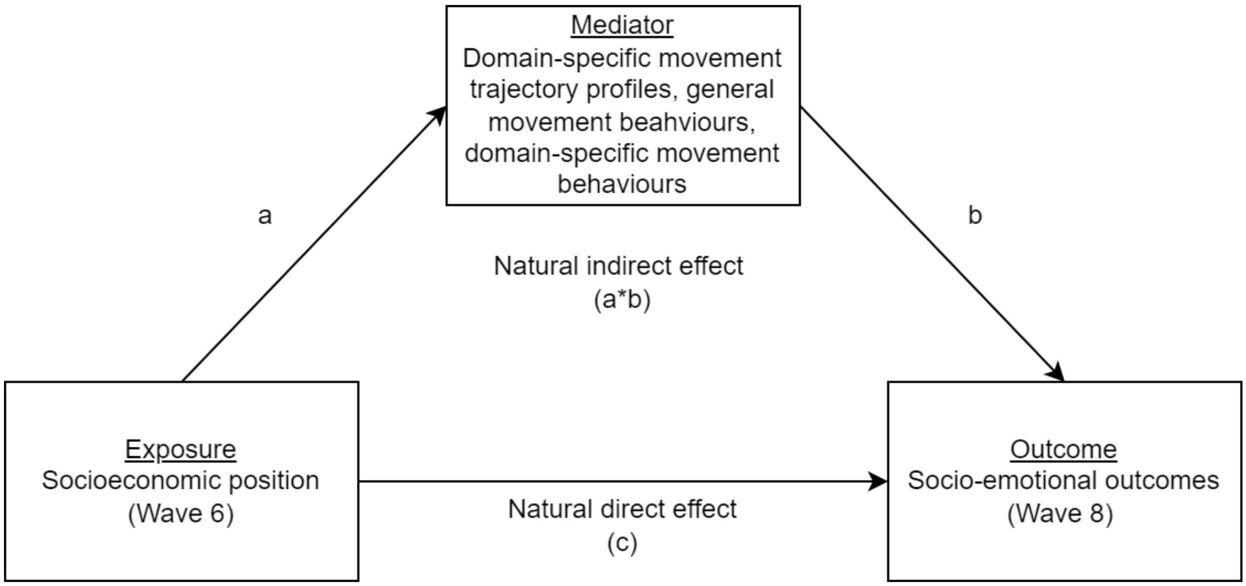


Figure 4.2 Mediation Model with Time Points

To address the first objective, to test if domain-specific movement behaviour trajectory profile membership mediated the relationship between a participant's socioeconomic position and socio-emotional outcomes, I used the medflex package in R version 0.6.7. The medflex package uses the counterfactual framework to provide natural direct and indirect effects[376]. To do this, medflex uses an expanded dataset, which includes the original data and counterfactuals. Counterfactuals are hypothetical effects of an outcome if the exposure and potential mediator values were different. So, if a person received an intervention, a counterfactual would be that the person did not receive the intervention and consequently, the value of the mediator would be what would have naturally been expected in that situation. For example, suppose there is an intervention to increase physical activity with an education component and it is hypothesised that the education component mediates the relationship between the intervention and physical activity. If a participant received the intervention the counterfactual would be the estimated change in their physical activity if they had not received the intervention and therefore did not receive the education component because that is naturally what would have occurred. This expanded dataset is then used to find the natural direct effects (exposure to the outcome) and natural indirect effects (mediation). Compared with other R packages such as mediation, the medlfex package also better caters for non-linear data.

Considering the exposure is continuous and the mediator is a categorical variable in this study, the medflex package is appropriate.

Before running a mediation analysis it is important to ensure assumptions are met[375]. All possible confounders between the exposure and the outcome (in this case, socioeconomic position and socio-emotional outcomes) and the mediator and the outcome (domain-specific movement trajectory profiles and socio-emotional outcomes) must be identified and included in the model. Meeting these assumptions ensures that the mediator, domain-specific movement trajectory profiles, is indeed causing an effect on participants' socio-emotional outcomes since all other possible explanations of the effect are being controlled for[375]. For this study, domain-specific movement trajectory profiles were coded as a categorical variable and I controlled for housing disadvantage, resources, whether a mother was present in the household, whether a father was present in the household, parental mental health, mother ethnicity, father ethnicity, puberty, remoteness and Indigenous status because all of these factors are associated with socioeconomic position and socio-emotional outcomes[85,369,377–381].

To address the second and third objectives, to identify which general and domain-specific movement behaviours are interacting to affect socio-emotional outcomes, I used lasso-based mediation. Lasso mediation uses penalising techniques specific to mediation analyses, allows multiple mediators to be analysed simultaneously, and accounts for any correlations among mediators[382].

For general movement behaviours, I made three pairwise and one three-way interaction variables. To test for the interactions of domain-specific movement behaviour variables on socio-emotional outcomes I made 78 variables by multiplying all possible pairwise combinations of movement behaviours (e.g., recreational screen activities*daytime naps). Next, I used the regmed package in R version 2.0.4 to run the lasso-based mediation on all individual general and domain-specific movement behaviours and all interactions. I selected the model with the lowest Bayesian Information Criterion (BIC). Mediation models were made for all movement behaviours that yielded significant results.

Results

Subject characteristics

In my second study, I identified domain-specific movement trajectory profiles for 1,206 females and 1,251 males. For this study, for females, 980 participants were included in the mediation analyses because 216 participants did not have data at Wave 8, nine were missing data for the Strengths and Difficulties Questionnaire, and one was missing covariate data. For the males, 1,014 participants were included in the mediation analyses because 226 participants did not have data at Wave 8, nine were missing Strengths and Difficulties Questionnaire data, and two were missing covariate data. Subject characteristics can be found in Table 4.2.

Mediation

For the first objective, my results indicated that lower socioeconomic position led to increased hyperactivity-inattentiveness and conduct problems later in life in males. For females, lower socioeconomic positions led to increased emotional, peer, and total socio-emotional problems. However, domain-specific movement trajectory profiles did not mediate the relationship between socioeconomic position and socio-emotional outcomes in children (see Table 4.3). Only figures with significant results are shown.

Table 4.2 Descriptive Statistics

	Male (N=1014)	**Female (N=980)**	**Overall (N=1994)**
Subject Details			
Age	10 (± 0.49)	10 (± 0.49)	10 (± 0.49)
Indigenous			
Not Aboriginal	991 (98 %)	957 (98 %)	1948 (98 %)
Aboriginal	19 (2 %)	22 (2 %)	41 (2 %)
Torres Strait Islander	2 (0 %)	0 (0 %)	2 (0 %)
Both	2 (0 %)	1 (0 %)	3 (0 %)
Remoteness			
Highly Accessible	531 (52 %)	493 (50 %)	1024 (51 %)
Accessible	281 (28 %)	281 (29 %)	562 (28 %)
Moderately Accessible	168 (17 %)	167 (17 %)	335 (17 %)
Remote	17 (2 %)	17 (2 %)	34 (2 %)
Very Remote	11 (1 %)	16 (2 %)	27 (1 %)
Not determined	6 (1 %)	6 (1 %)	12 (1 %)
Socioeconomic Position	0.099 (± 1.0)	0.11 (± 0.97)	0.11 (± 0.99)
Mother at Home			
No	10 (1 %)	8 (1 %)	18 (1 %)
Yes	1004 (99 %)	972 (99 %)	1976 (99 %)
Father at Home			
No	145 (14 %)	143 (15 %)	288 (14 %)
Yes	869 (86 %)	837 (85 %)	1706 (86 %)
Parent Sought Help for Mental Health			
No	960 (95 %)	936 (96 %)	1896 (95 %)
Yes	52 (5 %)	43 (4 %)	95 (5 %)
Missing	2 (0.2%)	1 (0.1%)	3 (0.2%)
Mother Ethnicity			
Not Australian	26 (3 %)	29 (3 %)	55 (3 %)
Australian	841 (83 %)	840 (86 %)	1681 (84 %)
Unknown	55 (5 %)	38 (4 %)	93 (5 %)
Missing	92 (9.1%)	73 (7.4%)	165 (8.3%)
Father Ethnicity			
Not Australian	28 (3 %)	24 (2 %)	52 (3 %)
Australian	730 (72 %)	728 (74 %)	1458 (73 %)
Unknown	62 (6 %)	55 (6 %)	117 (6 %)
Missing	194 (19.1%)	173 (17.7%)	367 (18.4%)
Socioeconomic Indexes for Areas			
Relative Socioeconomic Advantage and Disadvantage			
1	43 (4 %)	37 (4 %)	80 (4 %)
2	79 (8 %)	75 (8 %)	154 (8 %)
3	92 (9 %)	62 (6 %)	154 (8 %)

4	101 (10 %)	86 (9 %)	187 (9 %)
5	91 (9 %)	100 (10 %)	191 (10 %)
6	109 (11 %)	128 (13 %)	237 (12 %)
7	111 (11 %)	109 (11 %)	220 (11 %)
8	99 (10 %)	104 (11 %)	203 (10 %)
9	143 (14 %)	141 (14 %)	284 (14 %)
10	146 (14 %)	138 (14 %)	284 (14 %)
Relative Socioeconomic Disadvantage			
1	49 (5 %)	41 (4 %)	90 (5 %)
2	77 (8 %)	73 (7 %)	150 (8 %)
3	100 (10 %)	66 (7 %)	166 (8 %)
4	81 (8 %)	75 (8 %)	156 (8 %)
5	94 (9 %)	104 (11 %)	198 (10 %)
6	113 (11 %)	125 (13 %)	238 (12 %)
7	119 (12 %)	110 (11 %)	229 (11 %)
8	93 (9 %)	95 (10 %)	188 (9 %)
9	138 (14 %)	143 (15 %)	281 (14 %)
10	150 (15 %)	148 (15 %)	298 (15 %)
Economic Resources			
1	52 (5 %)	43 (4 %)	95 (5 %)
2	67 (7 %)	64 (7 %)	131 (7 %)
3	86 (8 %)	83 (8 %)	169 (8 %)
4	94 (9 %)	73 (7 %)	167 (8 %)
5	88 (9 %)	70 (7 %)	158 (8 %)
6	97 (10 %)	100 (10 %)	197 (10 %)
7	114 (11 %)	111 (11 %)	225 (11 %)
8	135 (13 %)	138 (14 %)	273 (14 %)
9	117 (12 %)	126 (13 %)	243 (12 %)
10	164 (16 %)	172 (18 %)	336 (17 %)
Education and Occupation			
1	56 (6 %)	52 (5 %)	108 (5 %)
2	84 (8 %)	69 (7 %)	153 (8 %)
3	86 (8 %)	77 (8 %)	163 (8 %)
4	96 (9 %)	102 (10 %)	198 (10 %)
5	80 (8 %)	91 (9 %)	171 (9 %)
6	118 (12 %)	116 (12 %)	234 (12 %)
7	95 (9 %)	118 (12 %)	213 (11 %)
8	147 (14 %)	121 (12 %)	268 (13 %)
9	151 (15 %)	126 (13 %)	277 (14 %)
10	101 (10 %)	108 (11 %)	209 (10 %)
Strengths And Difficulties Questionnaire Scores at Age 12			
Prosociality Scale	8.1 (± 1.8)	8.5 (± 1.7)	8.3 (± 1.7)
Hyperactivity Scale	3.1 (± 2.4)	2.1 (± 2.1)	2.6 (± 2.3)
Emotional Symptoms Scale	1.6 (± 1.8)	2.3 (± 2.2)	2.0 (± 2.0)
Peer Problems Scale	1.6 (± 1.7)	1.6 (± 1.8)	1.6 (± 1.7)

Conduct Problems Scale	0.88 (± 1.3)	0.85 (± 1.4)	0.86 (± 1.3)
Total Score	7.1 (± 5.3)	6.8 (± 5.6)	7.0 (± 5.5)
Domain Specific Movement Behaviours at Age 10			
Active Transport	12 (± 30)	11 (± 26)	12 (± 28)
Daytime Naps	2.7 (± 20)	3.9 (± 20)	3.3 (± 20)
Education Sedentary Behaviour	210 (± 160)	220 (± 160)	220 (± 160)
Leisure Time Sedentary Behaviour	140 (± 100)	160 (± 100)	150 (± 100)
Passive Transport	54 (± 52)	59 (± 51)	56 (± 51)
Screen Time	190 (± 160)	140 (± 130)	170 (± 150)
Self Care Sedentary Behaviour	13 (± 16)	14 (± 18)	14 (± 17)
Social Based Sedentary Behaviour	44 (± 72)	56 (± 75)	50 (± 74)
Structured Moderate-Vigorous Physical Activity	28 (± 52)	27 (± 53)	28 (± 53)
Unstructured Light Physical Activity	58 (± 75)	63 (± 79)	61 (± 77)
Unstructured Moderate-Vigorous Physical Activity	33 (± 54)	17 (± 37)	25 (± 47)
Household Light Physical Activity	55 (± 55)	68 (± 56)	61 (± 56)
Nighttime Sleep	580 (± 62)	590 (± 63)	590 (± 63)

Values represent or count (%); All variables, except strengths and Difficulties Questionnaires Scores are from Wave 6 (participants age 10); Age is measured in years; Socioeconomic Position is a composite score of income, educational attainment, and occupation status. The variable is standardized so, the mean is 0 and standard deviation is 1.; Movement Behaviours are measured in minutes; Socioeconomic Indexes for Areas variables are reported by decile (1 = most disadvantaged, 10 = most advantaged); Strengths and Difficulties subscales range from 0 – 10, the total score ranges from 0 – 40.

Table 4.3 Mediation of Movement Trajectory Profiles Between Socioeconomic Position and Socio-Emotional Outcomes

	Natural direct effect		Natural indirect effect		Total effect	
Socio-emotional outcome	Estimate (SE)	p	Estimate (SE)	p	Estimate (SE)	p
Males						
Prosocial behaviour	0.01 (0.04)	0.81	0.00 (0.00)	0.50	0.01 (0.04)	0.75
Hyperactivity-inattentiveness	-0.07 (0.04)	**0.04**	0.00 (0.00)	0.34	-0.08 (0.04)	**0.03**
Emotional problems	-0.02 (0.04)	0.49	0.00 (0.00)	1.00	-0.02 (0.04)	0.49
Peer problems	-0.02 (0.04)	0.61	0.00 (0.00)	0.30	-0.01 (0.04)	0.70
Conduct problems	-0.09 (0.04)	**0.02**	0.00 (0.00)	0.77	-0.09 (0.04)	**0.02**
Total	-0.07 (0.04)	**0.04**	0.00 (0.00)	0.81	-0.07 (0.04)	**0.04**
Females						
Prosocial behaviour	-0.01 (0.04)	0.87	0.01 (0.00)	0.13	0.00 (0.04)	0.99
Hyperactivity-inattentiveness	-0.18 (0.04)	**<.01**	0.00 (0.00)	0.40	-0.19 (0.04)	**<.01**
Emotional problems	-0.10 (0.04)	**<.01**	-0.01 (0.00)	0.19	-0.11 (0.04)	**<.01**
Peer problems	-0.07 (0.04)	0.06	-0.01 (0.00)	0.18	-0.08 (0.04)	**0.04**
Conduct problems	-0.05 (0.04)	0.21	0.00 (0.00)	0.35	-0.05 (0.04)	0.18
Total	-0.14 (0.04)	**<.01**	-0.01 (0.00)	0.14	-0.15 (0.04)	**<.01**

Note:

Socio-Emotional Outcomes are based on scores from the Strengths and Difficulties Questionnaire. SE = Standard Error

For the second objective, selected BICs and lambas for each socio-emotional outcome variable can be found in Appendix D.1. For general movement behaviours, no interactions of general movement behaviours mediated the relationship between socioeconomic position and socio-emotional outcomes. However, moderate-vigorous physical activity alone accounted for 7% of the relationship between socioeconomic position and peer problems in males (see Figure 4.3). Those with lower socioeconomic position participated in less moderate-vigorous physical activity which led to more peer problems. No general movement behaviours mediated the relationship between socioeconomic position and socio-emotional outcomes for females.

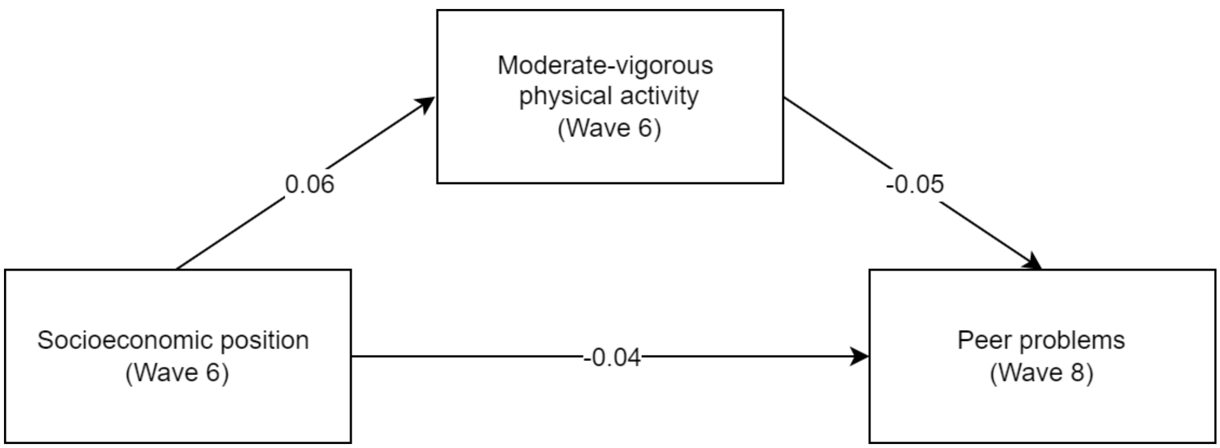


Figure 4.3 Pathways Between Socioeconomic Position and Peer Problems in Males

I did not find any interactions of domain-specific movement behaviours that mediated the relationship between socioeconomic position and socio-emotional outcomes in children. However, for single domain-specific movement behaviours, recreational screen activities had small mediation effects on the relationship between socioeconomic position and some socio-emotional outcomes (see Figures 4.4 and 4.5). Females with lower socioeconomic position participated in more recreational screen activities which led to increased conduct problems, accounting for 3% of the relationship between socioeconomic position and conduct problems. A similar pattern was found for total socio-emotional scores with recreational screen activities accounting for 2% of the relationship between socioeconomic position and total socio-emotional health. Finally, recreational screen activities led directly to decreased prosocial behaviour. Similarly, males from lower socioeconomic positions participated in more recreational screen activities, accounting for 3% of the relationship between socioeconomic position and peer problems and 1% between socioeconomic position and total socio-emotional problems.

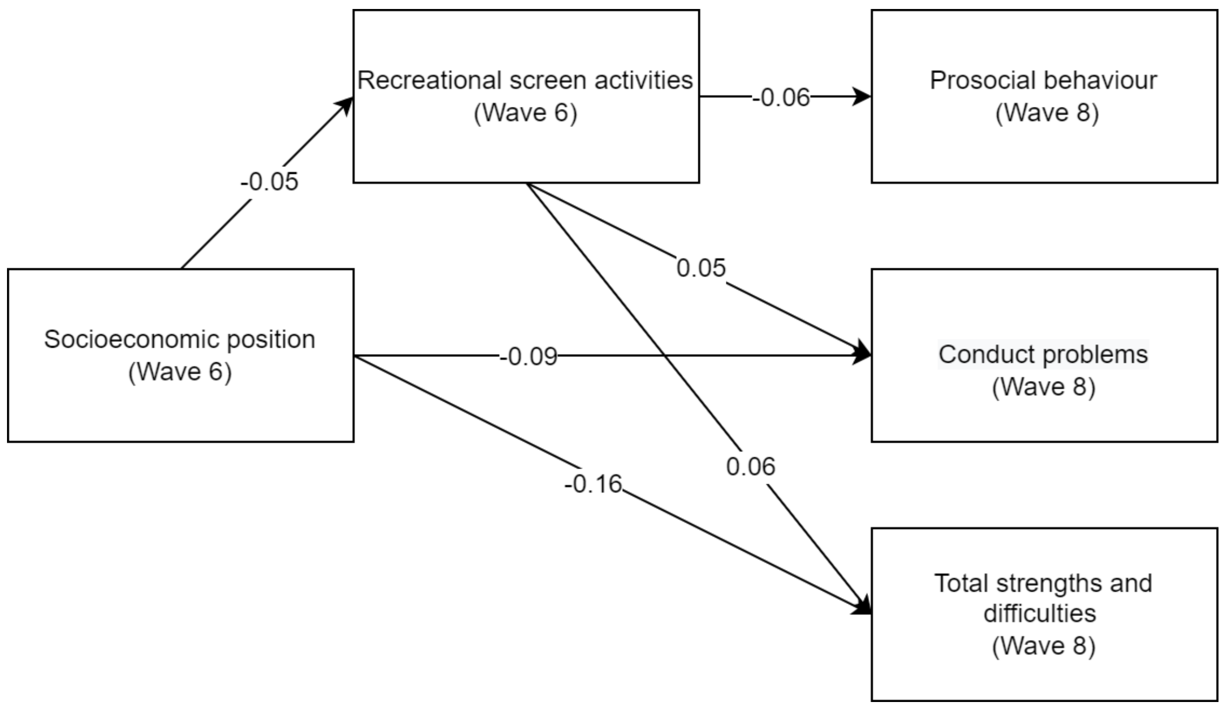


Figure 4.4 Pathways Between Socioeconomic Position and Female Socio-emotional Outcomes

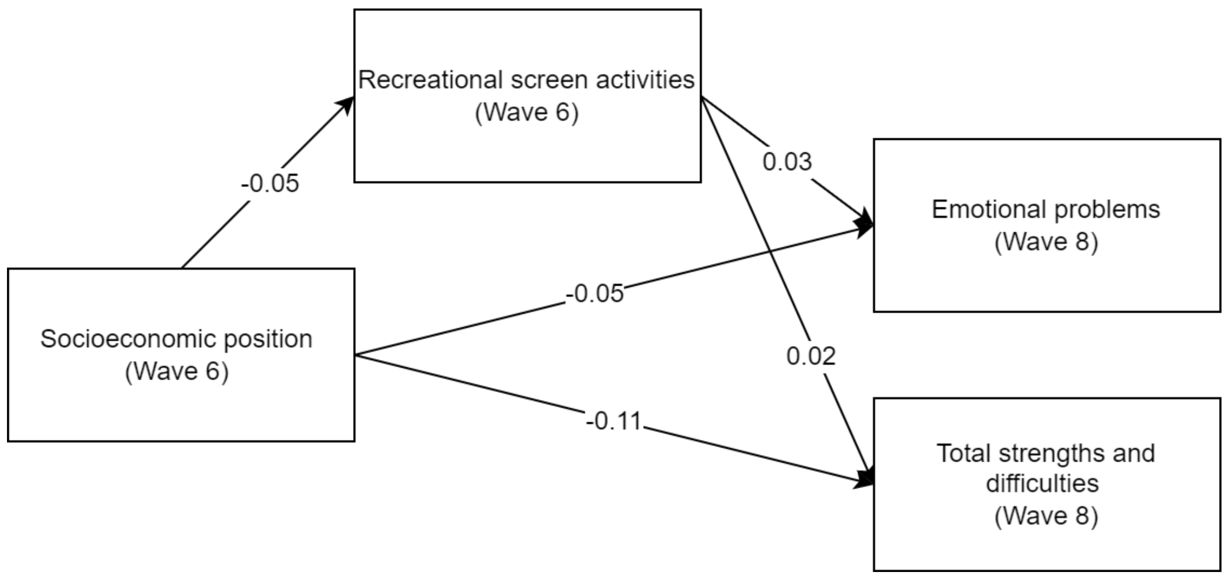


Figure 4.5 Pathways Between Socioeconomic Position and Male Socio-emotional Outcomes

Discussion

This study found that while youth from lower socioeconomic positions spend less time in moderate-vigorous physical activity and more time in recreational screen activities which lead to poorer socio-emotional outcomes, profiles or combinations of movement behaviours do not mediate this relationship. Females from lower socioeconomic backgrounds had more conduct and total socio-emotional problems, partially because they spend more time in recreational screen activities. Similarly, males from lower socioeconomic positions had more peer problems from higher amounts of recreational screen activities and lower moderate-vigorous physical activity. Males also had more total socio-emotional problems due to higher recreational screen activities compared to their higher socioeconomic peers. These findings align with previous studies that have found discrepancies in how much time children from different socioeconomic backgrounds spend in moderate-vigorous physical activity and recreational screen activities and associations with these movement behaviours and socio-emotional outcomes[64,96,102,138,383–386].

Combinations of total time spent in movement behaviours did not mediate the relationship between socioeconomic position and socio-emotional outcomes but perhaps the quality of these behaviours could. For example, in my second study, nighttime sleep was similar across children from different socioeconomic positions. However, sleep quality cannot be measured in time-use diaries. This can pose a problem as poor sleep quality is associated with decreased emotional regulation in children and those from lower socioeconomic positions tend to report poorer sleep quality than their higher socioeconomic peers[387,388]. This quality issue can be applied to other movement behaviours because researchers cannot tell whether participants enjoy or properly engage in these behaviours.

The transition from primary school to secondary school may explain that combinations of movement behaviours did not mediate the relationship between socioeconomic position and socio-emotional outcomes. Participants were 10 years old at the first timepoint of this study and 14 years old when their Strengths and Difficulties Questionnaires were considered. During this period participants would have transitioned into secondary school, which is often associated with a decline in students' socio-emotional health, especially in students from lower socioeconomic positions[389,390]. Many students consider the transition to secondary school a critical time to establish their identity[389,391,392]. For some, this comes with a decline in socio-emotional health. Many students feel a lack of social support during this time, which is also associated with poorer socio-emotional outcomes[389,391,392]. Therefore, although certain movement behaviours have been positively associated with socio-emotional health[50,138,386,393], the participants in this age group may be at a time in their lives when other factors are more important in mediating the relationship between their socioeconomic position and socio-emotional outcomes.

Researchers should not abandon the idea of exploring combinations of movement behaviours with different outcomes and age groups. Socio-emotional health is complicated for youth transitioning into a new school due to physical, psychological, and environmental changes[389,390]. Therefore, researchers can test if combinations of movement behaviours mediate the relationship between socioeconomic position and socio-emotional outcomes in different age groups. Alternatively, outcomes other than socio-emotional health can be explored.

Strategies to create opportunities, awareness, access, and encouragement to participate in moderate-vigorous physical activity for youth from lower socioeconomic positions should be implemented. Youth from lower socioeconomic position neighbourhoods tend to have less funds, resources, quality green spaces, and sport facilities to be physically active[110]. However, even when programs are made available to families from lower socioeconomic backgrounds, the programs are not necessarily utilised. A program in Australia provided vouchers to families so children could participate in organised sport at a reduced cost[394]. Parents considered to be most disadvantaged had lower odds of hearing about the program, registering for the program, and redeeming vouchers than less disadvantaged parents. Therefore, creating cost-effective programs should be done in conjunction with increasing program awareness and promotion in those from lower socioeconomic backgrounds. To best inform these programs and promotions, qualitative research should be implemented to understand what parents and youth from different socioeconomic backgrounds want in programs, identify barriers and challenges that get in their way from participating in programs, and to identify strategies that could help them make the most of the programs[395].

A deeper look into the relationship between youth from lower socioeconomic positions and recreational screen activities should also be a focus for future research and interventions. Recreational screen activities are complex because there are many factors to consider such as the type, content, time of use, co-participation, and parental monitoring of behaviours[396,397]. Some types of recreational screen activities (e.g., video games) can be helpful for educational outcomes and problem-solving but detrimental to other outcomes, including socio-emotional health[397,398]. Parents from higher socioeconomic backgrounds tend to employ a more autonomy-supportive parenting approach to their child's recreational screen use both in terms of duration and the content they are allowed to watch while parents from lower socioeconomic backgrounds tend to be more autonomy-restrictive[399,400]. The autonomy-supportive parenting approach allows parents to restrict their child's recreational screen activity use to suit the needs of their child better while an autonomy-restrictive approach is not as effective and can negatively affect youth's socio-emotional health[399,400]. Therefore, researchers should explore strategies to help parents from lower socioeconomic positions facilitate their children's recreational screen activities.

Although this study shed light on mechanisms that mediate the relationship between socioeconomic position and socio-emotional outcomes in youth, some limitations should be noted. First, time-use diaries cannot capture the quality of movement behaviours (e.g., sleep quality, the effort put into a task, content of recreational screen activities). To overcome this limitation, future research should use more direct observation or wearable cameras to capture the full scope of movement behaviours. Next, this study only examined a single day of weekday movement behaviours. Therefore, we could only analyse a small portion of their week and could not consider the differences in movement behaviours that youth participate in during a nonstructured day, which could have had implications on their social-emotional outcomes. Next, some activities may have been under- or overreported due to social desirability or recall bias. Finally, the associations found in this study are small which could be an indication of false positive mediators. However, having a large sample size and using a large fraction of lasso penalty (>=0.8) decreases the frequency of selecting false mediators[382].

Despite these limitations, this study had several strengths. First, this study used longitudinal, continuous data which allowed a full 24-hour day to be considered at multiple timepoints in the participants' lives. Next, analysing domain-specific movement behaviours allowed us to tease out that recreational screen activity is a mechanism that partially causes youth from lower socioeconomic positions to have poorer socio-emotional outcomes than their higher socioeconomic peers. If only general movement behaviours were considered we may have missed this important finding. Finally, the socioeconomic position variable was robust.

Conclusion

In this study, I found that moderate-vigorous physical activity accounted for 7% of the relationship between socioeconomic position and male peer problems. Recreational screen activities accounted for between 1-3% of the relationship between youth's socioeconomic position and some socio-emotional outcomes. Interventions to support youth should focus on alternatives to recreational screen activities and increasing opportunities for moderate- vigorous physical activity. However, all other movement behaviours did not mediate the relationship between socioeconomic position and socio-emotional outcomes. Researchers should continue studying domain-specific movement behaviours across youth from different socioeconomic backgrounds because the findings may provide a more detailed approach to improving specific outcomes in populations most in need. Combinations of movement behaviours should be considered in other physical, psychological, and education-related outcomes.

Researchers and policymakers should focus efforts on how best to improve socio-emotional health in youth from lower socioeconomic positions. Interventions to support these youth could include alternatives to recreational screen activities and increasing opportunities for moderate-vigorous physical activity.

Chapter 5: Discussion

Review of Thesis Objectives

The primary aim of my thesis was to improve our understanding of movement behaviour (i.e., physical activity, sedentary behaviour, and sleep) time-use across youth from different socioeconomic backgrounds. To achieve this objective, I completed three studies. In my first study, I systematically reviewed literature that investigated combinations of movement behaviours and physical health, psychological health, or education-related outcomes in children and adolescents. In the second study, I identified general and domain-specific movement trajectory profiles in youth. I discovered that socioeconomic position could predict how youth's movement behaviours change over time, especially domain-specific movements. In my final study, I found that moderate-vigorous physical activity and recreational screen time mediate the relationship between socioeconomic position and socio-emotional outcomes.

My systematic review aimed to evaluate associations of combinations of physical activity, sedentary behaviour, and sleep with youth's physical health, psychological health, and education-related outcomes. In agreement with a previous, smaller review, I generally found that combinations of "high" physical activity and sleep with "low" sedentary behaviour was associated with the best physical outcomes in children and adolescents[177]. My systematic review also found that the combination of "high" physical activity and sleep with "low" sedentary behaviour was associated with the best psychological health and education-related outcomes in children and adolescents. However, there was far less evidence for psychological and education-related outcomes than physical health. My systematic review also identified several gaps in the literature. First, although the "best" outcomes included a combination with "high" sleep, very few studies included sleep in their analyses, especially research in adolescents. Next, the type, or domain, of sedentary behaviour (i.e., overall sedentary behaviour vs. screen time) yielded different results depending on the outcome. Typically, "high" sedentary behaviour was “bad”, except for academic achievement. However, when sedentary behaviour was defined as “screen time” (as opposed to broader definition of sedentary behaviour), it was associated with poorer academic achievement. Another gap I identified was that movement behaviours were categorised differently across studies (e.g., dichotomised movement behaviours based on guidelines, study-specific tertiles), meaning I could not provide concrete amounts of time that should be spent on each movement behaviour. Finally, the evidence in my systematic review was largely based on cross-sectional studies, highlighting the need for more longitudinal research. In summary, my systematic review identified the following needs in future movement behaviour research: ensure that sleep is included in analyses, outcomes beyond physical health should be further explored more extensively, research using longitudinal and continuous data should be used, and specific types of movement behaviours should be considered.

To address the research gaps found in my systematic review and to explore the differences in how youth from different socioeconomic position use their time, my study aimed to identify different movement behaviour trajectory profiles and whether socioeconomic position could predict profile membership. First, I used a group-based multi-trajectory analysis to identify general and domain-specific movement trajectory profiles in youth. Group-based multi-trajectory analysis is a novel method in the public health field that allows researchers to evaluate continuous data longitudinally[401]. This method allowed me to identify different general and domain-specific movement trajectory profiles in youth. Next, I used multinomial logistic regression to test if socioeconomic position could predict profile membership. From this test, I discovered that, surprisingly, males from different socioeconomic backgrounds do not tend to differ in their physical activity, sedentary behaviour, and sleep. On the other hand, females from lower socioeconomic positions show a combination of being both less active and more sedentary than their higher socioeconomic peers. However, when examining domain-specific movement trajectory profiles, both males and females from lower socioeconomic backgrounds spend a combination of more time in recreational screen time and less time in education-related outcomes than those with a higher socioeconomic background. This difference in how youth from different socioeconomic backgrounds spend their time may partially explain discrepancies in psychological outcomes. These findings may also lead those who create interventions and policies to better consider the habits and needs of youth from different socioeconomic backgrounds.

My systematic review identified that there is less research on psychological and education-related outcomes than physical health and the results of my second study showed that youth from different socioeconomic backgrounds spend their time moving differently. Therefore, for my final study, I tested if movement behaviours mediate the relationship between socioeconomic position and socio-emotional outcomes in youth. I found that moderate-vigorous physical activity and recreational screen time mediate the relationship between socioeconomic position and some socio-emotional outcomes.

Implications

Policymakers

Understanding how movement behaviour time-use influences outcomes is important because we can improve our recommendations and policies for children and adolescents. Findings from my systematic review suggest that more countries should adopt the 24-hour movement behaviour guideline approach since we know that different combinations of movement behaviours make a difference in physical health, psychological health, and education-related outcomes. In addition, findings from my second study suggest that youth from different socioeconomic backgrounds change their movement behaviours differently as they age. Therefore, guidelines may also need to consider the different needs of youth from different socioeconomic backgrounds in their recommendations. Policies could provide specific strategies and guidance for youth and parents from lower socioeconomic positions to reach recommendations.

Policymakers should ensure that quality physical education and health programs are available in schools so that students have the opportunity to learn about and execute movement behaviours appropriately. It has been recommended that governments could mandate a minimum amount of time schools should allocate to physical education and recess time[402]. Education about participating in appropriate movement behaviours should also be addressed. In the United States, schools are encouraged to implement effective 'coordinated school health programs' which includes health education, opportunities to be physically active, nutrition services, physical and mental health services, family and community involvement, and maintaining a safe and supportive school environment for all students[403]. These programs have been shown to reduce academic achievement barriers and promote health[403,404]. Barriers to implementing these types of programs include staff having insufficient time, budget, funding, and staff turnover[405]. Policymakers can alleviate these barriers by mandating school health policies and programs, requiring schools to start and maintain quality coordinated school health programs or equivalent programs, ensuring schools provide enough time for health education (including lessons on sleep and domain-specific sedentary behaviours), and providing jobs such as district wellness coordinators who can liaison with schools and health departments, cater to schools' needs (e.g., socioeconomic positions), and aid with schools accessing resources[403,406].

Providing sports vouchers can help youth from lower socioeconomic areas accumulate sufficient physical activity. A 2020 paper identified that five out of eight Australian State and Territory Governments provided sports vouchers to youth, with the median value of vouchers at $150[407]. A $150 sport voucher could support 60% of sport-related expenditure per year in the most disadvantaged areas and 27% of sport-related expenditure in the least disadvantaged areas. Increasing sport voucher reach and amount, particularly in lower socioeconomic areas, could allow more youth to participate in community sports and aid in decreasing the sport-participation disparity.

Finally, policymakers could allocate funding to encourage physical activity in the built environment[408]. This can include funding for safe bicycle lanes, road crossings, sufficient sidewalks and streetlights, and creation and maintenance of green spaces in disadvantaged neighbourhoods[409].

Community

The community setting can provide means for youth to participate in ideal movement behaviours. Community organisations can offer cost-effective options to promote physical activity and learning. For example, nonprofit, community bike shops across the United States have helped in creating equitable access to bicycles in low-income communities, including youth[409]. The bike shops sell used, refurbished bikes at a minimal cost or through sweat equity programs and assist with bicycle maintenance. Sweat equity programs allow people to provide labor (e.g., cleaning, fixing bicycles) instead of paying money in exchange for goods. The nonprofit, community bike shops give residents from low-income communities means to own a bike, fix a bike, and create an opportunity to learn a skill (i.e., bicycle maintenance).

Other community-based programs that can help displace time spent in recreational screen time in youth from lower socioeconomic backgrounds. In Canada, a community-based arts program provided an opportunity for youth aged 9-15 years old to participate in drumming, acting, music, and crafts after school[410]. The program received positive feedback from the participants and their parents. They program also showed an increase in the youth's prosocial skills and a decrease in their emotional and conduct problems.

Schools

Children and adolescents should be given tools and opportunities to reallocate their movement behaviours to create a healthy 24-hour day. Some programs in Australia have already been put into place to address these issues. The iPLAY and Transform-Us! interventions are school-based programs with family-based components that aim to get children to move more and sit less[411,412]. Strategies implemented in the programs include teacher education, active breaks, incorporating physical activity with homework, parent newsletters, and providing active playgrounds (e.g., line markings, equipment). Both iPLAY and Transform-Us!

were deemed effective and feasible to implement and scale[413,414]. Therefore, providing strategies and opportunities for children to be more physically active and less sedentary is possible and manageable. Researchers in Spain conducted a school-based intervention program targeting all three movement behaviours along with other health behaviours (e.g., alcohol consumption) in two secondary schools[415]. The intervention was found to be successful in increasing the amount of students who met different combinations of physical activity, screen time, and sleep guidelines. Therefore, adding sleep to school interventions holds promise.

My second and third studies highlight the importance of catering to the socioeconomic position of youth. In my second study, I found that males from different socioeconomic backgrounds accrue general movement behavious in similar volumes while females from lower socioeconomic positions have a combination of being less active and more sedentary than their higher socioeconomic peers. However, the way youth from different socioeconomic positions accumulate their time differ. Youth from lower socioeconomic positions tend to spend a combination of more time in recreational screen time and less time in education-based sedentary behaviours than their higher socioeconomic peers. In my third study, I found that moderate-vigorous physical activity and recreational screen time mediate the relationship between youth from lower socioeconomic positions having poorer socio-emotional outcomes. To counteract these discrepancies schools should ensure there is sufficient time for youth, especially those from lower socioeconomic positions, to displace general sedentary behaviours with education-based sedentary behaviour and moderate-vigorous physical activity. One step could be to ensure there are suitable (e.g., clean, away from traffic) outdoor spaces for students to be active during the day.

Before and after-school programs are one option to displace general sedentary behaviours with education-based sedentary behaviour and moderate-vigorous physical activity. A meta-analysis of 73 after-school programs found that effective programs improved participants' attitudes and feelings toward school, socio-emotional outcomes, and academic performance and also included an education component (e.g., homework time, tutoring)[416]. Of the included programs, 25.7% were low-income, 19.7% were mixed-income, and 54.5% did not report their socioeconomic position. These findings suggest that the after-school programs are likely feasible and effective for children from low socioeconomic backgrounds. Along with promoting education-based sedentary behaviours, before and after-school programs that incorporate physical activity in their programs have been positively associated with improved physical and socio-emotional health, cognitive and academic benefits for children[417]. My second study found that females from lower socioeconomic positions tend to be less physically active overall than their higher socioeconomic peers. Attending physically active before and after-school programs may allow females from lower socioeconomic positions to narrow this gap. Further, these programs may allow males and females to reallocate time spent in recreational screen time to other activities. This is particularly important as recreational screen time was found to mediate the relationship between socioeconomic position and socio-emotional outcomes.

For adolescents, participation in intramural sports may allow them to be more physically active and displace time spent in recreational screen time. Intramurals sports are informal and take place within the school setting which can potentially eliminate cost and travel barriers of sport participation in those with low-income. Youth and parents from lower socioeconomic backgrounds have identified intramural sport participation as important and fun. However, some considerations for future intramural sport program development are ensuring students know how to play, keeping the focus away from winning, and creating an environment to make the students feel comfortable[418].

Families

The home is a place where appropriate movement behaviours should be encouraged and facilitated. The findings of this thesis support families using the *Consensus Statement on the Role of the Family in the Physical Activity, Sedentary and Sleep Behaviours of Children and Youth* (https://participaction.com/consensus-statement) as a tool to reference evidence-based strategies to guide children and youth to lead a healthy 24-hour day[419]. The *Consensus Statement* states that families include parents, elders, grandparents, siblings, and legal guardians. In short, families should know and understand the 24-Hour Movement Behaviour Guidelines, create an environment that supports and encourages adhering to the guidelines, role model appropriate movement behaviours, and involve their children in setting expectations for meeting guidelines. Strategies noted in the *Consensus Statement* include co-participating in physical activity and screen time, encouraging children to go outside, participating in more "screen-free family time", removing screens from bedrooms, ensuring consistent sleep-wake times, and providing a quiet, comfortable sleep space. This thesis suggests that families particularly from lower socioeconomic positions should also encourage and facilitate more time for education-based sedentary behaviour.

Parents play a major role in determining or influencing their child's movement behaviours. Parents should be made aware of the important of physical activity and potential detriments of recreational screen time[104]. From there, parents can create an environment that encourages physical activity and discourages recreational screen time. For example, parents can put up fences around their yard in they live in a heavily trafficked area so that younger children do not end up in the street. Toys, books, and sports equipment can be purchased for leisure-time activities. Parents, when possible, should also encourage their children to utilize outdoor spaces (e.g., yard, parks, trails) and community centers.

Strengths

I used best practice guidelines for all of my studies to ensure my research was of high quality. My systematic review was prospectively registered on PROSPERO (ID: CRD42020181097), I followed PRISMA and AMSTAR 2 guidelines, and my dataset is publicly available on the Open Science Framework repository (https://osf.io/jq8xh). My second and third studies were preregistered on the Open Science Framework (https://osf.io/j6uvz and https://osf.io/g5cze, respectively). The dataset for these studies is not publicly available, as I used secondary data from the *Longitudinal Study of Australian Children,* which requires permission from the owners to access.

The *Longitudinal Study of Australian Children* dataset was a strength of my thesis. First, the dataset provided me with a large, representative sample size of Australian children[348]. The data collection process was rigorous and included data on many outcomes. This allowed me to include many potential confounders in my analyses, reducing the risk of bias.

Specifically, the updated time-use diaries used by the *Longitudinal Study of Australian Children* were a strength of my thesis. The time-use diaries allowed me to find more accurate data on youth's movement behaviours because they instructed participants to record the exact time they participated in each activity rather than in 15-minutes increments[350]. Additionally, since the time-use diaries provided continuous data, I could use group-based multi- trajectory analysis to longitudinally analyse data while overcoming the limitation of dichotomising or categorising movement behaviours. For example, many studies dichotomise movement behaviours by whether participants meet a recommendation or not. Consequently, a participant who spends 59 minutes of physical activity will be grouped with a participant who spends 2 minutes in physical activity but separately from someone who participates in 61 minutes of physical activity. Therefore, group-based multi-trajectory analysis allowed me to better cluster individuals into appropriate groups. Another strength of this method was that it provided data for a full 24-hour day. Other methods may make a "day" by adding movement behaviour measurements. These "days" can be greater than or less than 24 hours. Isotemporal substitution and compositional data analysis can account for this problem but their estimates are hypothetical and the research is largely cross-sectional.

Limitations

The studies in my thesis measured the duration of movement behaviours which means that the quality of movement behaviours was not considered. Measuring the quality of movement behaviours is important because the quality can influence many of the same outcomes that movement behaviour duration can impact. For example, poor sleep quality can negatively affect cognitive functioning, academic performance, mental health, socio-emotional health, and cardiometabolic health in youth[50,386,419,420]. However, sleep quality has been insufficiently studied and there is no consensus on the best way to measure it[58,420,422]. Quality of movement behaviours can even be measured on a domain-specific level. For example, some forms of recreational screen time have been shown to have beneficial effects while others have detrimental effects[397]. For school music programs, there are discrepancies in the quality of the programs in different socioeconomic areas[143,423,424]. Therefore, although youth from different socioeconomic backgrounds may spend similar amounts of time in certain movement behaviours, they are not necessarily receiving the same quality experiences.

Although the *Longitudinal Study of Australian Children* dataset was a major strength of this thesis, it presents some limitations. First, even though the time-use diaries provided continuous domain-specific movement behaviour data, the reports are still subjective. Therefore, recall or social desirability bias may be present. Also, there were only sufficient time-use diary data to analyse weekdays, not weekends. Therefore, the results from my second and third studies are only generalisable to weekdays. Finally, since only youth living in Australia were analysed in the final two studies, the results are only generalisable to Australians and perhaps other similar countries. Consequently, other cultures and low and middle-income countries may not benefit the same from the findings of this thesis.

Finally, the multidimensional nature of socioeconomic position makes it complicated to measure. The composite socioeconomic position variable used in this thesis was robust but not without its limitations[425]. The components that make up the socioeconomic position variable (e.g., occupational status) cannot account for all implications. For example, a stay-at-home parent may not have an occupation because they chose to stay home to care for their children or someone regaining employment after being away may have a less prestigious position than they previously held. For educational attainment, the quality of education cannot be evaluated. Ultimately, although the socioeconomic position is robust, it cannot account for everything.

Future research

From my systematic review, I identified several gaps that should be included in future movement behaviour research. First, there is a need for sleep to be incorporated into more studies. Future research should not only measure sleep but ensure that their sleep data is continuous, and, if possible, measure sleep quality. Next, more longitudinal studies exploring combinations of movement behaviours and youth's outcomes should be conducted. Movement behaviour research should also aim to use continuous data. Definitions of “high” and “low” amounts of movement behaviours were highly variable, making it difficult to make firm conclusions of what exactly is considered “high” and “low” amounts of each movement behaviour. Finally, researchers should investigate combinations of all three movement behaviours and adolescents' cardiometabolic risk factors, cardiorespiratory fitness, muscular physical fitness, health-related quality of life, and cognitive/executive functions because, at the time of my searches, there were no studies that reported on any of these outcomes.

My second and third studies explored domain-specific movement behaviour time-use in Australian children and their socio-emotional outcomes. As stated in the limitations, my results are only generalisable to Australia and similar countries. Therefore, more research investigating domain-specific movement behaviour time-use is needed in low and middle-income countries. The associations between domain-specific movement behaviour time-use and other psychological and education-related outcomes should be explored. Finally, other age groups should be used to see if domain-specific movement trajectory profiles can mediate the relationship between socioeconomic position and socio-emotional outcomes.

Finally, qualitative research should be conducted to inform future interventions and programs for youth from different socioeconomic backgrounds[395]. Qualitative studies can help identify potential strategies, barriers that need to be considered, and provide in-depth insight about what the youth and parents would enjoy and expect in a program.

Conclusion

My thesis has contributed to the understanding of movement behaviour time-use in youth and the influence of socioeconomic background on youth's movement behaviours. I found that the combination of "high" physical activity and sleep with "low" sedentary behaviour is generally associated with better physical, psychological, and educational outcomes. I also found that males from different socioeconomic backgrounds spend similar amounts of time in general movement behaviours but females from lower socioeconomic positions are both less active and more sedentary than their higher socioeconomic peers. However, regardless of sex, youth from different socioeconomic backgrounds accumulate their movement behaviours differently. This is important because I found that youth from lower socioeconomic positions tend to spend more time in recreational screen activities which leads to some poorer socio-emotional outcomes. For males, those from lower socioeconomic positions also spent less time in moderate-vigorous physical activity which led to more peer problems. This information can help guide researchers, families, schools, and policymakers to better cater practices, programs, and policies for youth from lower socioeconomic positions.

More longitudinal research using continuous data and domain-specific movement behaviours is needed to improve our understanding of movement behaviour time-use in children from different socioeconomic backgrounds. However, the findings of this thesis suggest that children from different socioeconomic backgrounds likely differ in how they spend their day regarding domain-specific movement behaviours. Additionally, reducing the time children from lower socioeconomic backgrounds spend in recreational screen time and increasing the amount of time spent in moderate-vigorous physical activity may improve their socio-emotional outcomes.

References

1. Centre for Time Use Research. *Daily Life and Social Change.* Centre for Time Use Research. https://www.timeuse.org/research/archive/daily-life. Accessed October 27, 2022.

2. Chau JY, Gomersall SR, van der Ploeg HP, Milton K. The evolution of time use approaches for understanding activities of daily living in a public health context. *BMC Public Health*. 2019;19(2):451. doi:10.1186/s12889-019-6759-4

3. Pedišić Ž, Dumuid D, Olds TS. Integrating sleep, sedentary behaviour, and physical activity research in the emerging field of time-use epidemiology: definitions, concepts, statistical methods, theoretical framework, and future directions. *Kinesiology*. 2017;49(2):252-269. https://hrcak.srce.hr/186506. Accessed September 17, 2019.

4. Tremblay MS, Esliger DW, Tremblay A, Colley R. Incidental movement, lifestyle-embedded activity and sleep: new frontiers in physical activity assessment. *Can J Public Health*. 2007;98 Suppl 2:S208-S217. https://www.ncbi.nlm.nih.gov/pubmed/18213950.

5. World Health Organization. *Physical activity.* World Health Organization. November 26, 2020. https://www.who.int/news-room/fact-sheets/detail/physical-activity. Accessed August 30, 2022.

6. Jetté M, Sidney K, Blümchen G. Metabolic equivalents (METS) in exercise testing, exercise prescription, and evaluation of functional capacity. *Clin Cardiol*. 1990;13(8):555-565. doi:10.1002/clc.4960130809

7. Füzéki E, Engeroff T, Banzer W. Health Benefits of light-intensity physical activity: a systematic review of accelerometer data of the National Health and Nutrition Examination Survey (NHANES). *Sports Med*. 2017;47. doi:10.1007/s40279-017-0724-0

8. Janssen I, Leblanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *Int J Behav Nutr Phys Act*. 2010;7:40. doi:10.1186/1479-5868-7-40

9. Norton K, Norton L, Sadgrove D. Position statement on physical activity and exercise intensity terminology. *J Sci Med Sport*. 2010;13(5):496-502. doi:10.1016/j.jsams.2009.09.008

10. Faigenbaum AD, Kraemer WJ, Blimkie CJR, et al. Youth resistance training: updated position statement paper from the national strength and conditioning association. *J Strength Cond Res*. 2009;23(5 Suppl):S60-S79. doi:10.1519/JSC.0b013e31819df407

11. Biddle SJ, Asare M. Physical activity and mental health in children and adolescents: a review of reviews. *Br J Sports Med*. 2011;45(11):886-895. doi:10.1136/bjsports-2011-090185

12. Must A, Tybor DJ. Physical activity and sedentary behavior: a review of longitudinal studies of weight and adiposity in youth. *Int J Obes*. 2005;29 (2):S84-S96. doi:10.1038/sj.ijo.0803064

13. Biddle SJH, Ciaccioni S, Thomas G, Vergeer I. Physical activity and mental health in children and adolescents: An updated review of reviews and an analysis of causality. *Psychol Sport Exerc*. 2019;42:146-155. doi:10.1016/j.psychsport.2018.08.011

14. Smith JJ, Eather N, Weaver RG, Riley N, Beets MW, Lubans DR. Behavioral Correlates of muscular fitness in children and adolescents: a systematic review. *Sports Med*. 2019;49(6):887-904. doi:10.1007/s40279-019-01089-7

15. Watson A, Timperio A, Brown H, Best K, Hesketh KD. Effect of classroom-based physical activity interventions on academic and physical activity outcomes: a systematic review and meta-analysis. *Int J Behav Nutr Phys Act*. 2017;14(1):114. doi:10.1186/s12966-017-0569-9

16. de Greeff JW, Bosker RJ, Oosterlaan J, Visscher C, Hartman E. Effects of physical activity on executive functions, attention and academic performance in preadolescent children: a meta-analysis. *J Sci Med Sport*. 2018;21(5):501-507. doi:10.1016/j.jsams.2017.09.595

17. Donnelly JE, Hillman CH, Castelli D, et al. Physical activity, fitness, cognitive function, and academic achievement in children: a systematic review. *Med Sci Sports Exerc*. 2016;48(6):1197-1222. doi:10.1249/MSS.0000000000000901

18. Howley ET. Type of activity: resistance, aerobic and leisure versus occupational physical activity. *Med Sci Sports Exerc*. 2001;33(6 Suppl):S364-S369. doi:10.1097/00005768-200106001-00005

19. Prat IA, Viñolas EC, Cañas JCM, Wasley DA, Puig-Ribera A. From secondary school to university: associations between sport participation and total and domain-specific sedentary behaviours in Spanish students. *Eur J Pediatr*. 2020;179(10):1635-1645. doi:10.1007/s00431-020-03655-y

20. Cabanas-Sánchez V, Esteban-Cornejo I, Izquierdo-Gómez R, Padilla-Moledo C, Castro-Piñero J, Veiga ÓL. How socio-demographic and familiar circumstances are associated with total and domain-specific sedentary behaviour in youth? The UP&DOWN study. *EJSS* . 2020;20(8):1102-1112. doi:10.1080/17461391.2019.1691271

21. White RL, Babic MJ, Parker PD, Lubans DR, Astell-Burt T, Lonsdale C. Domain-specific physical activity and mental health: a meta-analysis. *Am J Prev Med*. 2017;52(5):653-666. doi:10.1016/j.amepre.2016.12.008

22. Owen KB, Foley BC, Wilhite K, Booker B, Lonsdale C, Reece LJ. Sport participation and academic performance in children and adolescents: a systematic review and meta-analysis. *Med Sci Sports Exerc*. 2022;54(2):299-306. doi:10.1249/MSS.0000000000002786

23. Aggio D, Smith L, Fisher A, Hamer M. Context-specific associations of physical activity and sedentary behavior with cognition in children. *Am J Epidemiol*. 2016;183(12):1075-1082. doi:10.1093/aje/kww031

24. Eime RM, Young JA, Harvey JT, Charity MJ, Payne WR. A systematic review of the psychological and social benefits of participation in sport for children and adolescents: informing development of a conceptual model of health through sport. *Int J Behav Nutr Phys Act*. 2013;10:98-98. doi:10.1186/1479-5868-10-98

25. Samitz G, Egger M, Zwahlen M. Domains of physical activity and all-cause mortality: systematic review and dose–response meta-analysis of cohort studies. *Int J Epidemiol*. 2011;40(5):1382-1400. doi:10.1093/ije/dyr112

26. Parrish AM, Tremblay MS, Carson S, et al. Comparing and assessing physical activity guidelines for children and adolescents: a systematic literature review and analysis. *Int J Behav Nutr Phys Act*. 2020;17(1):16. doi:10.1186/s12966-020-0914-2

27. The Department of Health and Aged Care. *For Children and Young People (5 to 17 Years).* Australian Government; 2021. Accessed September 19, 2022. https://www.health.gov.au/health-topics/physical-activity-and-exercise/physical-activity-and-exercise-guidelines-for-all-australians/for-children-and-young-people-5-to-17-years

28. Ainsworth B, Cahalin L, Buman M, Ross R. The current state of physical activity assessment tools. *Prog Cardiovasc Dis*. 2015;57(4):387-395. doi:10.1016/j.pcad.2014.10.005

29. Loprinzi PD, Cardinal BJ. Measuring children's physical activity and sedentary behaviors. *J Exerc Sci Fit*. 2011;9(1):15-23. doi:10.1016/S1728-869X(11)60002-6

30. Lynch BM, Matthews CE, Wijndaele K, Sedentary behaviour council of the international society for physical activity and health. new MeSH for sedentary behavior. *J Phys Act Health*. 2019;16(5):305. doi:10.1123/jpah.2019-0155

31. Rezende LFM de, Rodrigues Lopes M, Rey-López JP, Matsudo VKR, Luiz O do C. Sedentary behavior and health outcomes: an overview of systematic reviews. *PLoS One*. 2014;9(8):e105620. doi:10.1371/journal.pone.0105620

32. Rennie KL, Johnson L, Jebb SA. Behavioural determinants of obesity. *Best Pract Res Clin Endocrinol Metab*. 2005;19(3):343-358. doi:10.1016/j.beem.2005.04.003

33. De Vos CJCW, Du Toit D, Coetzee D. Verband tussen fiskiek aktiwiteit en sedentere tyd, en akademiese prestasie by graad 7-leerders in potchefstroom. *South African Journal for Research in Sport, Physical Education & Recreation*. 2018;40(3):13-27.

34. Biddle SJ, Pearson N, Ross GM, Braithwaite R. Tracking of sedentary behaviours of young people: a systematic review. *Prev Med*. 2010;51(5):345-351. doi:10.1016/j.ypmed.2010.07.018

35. Baradaran Mahdavi S, Riahi R, Vahdatpour B, Kelishadi R. Association between sedentary behavior and low back pain; a systematic review and meta-analysis. *Health Promot Perspect*. 2021;11(4):393-410. doi:10.34172/hpp.2021.50

36. Carson V, Kuzik N, Hunter S, et al. Systematic review of sedentary behavior and cognitive development in early childhood. *Prev Med*. 2015;78:115-122. doi:10.1016/j.ypmed.2015.07.016

37. Anderson CA, Bushman BJ. Effects of violent video games on aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and prosocial behavior: a meta-analytic review of the scientific literature. *Psychol Sci*. 2001;12(5):353-359. doi:10.1111/1467-9280.00366

38. Hale L, Guan S. Screen time and sleep among school-aged children and adolescents: a systematic literature review. *Sleep Med Rev*. 2015;21:50-58. doi:10.1016/j.smrv.2014.07.007

39. Wada K, Yamakawa M, Konishi K, et al. Associations of cell phone use and screen viewing with overweight in children. *Child Obes*. 2019;2019/07/13. doi:10.1089/chi.2018.0312

40. Carson V, Hunter S, Kuzik N, et al. Systematic review of sedentary behaviour and health indicators in school-aged children and youth: an update. *Appl Physiol Nutr Metab*. 2016;41(6 Suppl 3):S240-S265. doi:10.1139/apnm-2015-0630

41. Shqair AQ, Pauli LA, Costa VPP, Cenci M, Goettems ML. Screen time, dietary patterns and intake of potentially cariogenic food in children: a systematic review. *J Dent*. 2019;86:17-26. doi:10.1016/j.jdent.2019.06.004

42. Granic I, Lobel A, Engels RCME. The benefits of playing video games. *Am Psychol*. 2014;69(1):66-78. doi:10.1037/a0034857

43. Horowitz-Kraus T, Hutton JS. Brain connectivity in children is increased by the time they spend reading books and decreased by the length of exposure to screen-based media. *Acta Paediatr*. 2018;107(4):685-693. doi:10.1111/apa.14176

44. Saunders TJ, Rollo S, Kuzik N, et al. International school-related sedentary behaviour recommendations for children and youth. *Int J Behav Nutr Phys Act*. 2022;19(1):39. doi:10.1186/s12966-022-01259-3

45. Carskadon & Dement. Normal human sleep: an overview. *Principles of practice of sleep medicine*. 2005;4(1):13-23.

46. Buysse DJ. Sleep health: Can we define it? Does it matter? *Sleep*. 2014;37(1):9-17. doi:10.5665/sleep.3298

47. Spruyt K, Molfese DL, Gozal D. Sleep duration, sleep regularity, body weight, and metabolic homeostasis in school-aged children. *Pediatrics*. 2011;127(2):e345-e352. doi:10.1542/peds.2010-0497

48. Li L, Zhang S, Huang Y, Chen K. Sleep duration and obesity in children: a systematic review and meta-analysis of prospective cohort studies. *J Paediatr Child Health*. 2017;53(4):378-385. doi:10.1111/jpc.13434

49. Spruyt K. A review of developmental consequences of poor sleep in childhood. *Sleep Med*. 2019;60:3-12. doi:10.1016/j.sleep.2018.11.021

50. Ben Simon E, Vallat R, Barnes CM, Walker MP. Sleep loss and the socio-emotional brain. *Trends Cogn Sci*. 2020;24(6):435-450. doi:10.1016/j.tics.2020.02.003

51. Guglielmi O, Lanteri P, Garbarino S. Association between socioeconomic status, belonging to an ethnic minority and obstructive sleep apnea: a systematic review of the literature. *Sleep Med*. 2019;57:100-106. doi:10.1016/j.sleep.2019.01.042

52. Dewald JF, Meijer AM, Oort FJ, Kerkhof GA, Bögels SM. The influence of sleep quality, sleep duration and sleepiness on school performance in children and adolescents: a meta-analytic review. *Sleep Med Rev*. 2010;14(3):179-189. doi:10.1016/j.smrv.2009.10.004

53. Li S, Arguelles L, Jiang F, et al. Sleep, school performance, and a school-based intervention among school-aged children: a sleep series study in China. *PLoS One*. 2013;8(7):e67928-e67928. doi:10.1371/journal.pone.0067928

54. Short MA, Blunden S, Rigney G, et al. Cognition and objectively measured sleep duration in children: a systematic review and meta-analysis. *Sleep Health*. 2018;4(3):292-300. doi:10.1016/j.sleh.2018.02.004

55. Chaput JP, Gray CE, Poitras VJ, et al. Systematic review of the relationships between sleep duration and health indicators in school-aged children and youth. *Appl Physiol Nutr Metab*. 2016;41(suppl 3):S266-S282. doi:10.1139/apnm-2015-0627

56. Liu J, Feng R, Ji X, Cui N, Raine A, Mednick SC. Midday napping in children: associations between nap frequency and duration across cognitive, positive psychological well-being, behavioral, and metabolic health outcomes. *Sleep*. 2019;42(9). doi:10.1093/sleep/zsz126

57. Ji X, Li J, Liu J. The relationship between midday napping and neurocognitive function in early adolescents. *Behav Sleep Med*. 2019;17(5):537-551. doi:10.1080/15402002.2018.1425868

58. Paruthi S, Brooks LJ, D'Ambrosio C, et al. Consensus statement of the American Academy of Sleep Medicine on the recommended amount of sleep for healthy children: methodology and discussion. *J Clin Sleep Med*. 2016;12(11):1549-1561. doi:10.5664/jcsm.6288

59. Penzel T, Canisius S. Polysomnography. *Sleep Apnea*. 2006;35:51-60. doi:10.1159/000093144

60. Van de Water ATM, Holmes A, Hurley DA. Objective measurements of sleep for non-laboratory settings as alternatives to polysomnography--a systematic review. *J Sleep Res*. 2011;20(1pt2):183-200. doi:10.1111/j.1365-2869.2009.00814.x

61. Ji X, Liu J. Subjective sleep measures for adolescents: a systematic review. *Child Care Health Dev*. 2016;42(6):825-839. doi:10.1111/cch.12376

62. Bauman A, Bittman M, Gershuny J. A short history of time use research; implications for public health. *BMC Public Health*. 2019;19(2):1-7. doi:10.1186/s12889-019-6760-y

63. Olds T, Maher C, Dumuid D. Life on holidays: differences in activity composition between school and holiday periods in Australian children. *BMC Public Health*. 2019;19(2):450. doi:10.1186/s12889-019-6765-6

64. del Pozo-Cruz B, Perales F, Parker P, et al. Joint physical-activity/screen-time trajectories during early childhood: socio-demographic predictors and consequences on health-related quality-of-life and socio-emotional outcomes. *Int J Behav Nutr Phys Act*. 2019;16(1):55. doi:10.1186/s12966-019-0816-3

65. Ridley K, Olds TS, Hill A. The Multimedia Activity Recall for Children and Adolescents (MARCA): development and evaluation. *Int J Behav Nutr Phys Act*. 2006;3:10-10. doi:10.1186/1479-5868-3-10

66. Tsiros MD, Samaras MG, Coates AM, Olds T. Use-of-time and health-related quality of life in 10- to 13-year-old children: not all screen time or physical activity minutes are the same. *Qual Life Res*. 2017;26(11):3119-3129. doi:10.1007/s11136-017-1639-9

67. World Health Organization. *Guidelines on Physical Activity, Sedentary Behaviour and Sleep for Children Under 5 Years of Age.* World Health Organization; 2019. Accessed October 27, 2022. https://www.who.int/publications/i/item/9789241550536.

68. Draper CE, Tomaz SA, Biersteker L, et al. The South African 24-hour movement guidelines for birth to 5 Years: an integration of physical activity, sitting behavior, screen time, and sleep. *J Phys Act Health*. 2020;17(1):109-119. doi:10.1123/jpah.2019-0187

69. Tremblay MS, Carson V, Chaput JP, et al. Canadian 24-hour movement guidelines for children and youth: an integration of physical activity, sedentary behaviour, and sleep. *Appl Physiol Nutr Metab*. 2016;41(6):S311-S327. doi:10.1139/apnm-2016-0151

70. Baker EH. Socioeconomic Status, Definition. In: Cockerham WC, Dingwall R, Quah S, eds. *The Wiley Blackwell Encyclopedia of Health, Illness, Behavior, and Society*. Vol 896. Chichester, UK: John Wiley & Sons, Ltd; 2014:2210-2214. doi:10.1002/9781118410868.wbehibs395

71. Galobardes B, Lynch J, Smith GD. Measuring socioeconomic position in health research. *Br Med Bull*. 2007;81-82:21-37. doi:10.1093/bmb/ldm001

72. Wilkinson RH, Marmot M, eds. *Social Determinants of Health: The Solid Facts*. World Health Organization; 2003. https://play.google.com/store/books/details?id=QDFzqNZZHLMC.

73. Cheng TL, Goodman E, Committee on Pediatric Research. Race, ethnicity, and socioeconomic status in research on child health. *Pediatrics*. 2015;135(1):e225-e237. doi:10.1542/peds.2014-3109

74. Shavers VL. Measurement of socioeconomic status in health disparities research. *J Natl Med Assoc*. 2007;99(9):1013-1023. https://www.ncbi.nlm.nih.gov/pubmed/17913111.

75. Bröder J, Chang P, Kickbusch I, et al. IUHPE Position statement on health literacy: a practical vision for a health literate world. December 2018. doi:10.1177/1757975918814421

76. Donkin AJM. Social Gradient. In: *The Wiley Blackwell Encyclopedia of Health, Illness, Behavior, and Society*. Chichester, UK: John Wiley & Sons, Ltd; 2014:2172-2178. doi:10.1002/9781118410868.wbehibs530

77. Braudt DB, Lawrence EM, Tilstra AM, Rogers RG, Hummer RA. Family socioeconomic status and early life mortality risk in the United States. *Matern Child Health J*. 2019;23(10):1382-1391. doi:10.1007/s10995-019-02799-0

78. Barriuso L, Miqueleiz E, Albaladejo R, Villanueva R, Santos JM, Regidor E. Socioeconomic position and childhood-adolescent weight status in rich countries: a systematic review, 1990–2013. *BMC Pediatr*. 2015;15(1):129. doi:10.1186/s12887-015-0443-3

79. Bjur KA, Wi CI, Ryu E, et al. Socioeconomic status, race/ethnicity, and health disparities in children and adolescents in a mixed rural-urban community-Olmsted County, Minnesota. *Mayo Clin Proc*. 2019;94(1):44-53. doi:10.1016/j.mayocp.2018.06.030

80. Peralta LR, Mihrshahi S, Bellew B, Reece LJ, Hardy LL. Influence of school-level socioeconomic status on children's physical activity, fitness, and fundamental movement skill levels. *J Sch Health*. 2019;89(6):460-467. doi:10.1111/josh.12761

81. Pollitt RA, Kaufman JS, Rose KM, Diez-Roux AV, Zeng D, Heiss G. Early-life and adult socioeconomic status and inflammatory risk markers in adulthood. *Eur J Epidemiol*. 2007;22(1):55-66. doi:10.1007/s10654-006-9082-1

82. Galobardes B, Lynch JW, Davey Smith G. Childhood socioeconomic circumstances and cause-specific mortality in adulthood: systematic review and interpretation. *Epidemiol Rev*. 2004;26:7-21. doi:10.1093/epirev/mxh008

83. Galobardes B, Lynch JW, Smith GD. Is the association between childhood socioeconomic circumstances and cause-specific mortality established? Update of a systematic review. *J Epidemiol Community Health*. 2008;62(5):387-390. doi:10.1136/jech.2007.065508

84. Puolakka E, Pahkala K, Laitinen TT, et al. Childhood socioeconomic status in predicting metabolic syndrome and glucose abnormalities in adulthood: the Cardiovascular Risk in Young Finns Study. *Diabetes Care*. 2016;39(12):2311-2317. doi:10.2337/dc16-1565

85. Reiss F. Socioeconomic inequalities and mental health problems in children and adolescents: a systematic review. *Soc Sci Med*. 2013;90:24-31. doi:10.1016/j.socscimed.2013.04.026

86. Russell AE, Ford T, Williams R, Russell G. The association between socioeconomic disadvantage and Attention Deficit/Hyperactivity Disorder (ADHD): a systematic review. *Child Psychiatry Hum Dev*. 2016;47(3):440-458. doi:10.1007/s10578-015-0578-3

87. Piotrowska PJ, Stride CB, Croft SE, Rowe R. Socioeconomic status and antisocial behaviour among children and adolescents: a systematic review and meta-analysis. *Clin Psychol Rev*. 2015;35:47-55. doi:10.1016/j.cpr.2014.11.003

88. Warren D. *Low Income and Poverty Dynamics Implications for Child Outcomes*. Australian Institute of Family Studies, Canberra; 2017.

89. Lemstra M, Neudorf C, D'Arcy C, Kunst A, Warren LM, Bennett NR. A systematic review of depressed mood and anxiety by SES in youth aged 10–15 Years. *Can J Public Health*. 2008;99(2):125-129. doi:10.1007/BF03405459

90. Chung, K. K. H. (2015). Socioeconomic status and academic achievement. In Wright, JD, eds. *International Encyclopedia of the Social & Behavioral Sciences*. 2nd ed. Amsterdam: Elsevier; 2015:924-930. https://repository.eduhk.hk/en/publications/socioeconomic-status-and-academic-achievement-4.

91. Klein M, Sosu EM, Dare S. Mapping inequalities in school attendance: the relationship between dimensions of socioeconomic status and forms of school absence. *Child Youth Serv Rev*. 2020;118:105432. doi:10.1016/j.childyouth.2020.105432

92. Last BS, Lawson GM, Breiner K, Steinberg L, Farah MJ. Childhood socioeconomic status and executive function in childhood and beyond. *PLoS One*. 2018;13(8):e0202964. doi:10.1371/journal.pone.0202964

93. Fairclough SJ, Boddy LM, Hackett AF, Stratton G. Associations between children's socioeconomic status, weight status, and sex, with screen-based sedentary behaviours and sport participation. *Int J Pediatr Obes*. 2009;4(4):299-305. doi:10.3109/17477160902811215

94. Gonzalo-Almorox E, Urbanos-Garrido RM. Decomposing socio-economic inequalities in leisure-time physical inactivity: the case of Spanish children. *Int J Equity Health*. 2016;15(1):106. doi:10.1186/s12939-016-0394-9

95. Tandon PS, Zhou C, Sallis JF, Cain KL, Frank LD, Saelens BE. Home environment relationships with children's physical activity, sedentary time, and screen time by socioeconomic status. *Int J Behav Nutr Phys Act*. 2012;9:88-88. doi:10.1186/1479-5868-9-88

96. Stalsberg R, Pedersen AV. Effects of socioeconomic status on the physical activity in adolescents: a systematic review of the evidence. *Scand J Med Sci Sports*. 2010;20(3):368-383. doi:10.1111/j.1600-0838.2009.01047.x

97. Owen KB, Nau T, Reece LJ, et al. Fair play? Participation equity in organised sport and physical activity among children and adolescents in high income countries: a systematic review and meta-analysis. *Int J Behav Nutr Phys Act*. 2022;19(1):27. doi:10.1186/s12966-022-01263-7

98. Hardy LL, Mihrshahi S, Drayton BA, Bauman AE. *NSW Schools Physical Activity and Nutrition Survey (SPANS)*. NSW Department of Health; 2017. Accessed October 27, 2022. https://ses.library.usyd.edu.au/handle/2123/16754.

99. Smith M, Hosking J, Woodward A, et al. Systematic literature review of built environment effects on physical activity and active transport - an update and new findings on health equity. *Int J Behav Nutr Phys Act*. 2017;14(1):158. doi:10.1186/s12966-017-0613-9

100. Molina-García J, Queralt A. Neighborhood built environment and socioeconomic status in relation to active commuting to school in children. *J Phys Act Health*. 2017;14(10):761-765. doi:10.1123/jpah.2017-0033

101. Määttä S, Konttinen H, Haukkala A, Erkkola M, Roos E. Preschool children's context-specific sedentary behaviours and parental socioeconomic status in Finland: a cross-sectional study. 2017;7(11):e016690. doi:10.1136/bmjopen-2017-016690 %J BMJ Open

102. Musić Milanović S, Buoncristiano M, Križan H, et al. Socioeconomic disparities in physical activity, sedentary behavior and sleep patterns among 6- to 9-year-old children from 24 countries in the WHO European region. *Obes Rev*. July 2021:e13209. doi:10.1111/obr.13209

103. Stokols D. Translating social ecological theory into guidelines for community health promotion. *Am J Health Promot*. 1996;10(4):282-298. doi:10.4278/0890-1171-10.4.282

104. Martínez-Andrés M, Bartolomé-Gutiérrez R, Rodríguez-Martín B, Pardo-Guijarro MJ, Garrido-Miguel M, Martínez-Vizcaíno V. Barriers and facilitators to leisure physical activity in children: a qualitative approach using the socio-ecological model. *Int J Environ Res Public Health*. 2020;17(9). doi:10.3390/ijerph17093033

105. Sampson R, Groves WB. Community structure and crime: testing social-disorganization theory. *Am J Sociol*. 1989. doi:10.1086/229068

106. Liu SR, Kia-Keating M, Santacrose DE, Modir S. Linking profiles of neighborhood elements to health and related outcomes among children across the United States. *Health Place*. 2018;53:203-209. doi:10.1016/j.healthplace.2018.08.013

107. Sanders T, Feng X, Fahey PP, Lonsdale C, Astell-Burt T. The influence of neighbourhood green space on children's physical activity and screen time: findings from the longitudinal study of Australian children. *Int J Behav Nutr Phys Act*. 2015;12:126. doi:10.1186/s12966-015-0288-z

108. Zhou X, Rana MP. Social benefits of urban green space : A conceptual framework of valuation and accessibility measurements. *Management of Environmental Quality: An International Journal*. 2012;23(2):173-189. doi:10.1108/14777831211204921

109. Hoffimann E, Barros H, Ribeiro AI. Socioeconomic inequalities in green space quality and accessibility—evidence from a southern European city. *Int J Environ Res Public Health*. 2017;14(8):916. doi:10.3390/ijerph14080916

110. Chen Y, Yue W, La Rosa D. Which communities have better accessibility to green space? An investigation into environmental inequality using big data. *Landsc Urban Plan*. 2020;204:103919. doi:10.1016/j.landurbplan.2020.103919

111. Lareau A. *Unequal Childhoods: Class, Race, and Family Life*. University of California Press; 2011.

112. Bürgi R, Tomatis L, Murer K, de Bruin ED. Spatial physical activity patterns among primary school children living in neighbourhoods of varying socioeconomic status: a cross-sectional study using accelerometry and Global Positioning System. *BMC Public Health*. 2016;16:282-282. doi:10.1186/s12889-016-2954-8

113. Ferreira I, van der Horst K, Wendel-Vos W, Kremers S, van Lenthe FJ, Brug J. Environmental correlates of physical activity in youth - a review and update. *Obes Rev*. 2007;8(2):129-154. doi:10.1111/j.1467-789X.2006.00264.x

114. Jones A, Hillsdon M, Coombes E. Greenspace access, use, and physical activity: understanding the effects of area deprivation. *Prev Med* . 2009;49(6):500-505. doi:10.1016/j.ypmed.2009.10.012

115. Hunter JC, Hayden KM. The association of sleep with neighborhood physical and social environment. *Public Health*. 2018;162:126-134. doi:10.1016/j.puhe.2018.05.003

116. Vanaken GJ, Danckaerts M. Impact of green space exposure on children's and adolescents' mental health: a systematic review. *Int J Environ Res Public Health*. 2018;15(12). doi:10.3390/ijerph15122668

117. Weir LA, Etelson D, Brand DA. Parents' perceptions of neighborhood safety and children's physical activity. *Prev Med* . 2006;43(3):212-217. doi:10.1016/j.ypmed.2006.03.024

118. Carver A, Timperio A, Crawford D. Playing it safe: the influence of neighbourhood safety on children's physical activity. A review. *Health Place*. 2008;14(2):217-227. doi:10.1016/j.healthplace.2007.06.004

119. Ghekiere A, Deforche B, Carver A, et al. Insights into children's independent mobility for transportation cycling- which socio-ecological factors matter? *J Sci Med Sport*. 2017;20(3):267-272. doi:10.1016/j.jsams.2016.08.002

120. Larouche R, Mire EF, Belanger K, et al. Relationships between outdoor time, physical activity, sedentary time, and body mass index in children: a 12-country study. *Pediatr Exerc Sci*. 2019;31(1):118-129. doi:10.1123/pes.2018-0055

121. Bélanger M, Gallant F, Doré I, et al. Physical activity mediates the relationship between outdoor time and mental health. *Prev Med Rep*. 2019;16:101006. doi:10.1016/j.pmedr.2019.101006

122. Bruner MW, Lawson J, Pickett W, Boyce W, Janssen I. Rural Canadian adolescents are more likely to be obese compared with urban adolescents. *Int J Pediatr Obes*. 2008;3(4):205-211. doi:10.1080/17477160802158477

123. Veitch J, Hume C, Salmon J, Crawford D, Ball K. What helps children to be more active and less sedentary? Perceptions of mothers living in disadvantaged neighbourhoods. *Child Care Health Dev*. 2013;39(1):94-102. doi:10.1111/j.1365-2214.2011.01321.x

124. Ilari B, Perez P, Wood A, Habibi A. The role of community-based music and sports programmes in parental views of children's social skills and personality. *Int J Community Music*. 2019;12(1):35-56. https://doi.org/10.1386/ijcm.12.1.35_1

125. Evans GW, Kantrowitz E. Socioeconomic status and health: the potential role of environmental risk exposure. *Annu Rev Public Health*. 2002;23:303-331. doi:10.1146/annurev.publhealth.23.112001.112349

126. Liu J, Wu T, Liu Q, Wu S, Chen JC. Air pollution exposure and adverse sleep health across the life course: a systematic review. *Environ Pollut*. 2020;262:114263. doi:10.1016/j.envpol.2020.114263

127. Tainio M, Jovanovic Andersen Z, Nieuwenhuijsen MJ, et al. Air pollution, physical activity and health: a mapping review of the evidence. *Environ Int*. 2021;147:105954. doi:10.1016/j.envint.2020.105954

128. Caddick ZA, Gregory K, Arsintescu L, Flynn-Evans EE. A review of the environmental parameters necessary for an optimal sleep environment. *Build Environ*. 2018;132:11-20. doi:10.1016/j.buildenv.2018.01.020

129. Dumuid D, Olds TS, Lewis LK, Maher C. Does home equipment contribute to socioeconomic gradients in Australian children’s physical activity, sedentary time and screen time? *BMC Public Health*. 2016;16:736. doi:10.1186/s12889-016-3419-9

130. Bagley EJ, Kelly RJ, Buckhalt JA, El-Sheikh M. What keeps low-SES children from sleeping well: the role of presleep worries and sleep environment. *Sleep Med*. 2015;16(4):496-502. doi:10.1016/j.sleep.2014.10.008

131. Olstad DL, Ancilotto R, Teychenne M, et al. Can targeted policies reduce obesity and improve obesity-related behaviours in socioeconomically disadvantaged populations? A systematic review. *Obes Rev*. 2017;18(7):791-807. doi:10.1111/obr.12546

132. Olstad DL, Teychenne M, Minaker LM, et al. Can policy ameliorate socioeconomic inequities in obesity and obesity-related behaviours? A systematic review of the impact of universal policies on adults and children. *Obes Rev*. 2016;17(12):1198-1217. doi:10.1111/obr.12457

133. Wallach JB, Rey MJ. A socioeconomic analysis of obesity and diabetes in New York City. *Prev Chronic Dis*. 2009;6(3):A108. https://www.ncbi.nlm.nih.gov/pubmed/19527580.

134. Ren Z, Ge Y, Wang J, Mao J, Zhang Q. Understanding the inconsistent relationships between socioeconomic factors and poverty incidence across contiguous poverty-stricken regions in China: multilevel modelling. *Spatial Statistics*. 2017;21:406-420. doi:10.1016/j.spasta.2017.02.009

135. Lewis L, Maher C, Katzmarzyk P, Olds T. Individual and school-level socioeconomic gradients in physical activity in Australian schoolchildren. *J Sch Health*. 2016;86(2):105-112. doi:10.1111/josh.12357

136. Carlson JA, Mignano AM, Norman GJ, et al. Socioeconomic disparities in elementary school practices and children’s physical activity during school. *Am J Health Promot*. 2014;28(3 Suppl):S47-S53. doi:10.4278/ajhp.130430-QUAN-206

137. Van Dyke ME, Cheung PC, Franks P, Gazmararian JA. Socioeconomic and racial/ethnic disparities in physical activity environments in Georgia elementary schools. *Am J Health Promot*. 2018;32(2):453-463. doi:10.1177/0890117117717016

138. Luna P, Cejudo J, Piqueras JA, Rodrigo-Ruiz D, Bajo M, Pérez-González JC. Impact of the MooN physical education program on the socio-emotional competencies of preadolescents. *Int J Environ Res Public Health*. 2021;18(15). doi:10.3390/ijerph18157896

139. Macpherson AK, Jones J, Rothman L, Macarthur C, Howard AW. Safety standards and socioeconomic disparities in school playground injuries: a retrospective cohort study. *BMC Public Health*. 2010;10:542. doi:10.1186/1471-2458-10-542

140. Jaschke AC, Honing H, Scherder EJA. Longitudinal analysis of music education on executive functions in primary school children. *Front Neurosci*. 2018;12:103. doi:10.3389/fnins.2018.00103

141. Shaw. Toward socially inclusive music organizations: Promoting socioeconomic diversity in choral ensembles. *The Choral Journal*. 2017;58(4):22-37. https://www.jstor.org/stable/26412895.

142. Elpus K, Abril CR. High school music ensemble students in the United States: a Demographic profile. *Journal of Research in Music Education*. 2011;59(2):128-145. doi:10.1177/0022429411405207

143. Hoffman AR. Compelling questions about music, education, and socioeconomic status. *Music Educators Journal*. 2013;100(1):63-68. doi:10.1177/0027432113494414

144. Taylor WC, Baranowski T, Sallis JF. Family determinants of childhood physical activity: a social-cognitive model. In: Dishman RK, ed. *Advances in Exercise Adherence,* Vol 406. Champaign, IL, England: Human Kinetics Publishers; 1994:319-342.

145. Xu H, Wen LM, Rissel C. Associations of parental influences with physical activity and screen time among young children: a systematic review. *J Obes*. 2015;2015:546925. doi:10.1155/2015/546925

146. Golan M, Weizman A. Familial approach to the treatment of childhood obesity: conceptual model. *J Nutr Educ*. 2001;33(2):102-107. doi:10.1016/S1499-4046(06)60173-5

147. Morgan PJ, Collins CE, Plotnikoff RC, et al. The “Healthy Dads, Healthy Kids” community randomized controlled trial: a community-based healthy lifestyle program for fathers and their children. *Prev Med*. 2014;61:90-99. doi:10.1016/j.ypmed.2013.12.019

148. Hosokawa R, Katsura T. A longitudinal study of socioeconomic status, family processes, and child adjustment from preschool until early elementary school: the role of social competence. *Child Adolesc Psychiatry Ment Health*. 2017;11:62. doi:10.1186/s13034-017-0206-z

149. Friedson M. Authoritarian parenting attitudes and social origin: the multigenerational relationship of socioeconomic position to childrearing values. *Child Abuse Negl*. 2016;51:263-275. doi:10.1016/j.chiabu.2015.10.001

150. Crouch JL, Irwin LM, Milner JS, Skowronski JJ, Rutledge E, Davila AL. Do hostile attributions and negative affect explain the association between authoritarian beliefs and harsh parenting? *Child Abuse Negl*. 2017;67:13-21. doi:10.1016/j.chiabu.2017.02.019

151. Lareau A. Invisible Inequality: Social class and childrearing in black families and white families. *Am Sociol Rev*. 2002;67(5):747-776. doi:10.2307/3088916

152. Jago R, Davison KK, Brockman R, Page AS, Thompson JL, Fox KR. Parenting styles, parenting practices, and physical activity in 10- to 11-year olds. *Prev Med*. 2011;52(1):44-47. doi:10.1016/j.ypmed.2010.11.001

153. Langer SL, Crain AL, Senso MM, Levy RL, Sherwood NE. Predicting child physical activity and screen time: parental support for physical activity and general parenting styles. *J Pediatr Psychol*. 2014;39(6):633-642. doi:10.1093/jpepsy/jsu021

154. Ranum BM, Wichstrøm L, Pallesen S, Falch-Madsen J, Steinsbekk S. Persistent short sleep from childhood to adolescence: child, parent and peer predictors. *Nat Sci Sleep*. 2021;13:163-175. doi:10.2147/NSS.S290586

155. Lam CB, McHale SM. Developmental patterns and parental correlates of youth leisure-time physical activity. *J Fam Psychol*. 2015;29(1):100-107. doi:10.1037/fam0000049

156. Mutz M, Albrecht P. Parents’ social status and children's daily physical activity: the role of familial socialization and support. *J Child Fam Stud*. 2017;26(11):3026-3035. doi:10.1007/s10826-017-0808-3

157. Coyl-Shepherd DD, Hanlon C. Family play and leisure activities: correlates of parents' and children's socio-emotional well-being. *International Journal of Play*. 2013;2(3):254-272. doi:10.1080/21594937.2013.855376

158. Seabra A, Mendonca D, Maia J, et al. Gender, weight status and socioeconomic differences in psychosocial correlates of physical activity in schoolchildren. *J Sci Med Sport*. 2013;16(4):320-326. doi:10.1016/j.jsams.2012.07.008

159. Park CL, Cho D, Moore PJ. How does education lead to healthier behaviours? Testing the mediational roles of perceived control, health literacy and social support. *Psychol Health*. 2018;33(11):1416-1429. doi:10.1080/08870446.2018.1510932

160. Craike M, Wiesner G, Hilland TA, Bengoechea EG. Interventions to improve physical activity among socioeconomically disadvantaged groups: an umbrella review. *Int J Behav Nutr Phys Act*. 2018;15(1):43. doi:10.1186/s12966-018-0676-2

161. Wight VR, Raley SB, Bianchi SM. Time for children, one's spouse and oneself among parents who work nonstandard hours. *Soc Forces*. 2008;87(1):243-271. doi:10.1353/sof.0.0092 %J Social Forces

162. Donkin A, Marmot M. Poverty and reductions in fitness levels in children and adolescents in upper middle-income countries. *Br J Sports Med*. 2019;53(8):462-463. doi:10.1136/bjsports-2017-098992

163. Prochaska JJ, Rodgers MW, Sallis JF. Association of parent and peer support with adolescent physical activity. *Res Q Exerc Sport*. 2002;73(2):206-210. doi:10.1080/02701367.2002.10609010

164. Richards R, McGee R, Williams SM, Welch D, Hancox RJ. Adolescent screen time and attachment to parents and peers. *Arch Pediatr Adolesc Med*. 2010;164(3):258-262. doi:10.1001/archpediatrics.2009.280

165. Inchley I, Currie D, Young T, *Growing Up Unequal: Gender and Socioeconomic Differences in Young People's Health and Well-Being. Health Behaviour in School-Aged Children (HBSC) Study: International Report from the 2013/2014 Survey*. World Health Organization; 2016. Accessed October 21, 2022.

166. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am Psychol*. 2000;55(1):68-78. doi:10.1037/0003-066X.55.1.68

167. White RL, Bennie A, Vasconcellos D, et al. Self-determination theory in physical education: a systematic review of qualitative studies. *Teaching and Teacher Education*. 2021;99:103247. doi:10.1016/j.tate.2020.103247

168. Owen KB, Smith J, Lubans DR, Ng JYY, Lonsdale C. Self-determined motivation and physical activity in children and adolescents: a systematic review and meta-analysis. *Prev Med*. 2014;67:270-279. doi:10.1016/j.ypmed.2014.07.033

169. Niemiec CP, Ryan RM. Autonomy, competence, and relatedness in the classroom: applying self-determination theory to educational practice. *Educ Res Eval*. 2009;7(2):133-144. doi:10.1177/1477878509104318

170. Ntoumanis N, Standage M. Motivation in physical education classes: a self-determination theory perspective. *Educ Res Eval*. 2009;7(2):194-202. doi:10.1177/1477878509104324

171. Brockman R, Jago R, Fox KR, Thompson JL, Cartwright K, Page AS. “Get off the sofa and go and play”: family and socioeconomic influences on the physical activity of 10-11 year old children. *BMC Public Health*. 2009;9:253. doi:10.1186/1471-2458-9-253

172. Biggs SN, Lushington K, James Martin A, van den Heuvel C, Declan Kennedy J. Gender, socioeconomic, and ethnic differences in sleep patterns in school-aged children. *Sleep Med*. 2013;14(12):1304-1309. doi:10.1016/j.sleep.2013.06.014

173. Morrison KM, Cairney J, Eisenmann J, Pfeiffer K, Gould D. Associations of body mass index, motor performance, and perceived athletic competence with physical activity in normal weight and overweight children. *J Obes*. 2018;2018:3598321. doi:10.1155/2018/3598321

174. Dollman J, Lewis NR. The impact of socioeconomic position on sport participation among South Australian youth. *J Sci Med Sport*. 2010;13(3):318-322. doi:10.1016/j.jsams.2009.04.007

175. Amin SA, Duquesnay PJ, Wright CM, Chui K, Economos CD, Sacheck JM. The association between perceived athletic competence and physical activity: implications for low-income schoolchildren. *Pediatr Exerc Sci*. 2018;30(3):433-440. doi:10.1123/pes.2017-0242

176. Bandura A. Self-efficacy: Toward a unifying theory of behavioral change. *Psychol Rev*. 1977;84(2):191-215. doi:10.1037/0033-295X.84.2.191

177. Saunders TJ, Gray CE, Poitras VJ, et al. Combinations of physical activity, sedentary behaviour and sleep: relationships with health indicators in school-aged children and youth. *Appl Physiol Nutr Metab*. 2016;41(6 Suppl 3):S283-S293. doi:10.1139/apnm-2015-0626

178. Chen Y. A systematic review of interventions for childhood depression. In: *Advances in Social Science, Education and Humanities Research, Volume 615*. Atlantis Press; 2021:1683-1686. https://www.atlantis-press.com/proceedings/ichess-21/125966915.

179. Gleason MM, Thompson LA. Depression and anxiety disorder in children and adolescents. *JAMA Pediatr*. March 2022. doi:10.1001/jamapediatrics.2022.0052

180. Mavilidi MF, Mason C, Leahy AA, et al. Effect of a time-efficient physical activity intervention on senior school students’ on-task behaviour and subjective vitality: the “burn 2 learn” cluster randomised controlled trial. *Educ Psychol Rev*. 2021;33(1):299-323. doi:10.1007/s10648-020-09537-x

181. Tremblay MS, LeBlanc AG, Kho ME, et al. Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *Int J Behav Nutr Phys Act*. 2011;8:98. doi:10.1186/1479-5868-8-98

182. Anokye NK, Trueman P, Green C, Pavey TG, Taylor RS. Physical activity and health related quality of life. *BMC Public Health*. 2012;12:624. doi:10.1186/1471-2458-12-624

183. Mavilidi MF, Lubans DR, Miller A, et al. Impact of the “Thinking while Moving in English” intervention on primary school children’s academic outcomes and physical activity: a cluster randomised controlled trial. *Int J Educ Res*. 2020;102:101592. doi:10.1016/j.ijer.2020.101592

184. Nixon GM, Thompson JMD, Han DY, et al. Short sleep duration in middle childhood: risk factors and consequences. *Sleep*. 2008;31(1):71-78. doi:10.1093/sleep/31.1.71

185. Tremblay MS. Introducing 24-hour movement guidelines for the early years: a new paradigm gaining momentum. *J Phys Act Health*. 2020;17(1):92-95. doi:10.1123/jpah.2019-0401

186. Chastin SFM, Palarea-Albaladejo J, Dontje ML, Skelton DA. Combined effects of time spent in physical activity, sedentary behaviors and sleep on obesity and cardio-metabolic health markers: a novel compositional data analysis approach. *PLoS One*. 2015;10(10):e0139984. doi:10.1371/journal.pone.0139984

187. Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009;6(7):e1000097. doi:10.1371/journal.pmed.1000097

188. Hinde S, Spackman E. Bidirectional citation searching to completion: an exploration of literature searching methods. *Pharmacoeconomics*. 2015;33(1):5-11. doi:10.1007/s40273-014-0205-3

189. von Elm E, Altman DG, Egger M, et al. Strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *BMJ*. 2007;335(7624):806-808. doi:10.1136/bmj.39335.541782.AD

190. Doherty C, Delahunt E, Caulfield B, Hertel J, Ryan J, Bleakley C. The incidence and prevalence of ankle sprain injury: a systematic review and meta-analysis of prospective epidemiological studies. *Sports Med*. 2014;44(1):123-140. doi:10.1007/s40279-013-0102-5

191. López-Valenciano A, Ruiz-Pérez I, Garcia-Gómez A, et al. Epidemiology of injuries in professional football: a systematic review and meta-analysis. *Br J Sports Med*. 2020;54(12):711-718. doi:10.1136/bjsports-2018-099577

192. Boone JE, Gordon-Larsen P, Adair LS, Popkin BM. Screen time and physical activity during adolescence: longitudinal effects on obesity in young adulthood. *Int J Behav Nutr Phys Act*. 2007;4. doi:10.1186/1479-5868-4-26

193. Gordon-Larsen P, Adair LS, Popkin BM. Ethnic differences in physical activity and inactivity patterns and overweight status. *Obes Res*. 2002;10(3):141-149. doi:10.1038/oby.2002.23

194. Lee EY, Spence JC, Tremblay MS, Carson V. Meeting 24-hour movement guidelines for children and youth and associations with psychological well-being among South Korean adolescents. *Ment Health Phys Act*. 2018;14:66-73. doi:10.1016/J.MHPA.2018.02.001

195. Sánchez-Oliva D, Grao-Cruces A, Carbonell-Baeza A, Cabanas-Sánchez V, Veiga OL, Castro-Piñero J. Lifestyle clusters in school-aged youth and longitudinal associations with fatness: the UP&DOWN Study. *J Pediatr*. 2018;203:317-324.e1. doi:10.1016/j.jpeds.2018.07.092

196. Van den Bulck J, Hofman A. The television-to-exercise ratio is a predictor of overweight in adolescents: results from a prospective cohort study with a two year follow up. *Prev Med*. 2009;48(4):368-371. doi:10.1016/j.ypmed.2009.02.006

197. Tahir MJ, Willett W, Forman MR. The association of television viewing in childhood with overweight and obesity throughout the life course. *Am J Epidemiol*. 2019;188(2):282-293. doi:10.1093/aje/kwy236

198. Djalalinia S, Qorbani M, Rezaei N, et al. Joint association of screen time and physical activity with anthropometric measures in Iranian children and adolescents: the weight disorders survey of the CASPIAN-IV study. *J Pediatr Endocrinol Metab*. 2017;30(7):731-738. doi:10.1515/jpem-2016-0486

199. Dollman J, Olds T, Ridley K, Pilgrim A. Clusters of children's physical activity and sedentary behaviours differ in physiological, social and environmental attributes. *J of Sci Med Sport*. 2004;7(suppl 4):85. abstract.

200. Dollman J, Ridley K. Differences in body fatness, fat patterning and cardio-respiratory fitness between groups of Australian children formed on the basis of physical activity and television viewing guidelines. *J Phys Act Health*. 2006;3(2):191-199. doi:10.1123/jpah.3.2.191

201. Drenowatz C, Kobel S, Kettner S, Kesztyüs D, Steinacker JM. Interaction of sedentary behaviour, sports participation and fitness with weight status in elementary school children. *Eur J Sport Sci*. 2014;14(1):100-105. doi:10.1080/17461391.2012.732615

202. Maher C, Olds TS, Eisenmann JC, Dollman J. Screen time is more strongly associated than physical activity with overweight and obesity in 9-to 16-year-old Australians. *Acta Paediatr*. 2012;101(11):1170-1174. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1651-2227.2012.02804.x.

203. Steele RM, van Sluijs EMF, Cassidy A, Griffin SJ, Ekelund U. Targeting sedentary time or moderate- and vigorous-intensity activity: independent relations with adiposity in a population-based sample of 10-y-old British children. *Am J Clin Nutr*. 2009;90(5):1185-1192. doi:10.3945/ajcn.2009.28153

204. Xi B, Wang C, Wu L, et al. Influence of physical inactivity on associations between single nucleotide polymorphisms and genetic predisposition to childhood obesity. *Am J Epidemiol*. 2011;173(11):1256-1262. doi:10.1093/aje/kwr008

205. Laurson KR, Eisenmann JC, Welk GJ, Wickel EE, Gentile DA, Walsh DA. Combined influence of physical activity and screen time recommendations on childhood overweight. *J Pediatr*. 2008;153(2):209-214. doi:10.1016/j.jpeds.2008.02.042

206. Loprinzi PD, Cardinal BJ, Lee H, Tudor-Locke C. Markers of adiposity among children and adolescents: implications of the isotemporal substitution paradigm with sedentary behavior and physical activity patterns. *J Diabetes Metab Disord*. 2015;14:46. doi:10.1186/s40200-015-0175-9

207. De Bourdeaudhuij I, Verloigne M, Maes L, et al. Associations of physical activity and sedentary time with weight status among school-aged girls and boys across five European countries. *J of Sci Med Sport*. 2012;15:S41-S41. doi:10.1016/j.jsams.2012.11.101

208. Hjorth MF, Chaput JP, Ritz C, et al. Fatness predicts decreased physical activity and increased sedentary time, but not vice versa: support from a longitudinal study in 8- to 11-year-old children. *Int J Obes* . 2014;38(7):959-965. doi:10.1038/ijo.2013.229

209. Bai Y, Chen S, Laurson KR, Kim Y, Saint-Maurice PF, Welk GJ. The associations of youth physical activity and screen time with fatness and fitness: the 2012 NHANES National youth fitness survey. *PLoS One*. 2016;11(1):e0148038. doi:10.1371/journal.pone.0148038

210. Chaput JP, Saunders TJ, Mathieu MÈ, et al. Combined associations between moderate to vigorous physical activity and sedentary behaviour with cardiometabolic risk factors in children. *Appl Physiol Nutr Metab*. 2013;38(5):477-483. doi:10.1139/apnm-2012-0382

211. Spengler S, Mess F, Mewes N, Mensink GBM, Woll A. A cluster-analytic approach towards multidimensional health-related behaviors in adolescents: the MoMo-Study. *BMC Public Health*. 2012;12:1128. doi:10.1186/1471-2458-12-1128

212. Lane A, Harrison M, Murphy N. Screen time increases risk of overweight and obesity in active and inactive 9-year-old Irish children: a cross sectional analysis. *J Phys Act Health*. 2014;11(5):985-991. doi:10.1123/jpah.2012-0182

213. te Velde SJ, De Bourdeaudhuij I, Thorsdottir I, et al. Patterns in sedentary and exercise behaviors and associations with overweight in 9–14-year-old boys and girls - a cross-sectional study. *BMC Public Health*. 2007;7(1):16. doi:10.1186/1471-2458-7-16

214. Herman KM, Chaput JP. Combined physical activity/sedentary behavior associations with indices of adiposity in 8-to 10-year-old children. *J Sci Med Sport*. 2015;12(1):20-29. doi:10.1123/jpah.2013-0019

215. Herman K, Sabiston C, Mathieu M, Tremblay A, Paradis G. Active couch-potatoes? Combined physical activity–sedentary behaviour associations with weight status in 8–10 year old children. *Journal of Science & Medicine in Sport*. 2012;15:S250-S250. doi:10.1016/j.jsams.2012.11.607

216. Dm SAE, Brown HS, Barroso CS, Kelder SH. Physical activity, watching television, and the risk of obesity in students, Texas, 2004-2005. *Prev Chronic Dis*. 2011;8(3). http://www.cdc.gov/pcd/issues/2011/may/10_0007.htm.

217. Crowe M, Sampasa-Kanyinga H, Saunders TJ, Hamilton HA, Benchimol EI, Chaput JP. Combinations of physical activity and screen time recommendations and their association with overweight/obesity in adolescents. *Can J Public Health*. 2020;111:515-522. doi:10.17269/s41997-020-00313-6

218. Dowd K, Harrington D, Hannigan A, et al. The development of activity profiles in adolescent females and their association with adiposity. *Pediatr Exerc Sci*. 2016;28(1):109. doi:10.1123/pes.2015-0081

219. Wong SL, Leatherdale ST. Association between sedentary behavior, physical activity, and obesity: inactivity among active kids. *Prev Chronic Dis*. 2009;6(1):A26. https://www.ncbi.nlm.nih.gov/pubmed/19080032.

220. Melkevik O, Torsheim T, Rasmussen M. Patterns of screen-based sedentary behavior and physical activity and associations with overweight among Norwegian adolescents: a latent profile approach. *Nor Epidemiol*. 2010;20(1):109-117. doi:10.5324/nje.v20i1.1301

221. Melkevik O, Haug E, Rasmussen M, et al. Are associations between electronic media use and BMI different across levels of physical activity? *BMC Public Health*. 2015;15:497. doi:10.1186/s12889-015-1810-6

222. Pitanga FJG, Alves CFA, Pamponet ML, Medina MG, Aquino R. Combined effect of physical activity and reduction of screen time for overweight prevention in adolescents. *Rev bras cineantropom desempenho hum*. 2019;21. doi:10.1590/1980-0037.2019v21e58392

223. Eisenmann JC, Bartee RT, Smith DT, Welk GJ, Fu Q. Combined influence of physical activity and television viewing on the risk of overweight in US youth. *Int J Obes* . 2008;32(4):613-618. doi:10.1038/sj.ijo.0803800

224. Heshmat R, Qorbani M, Shahr Babaki AE, et al. Joint association of screen time and physical activity with cardiometabolic risk factors in a national sample of Iranian adolescents: the CASPIANIII study. *PLoS One*. 2016;11(5):e0154502. doi:10.1371/journal.pone.0154502

225. Patnode CD, Lytle LA, Erickson DJ, Sirard JR, Barr-Anderson DJ, Story M. Physical activity and sedentary activity patterns among children and adolescents: a latent class analysis approach. *J Phys Act Health*. 2011;8(4):457-467. doi:10.1123/jpah.8.4.457

226. Rendo-Urteaga T, de Moraes ACF, Collese TS, et al. The combined effect of physical activity and sedentary behaviors on a clustered cardio-metabolic risk score: the Helena study. *Int J Cardiol*. 2015;186:186-195. doi:10.1016/j.ijcard.2015.03.176

227. Kim Y, Barreira TV, Kang M. Concurrent associations of physical activity and screen-based sedentary behavior on obesity among US adolescents: a latent class analysis. *J Epidemiol*. 2016;26(3):137-144. doi:10.2188/jea.JE20150068

228. Pérez-Rodrigo C, Gil Á, González-Gross M, et al. Clustering of dietary patterns, lifestyles, and overweight among Spanish children and adolescents in the ANIBES study. *Nutrients*. 2015;8(1). doi:10.3390/nu8010011

229. Parker KE, Salmon J, Brown HL, Villanueva K, Timperio A. Typologies of adolescent activity related health behaviours. *J Sci Med Sport*. 2019;22(3):319-323. doi:10.1016/j.jsams.2018.08.015

230. Herman KM, Sabiston CM, Mathieu ME, Tremblay A, Paradis G. Sedentary behavior in a cohort of 8- to 10-year-old children at elevated risk of obesity. *Prev Med*. 2014;60:115-120. doi:10.1016/j.ypmed.2013.12.029

231. Monda KL, Popkin BM. Cluster analysis methods help to clarify the activity—BMI relationship of Chinese youth. *Obes Res*. 2005;13(6):1042-1051. doi/abs/10.1038/oby.2005.122.

232. Marques A, Santos R, Ekelund ULF, Sardinha LB. Association between physical activity, sedentary time, and healthy fitness in youth. *Med Sci Sports Exercise*. 2015;47(3):575-580. doi:10.1249/MSS.0000000000000426

233. Katzmarzyk PT, Barreira TV, Broyles ST, et al. Physical activity, sedentary time, and obesity in an international sample of children. *Med Sci Sports Exercise*. 2015;47(10):2062-2069. doi:10.1249/MSS.0000000000000649

234. Ekelund U, Luan J ’an, Sherar LB, et al. Moderate to vigorous physical activity and sedentary time and cardiometabolic risk factors in children and adolescents. *JAMA*. 2012;307(7):704-712. doi:10.1001/jama.2012.156

235. Sisson SB, Broyles ST, Baker BL, Katzmarzyk PT. Screen time, physical activity, and overweight in U.S. youth: National Survey of Children’s Health 2003. *J Adolesc Health Care*. 2010;47(3):309-311. doi:10.1016/j.jadohealth.2010.02.016

236. Mielke GI, Brown WJ, Wehrmeister FC, et al. Associations between self-reported physical activity and screen time with cardiometabolic risk factors in adolescents: findings from the 1993 Pelotas (Brazil) Birth Cohort Study. *Prev Med*. 2019;119:31-36. doi:10.1016/j.ypmed.2018.12.008

237. Bergmann GG, Tassitano RM, de Araújo Bergmann ML, Tenório MCM, Mota J. Screen time, physical activity and cardiovascular risk factors in adolescents. *Revista Brasileira de Atividade Física & Saúde*. 2018;23:1-12. doi:10.12820/rbafs.23e0008

238. Faria FR de, Neves Miranda VP, Howe CA, Sasaki JE, Dos Santos Amorim PR. Behavioral classes related to physical activity and sedentary behavior on the evaluation of health and mental outcomes among Brazilian adolescents. *PLoS One*. 2020;15(6):e0234374. doi:10.1371/journal.pone.0234374

239. Dalene KE, Anderssen SA, Andersen LB, et al. Cross-sectional and prospective associations between physical activity, body mass index and waist circumference in children and adolescents. *Obesity science & practice*. 2017;3(3):249-257. doi:10.1002/osp4.114

240. Sardinha LB, Marques A, Minderico C, Ekelund U. Cross-sectional and prospective impact of reallocating sedentary time to physical activity on children's body composition. *Pediatr Obes*. 2017;12(5):373-379. doi:10.1111/ijpo.12153

241. Aggio D, Smith L, Hamer M. Effects of reallocating time in different activity intensities on health and fitness: a cross sectional study. *Int J Behav Nutr Phys Act*. 2015;12:83. doi:10.1186/s12966-015-0249-6

242. Collings PJ, Westgate K, Väistö J, et al. Cross-sectional associations of objectively-measured physical activity and sedentary time with body composition and cardiorespiratory fitness in mid-childhood: the PANIC study. *Sports Med*. 2017;47(4):769-780. doi:10.1007/s40279-016-0606-x

243. Hansen BH, Anderssen SA, Andersen LB, et al. Cross-sectional associations of reallocating time between sedentary and active behaviours on cardiometabolic risk factors in young people: an international children's accelerometry database (ICAD) analysis. *Sports Med*. 2018;48(10):2401-2412. doi:10.1007/s40279-018-0909-1

244. Jones MA, Skidmore PM, Stoner L, et al. Associations of accelerometer-measured sedentary time, sedentary bouts, and physical activity with adiposity and fitness in children. *J Sports Sci*. 2020;38(1):114-120. doi:10.1080/02640414.2019.1685842

245. Gába A, Pedišić Ž, Štefelová N, et al. Sedentary behavior patterns and adiposity in children: a study based on compositional data analysis. *BMC Pediatr*. 2020;20(1):147. doi:10.1186/s12887-020-02036-6

246. Fairclough SJ, Dumuid D, Mackintosh KA, et al. Adiposity, fitness, health-related quality of life and the reallocation of time between children's school day activity behaviours: a compositional data analysis. *Prev Med Rep*. 2018;11:254-261. doi:10.1016/j.pmedr.2018.07.011

247. Carson V, Tremblay MS, Chaput JP, McGregor D, Chastin S. Compositional analyses of the associations between sedentary time, different intensities of physical activity, and cardiometabolic biomarkers among children and youth from the United States. *PLoS One*. 2019;14(7):e0220009. doi:10.1371/journal.pone.0220009

248. Moura BP, Rufino RL, Faria RC, Amorim PRS. Effects of isotemporal substitution of sedentary behavior with light-intensity or moderate-to-vigorous physical activity on cardiometabolic markers in male adolescents. *PLoS One*. 2019;14(11):e0225856. doi:10.1371/journal.pone.0225856

249. Chaput JP, Leduc G, Boyer C, et al. Objectively measured physical activity, sedentary time and sleep duration: independent and combined associations with adiposity in Canadian children. *Nutr Diabetes*. 2014;4:e117. doi:10.1038/nutd.2014.14

250. Chen ST, Liu Y, Tremblay MS, et al. Meeting 24-hour movement guidelines: prevalence, correlates and the relationships with overweight and obesity among Chinese children and adolescents. *J Sport Health Sci*. 2020;10(3):349-359. doi:10.1016/j.jshs.2020.07.002

251. Carson V, Chaput JP, Janssen I, Tremblay MS. Health associations with meeting new 24-hour movement guidelines for Canadian children and youth. *Prev Med*. 2017;95:7-13. doi:10.1016/j.ypmed.2016.12.005

252. Jakubec L, Gába A, Dygrýn J, Rubín L, Šimůnek A, Sigmund E. Is adherence to the 24-hour movement guidelines associated with a reduced risk of adiposity among children and adolescents? *BMC Public Health*. 2020;20(1):1119. doi:10.1186/s12889-020-09213-3

253. Zhu X, Healy S, Haegele JA, Patterson F. Twenty-four-hour movement guidelines and body weight in youth. *J Pediatr*. 2020;218:204-209. doi:10.1016/j.jpeds.2019.11.031

254. Roman-Viñas B, Chaput JP, Katzmarzyk PT, et al. Proportion of children meeting recommendations for 24-hour movement guidelines and associations with adiposity in a 12-country study. *Int J Behav Nutr Phys Act*. 2016;13(1):123. doi:10.1186/s12966-016-0449-8

255. Tanaka C, Tremblay MS, Okuda M, Inoue S, Tanaka S. Proportion of Japanese primary school children meeting recommendations for 24-h movement guidelines and associations with weight status. *Obes Res Clin Pract*. 2020;14(3):234-240. doi:10.1016/j.orcp.2020.05.003

256. Wilkie HJ, Standage M, Gillison FB, Cumming SP, Katzmarzyk PT. Multiple lifestyle behaviours and overweight and obesity among children aged 9–11 years: results from the UK site of the International Study of Childhood Obesity, Lifestyle and the Environment. *BMJ Open*. 2016;6(2):e010677. doi:10.1136/bmjopen-2015-010677

257. Guan H, Zhang Z, Wang B, et al. Proportion of kindergarten children meeting the WHO guidelines on physical activity, sedentary behaviour and sleep and associations with adiposity in urban Beijing. *BMC Pediatr*. 2020;20(1):1-9. doi:10.1186/s12887-020-1969-6

258. Laurson KR, Lee JA, Gentile DA, Walsh DA, Eisenmann JC. Concurrent associations between physical activity, screen time, and sleep duration with childhood obesity. *ISRN Obes*. 2014;2014:204540. doi:10.1155/2014/204540

259. Yan S, Yajun Huang W, Hui-Ping Sit C, Heung-Sang Wong S. Compliance with 24-hour movement guidelines in Hong Kong adolescents: associations with weight status. *J Phys Act Health*. 2020;17(3):287-292. doi: 10.1123/jpah.2019-0230

260. Tassitano RM, Weaver RG, Tenório MCM, Brazendale K, Beets MW. Clusters of non-dietary obesogenic behaviors among adolescents in Brazil: a latent profile analysis. *Int J Public Health*. 2020;65(6):881-891. doi:10.1007/s00038-020-01418-y

261. Carson V, Faulkner G, Sabiston CM, Tremblay MS, Leatherdale ST. Patterns of movement behaviors and their association with overweight and obesity in youth. *Int J Public Health*. 2015;60(5):551-559. doi:10.1007/s00038-015-0685-8

262. Janssen I, Roberts KC. Is adherence to the Canadian 24-hour movement behaviour guidelines for children and youth associated with improved indicators of physical, mental, and social health? *Appl Physiol Nutr Metab*. 2017;42(7). doi:10.1139/apnm-2016-0681

263. Verswijveren SJJM, Lamb KE, Martín-Fernández JA, et al. Using compositional data analysis to explore associations between accumulation of sedentary behaviour and physical activity and biomarkers of cardiometabolic health in children and adolescents: a cross-sectional study [Preprint]. *J Sport Health Sci*. 2020. doi:10.1016/j.jshs.2021.03.004

264. Fairclough SJ, Dumuid D, Taylor S, et al. Fitness, fatness and the reallocation of time between children's daily movement behaviours: an analysis of compositional data. *Int J Behav Nutr Phys Act*. 2017;14(1):64. doi:10.1186/s12966-017-0521-z

265. Dumuid D, Wake M, Clifford S, et al. The association of the body composition of children with 24-hour activity composition. *J Pediatr*. 2019;208:43-49.e9. doi:10.1016/j.jpeds.2018.12.030

266. Talarico R, Janssen I. Compositional associations of time spent in sleep, sedentary behavior and physical activity with obesity measures in children. *Int J Obes* . 2018;42(8):1508-1514. doi:10.1038/s41366-018-0053-x

267. Taylor RW, Haszard JJ, Farmer VL, et al. Do differences in compositional time use explain ethnic variation in the prevalence of obesity in children? Analyses using 24-hour accelerometry. *Int J Obes* . 2020;44(1):94-103. doi:10.1038/s41366-019-0377-1

268. Del Pozo-Cruz B, Gant N, Del Pozo-Cruz J, Maddison R. Relationships between sleep duration, physical activity and body mass index in young New Zealanders: an isotemporal substitution analysis. *PLoS One*. 2017;12(9):e0184472. doi:10.1371/journal.pone.0184472

269. Huang WY, Wong SHS, He G, Salmon JO. Isotemporal substitution analysis for sedentary behavior and body mass index. *Med Sci Sports Exerc*. 2016;48(11):2135-2141. doi:10.1249/MSS.0000000000001002

270. Carson V, Tremblay MS, Chaput JP, Chastin SFM. Associations between sleep duration, sedentary time, physical activity, and health indicators among Canadian children and youth using compositional analyses. *Appl Physiol Nutr Metab*. 2016;41(6 Suppl 3):S294-S302. doi:10.1139/apnm-2016-0026

271. Dumuid D, Stanford TE, Martin-Fernández JA, et al. Compositional data analysis for physical activity, sedentary time and sleep research. *Stat Methods Med Res*. 2018;27(12):3726-3738. doi:10.1177/0962280217710835

272. Väistö J, Eloranta AM, Viitasalo A, et al. Physical activity and sedentary behaviour in relation to cardiometabolic risk in children: cross-sectional findings from the Physical Activity and Nutrition in Children (PANIC) Study. *Int J Behav Nutr Phys Act*. 2014;11(1):55. doi:10.1186/1479-5868-11-55

273. de Moraes ACF, Carvalho HB, Rey-López JP, et al. Independent and combined effects of physical activity and sedentary behavior on blood pressure in adolescents: gender differences in two cross-sectional studies. *PLoS One*. 2013;8(5):e62006. doi:10.1371/journal.pone.0062006

274. Cristi-Montero C, Chillón P, Labayen I. Cardiometabolic risk through an integrative classification combining physical activity and sedentary behavior in European adolescents: HELENA study. *Journal of sport and*. 2019. https://doi.org/10.1016/j.jshs.2018.03.004

275. Agostinis-Sobrinho C, Gómez-Martínez S, Nova E, et al. Lifestyle patterns and endocrine, metabolic, and immunological biomarkers in European adolescents: The HELENA study. *Pediatr Diabetes*. 2018;18:543. doi:10.1111/pedi.12802

276. Weisser B, Hacke C. Screen time is a risk factor for higher exercise blood pressure independent of moderate-to-vigorous physical activity or fitness in adolescents. *Eur Heart J*. 2015;36:469-470.

277. Cureau FV, Ekelund U, Bloch KV, Schaan BD. Does body mass index modify the association between physical activity and screen time with cardiometabolic risk factors in adolescents? Findings from a country-wide survey. *Int J Obes*. 2017;41(4):551-559. doi:10.1038/ijo.2016.210

278. Lee PH. Association between adolescents' physical activity and sedentary behaviors with change in BMI and risk of type 2 diabetes. *PLoS One*. 2014;9(10):e110732. doi:10.1371/journal.pone.0110732

279. Jones PR, Rajalahti T, Resaland GK, et al. Associations of physical activity and sedentary time with lipoprotein subclasses in Norwegian schoolchildren: the Active Smarter Kids (ASK) study. *Atherosclerosis*. 2019;288:186-193. doi:10.1016/j.atherosclerosis.2019.05.023

280. Mota J, Silva-Santos S, Barros M, Farias Júnior JC, Vale S. Influence of different behavioural factors and obesity status on systolic blood pressure among pre-school children. *Ann Hum Biol*. 2014;41(6):506-510. doi:10.3109/03014460.2014.909884

281. Santos DA, Marques A, Minderico CS, Ekelund U, Sardinha LB. A cross-sectional and prospective analysis of reallocating sedentary time to physical activity on children's cardiorespiratory fitness. *J Sports Sci*. 2018;36(15):1720-1726. doi:10.1080/02640414.2017.1411176

282. Sun Y, Yin X, Li Y, et al. Isotemporal substitution of sedentary behavior for physical activity on cardiorespiratory fitness in children and adolescents. *Medicine*. 2020;99(30):e21367. doi:10.1097/md.0000000000021367

283. Kidokoro T, Suzuki K, Naito H, et al. Moderate-to-vigorous physical activity attenuates the detrimental effects of television viewing on the cardiorespiratory fitness in Asian adolescents: the Asia-fit study. *BMC Public Health*. 2019;19(1):1737. doi:10.1186/s12889-019-8079-0

284. Porter AK, Matthews KJ, Salvo D, Kohl HW. Associations of physical activity, sedentary time, and screen time with cardiovascular fitness in United States adolescents: results from the NHANES National Youth Fitness Survey. *J Phys Act Health*. 2017;14(7):506-512. doi:10.1123/jpah.2016-0165

285. Moore JB, Beets MW, Barr-Anderson DJ, Evenson KR. Sedentary time and vigorous physical activity are independently associated with cardiorespiratory fitness in middle school youth. *J Sports Sci*. 2013;31(14):1520-1525. doi:10.1080/02640414.2013.793378

286. Santos R, Mota J, Okely AD, et al. The independent associations of sedentary behaviour and physical activity on cardiorespiratory fitness. *Br J Sports Med*. 2014;48(20):1508-1512. doi:10.1136/bjsports-2012-091610

287. Martinez-Gomez D, Ortega FB, Ruiz JR, et al. Excessive sedentary time and low cardiorespiratory fitness in European adolescents: the HELENA study. *Arch Dis Child*. 2011;96(3):240-246. doi:10.1136/adc.2010.187161

288. Tanaka C, Tremblay MS, Okuda M, Tanaka S. Association between 24-hour movement guidelines and physical fitness in children. *Pediatr Int*. 2020;62(12):1381-1387. doi:10.1111/ped.14322

289. Sánchez-Oliva D, Esteban-Cornejo I, Padilla-Moledo C, et al. Associations between physical activity and sedentary time profiles transitions and changes in well-being in youth: the UP&DOWN longitudinal study. *Psychol Sport Exerc*. 2020;47:101558. doi:10.1016/j.psychsport.2019.101558

290. García-Hermoso A, Hormazábal-Aguayo I, Fernández-Vergara O, Olivares PR, Oriol-Granado X. Physical activity, screen time and subjective well-being among children. *Int J Clin Health Psychol*. 2020;20(2):126-134. doi:10.1016/j.ijchp.2020.03.001

291. Matin N, Kelishadi R, Heshmat R, et al. Joint association of screen time and physical activity on self-rated health and life satisfaction in children and adolescents: the CASPIAN-IV study. *Int Health*. 2017;9(1):58-68. doi:10.1093/inthealth/ihw044

292. Taheri E, Heshmat R, Esmaeil Motlagh M, et al. Association of physical activity and screen time with psychiatric distress in children and adolescents: CASPIAN-IV study. *J Trop Pediatr*. 2019;65(4):361-372. doi:10.1093/tropej/fmy063

293. Hamer M, Stamatakis E, Mishra G. Psychological distress, television viewing, and physical activity in children aged 4 to 12 years. *Pediatrics*. 2009;123(5):1263-1268. doi:10.1542/peds.2008-1523

294. Khan A, Uddin R, Burton NW. Insufficient physical activity in combination with high screen time is associated with adolescents' psychosocial difficulties. *Int Health*. 2018;10(4):246-251. doi:10.1093/inthealth/ihy019

295. Keane E, Kelly C, Molcho M, Nic Gabhainn S. Physical activity, screen time and the risk of subjective health complaints in school-aged children. *Prev Med*. 2017;96:21-27. doi:10.1016/j.ypmed.2016.12.011

296. Omorou AY, Langlois J, Lecomte E, Briançon S, Vuillemin A. Cumulative and bidirectional association of physical activity and sedentary behaviour with health-related quality of life in adolescents. *Qual Life Res*. 2016;25(5):1169-1178. doi:10.1007/s11136-015-1172-7

297. Wong M, Olds T, Gold L, et al. Time-use patterns and health-related quality of life in adolescents. *Pediatrics*. 2017;140(1). doi:10.1542/peds.2016-3656

298. Motamed-Gorji N, Qorbani M, Nikkho F, et al. Association of screen time and physical activity with health-related quality of life in Iranian children and adolescents. *Health Qual Life Outcomes*. 2019;17. doi:10.1186/s12955-018-1071-z

299. Werneck AO, Collings PJ, Barboza LL, Stubbs B, Silva DR. Associations of sedentary behaviors and physical activity with social isolation in 100,839 school students: the Brazilian Scholar Health Survey. *Gen Hosp Psychiatry*. 2019;59:7-13. doi:10.1016/j.genhosppsych.2019.04.010

300. Lacy KE, Allender SE, Kremer PJ, et al. Screen time and physical activity behaviours are associated with health-related quality of life in Australian adolescents. *Qual Life Res*. 2012;21(6):1085-1099. doi:10.1007/s11136-011-0014-5

301. Sampasa-Kanyinga H, Standage M, Tremblay MS, et al. Associations between meeting combinations of 24-h movement guidelines and health-related quality of life in children from 12 countries. *Public Health*. 2017;153:16-24. doi:10.1016/j.puhe.2017.07.010

302. Cao H, Qian Q, Weng T, et al. Screen time, physical activity and mental health among urban adolescents in China. *Prev Med*. 2011;53(4-5):316-320. doi:10.1016/j.ypmed.2011.09.002

303. Sampasa-Kanyinga H, Chaput JP, Goldfield GS, et al. 24-hour movement guidelines and suicidality among adolescents. *J Affect Disord*. 2020;274:372-380. doi:10.1016/j.jad.2020.05.096

304. Trinh L, Wong B, Faulkner GE. The independent and interactive associations of screen time and physical activity on mental health, school connectedness and academic achievement among a population-based sample of youth. *J Can Acad Child Adolesc Psychiatry*. 2015;24(1):17-24. https://www.ncbi.nlm.nih.gov/pubmed/26336376.

305. Uddin R, Burton NW, Maple M, Khan SR, Tremblay MS, Khan A. Low physical activity and high sedentary behaviour are associated with adolescents' suicidal vulnerability: evidence from 52 low- and middle-income countries. *Acta Paediatr*. 2020;109(6):1252-1259. doi:10.1111/apa.15079

306. Hrafnkelsdottir SM, Brychta RJ, Rognvaldsdottir V, et al. Less screen time and more frequent vigorous physical activity is associated with lower risk of reporting negative mental health symptoms among Icelandic adolescents. *PLoS One*. 2018;13(4):e0196286. doi:10.1371/journal.pone.0196286

307. Liu M, Zhang J, Hu E, Yang H, Cheng C, Yao S. Combined patterns of physical activity and screen-related sedentary behavior among Chinese adolescents and their correlations with depression, anxiety and self-injurious behaviors. *Psychol Res Behav Manag*. 2019;12:1041-1050. doi:10.2147/PRBM.S220075

308. Zhu X, Haegele JA, Healy S. Movement and mental health: Behavioral correlates of anxiety and depression among children of 6–17 years old in the U.S. *Ment Health Phys Act*. 2019;16:60-65. doi:10.1016/j.mhpa.2019.04.002

309. Gillis BT, El-Sheikh M. Sleep and adjustment in adolescence: physical activity as a moderator of risk. *Sleep Health*. 2019;5(3):266-272. doi:10.1016/j.sleh.2019.02.001

310. Cao R, Gao T, Hu Y, et al. Clustering of lifestyle factors and the relationship with depressive symptoms among adolescents in Northeastern China. *J Affect Disord*. 2020;274:704-710. doi:10.1016/j.jad.2020.05.064

311. Ogawa S, Kitagawa Y, Fukushima M, et al. Interactive effect of sleep duration and physical activity on anxiety/depression in adolescents. *Psychiatry Res*. 2019;273:456-460. doi:10.1016/j.psychres.2018.12.085

312. Ishii K, Aoyagi K, Shibata A, Koohsari MJ, Carver A, Oka K. Joint associations of leisure screen time and physical activity with academic performance in a sample of Japanese children. *Int J Environ Res Public Health*. 2020;17(3). doi:10.3390/ijerph17030757

313. García-Hermoso A, Marina R. Relationship of weight status, physical activity and screen time with academic achievement in adolescents. *Obes Res Clin Pract*. 2017;11(1):44-50. doi:10.1016/j.orcp.2015.07.006

314. Kantomaa MT, Stamatakis E, Kankaanpää A, Kajantie E, Taanila A, Tammelin T. Associations of physical activity and sedentary behavior with adolescent academic achievement. *J Res Adolesc*. 2016;26(3):432-442. doi:10.1111/jora.12203

315. Haapala EA, Väistö J, Lintu N, et al. Physical activity and sedentary time in relation to academic achievement in children. *J Sci Med Sport*. 2017;20(6):583-589. doi:10.1016/j.jsams.2016.11.003

316. Dumuid D, Olds T, Martín-Fernández JA, Lewis LK, Cassidy L, Maher C. Academic performance and lifestyle behaviors in Australian school children: a cluster analysis. *Health Educ Behav*. 2017;44(6):918-927. https://journals.sagepub.com/doi/abs/10.1177/1090198117699508.

317. Wilson R, Dumuid D, Olds T, Evans J. Lifestyle clusters and academic achievement in Australian Indigenous children: empirical findings and discussion of ecological levers for closing the gap. *SSM Popul Health*. 2020;10:100535. doi:10.1016/j.ssmph.2019.100535

318. Maher C, Lewis L, Katzmarzyk PT, Dumuid D, Cassidy L, Olds T. The associations between physical activity, sedentary behaviour and academic performance. *J Sci Med Sport*. 2016;19(12):1004-1009. doi:10.1016/j.jsams.2016.02.010

319. Lien A, Sampasa-Kanyinga H, Colman I, Hamilton HA, Chaput JP. Adherence to 24-hour movement guidelines and academic performance in adolescents. *Public Health*. 2020;183:8-14. doi:10.1016/j.puhe.2020.03.011

320. Zeng X, Cai L, Wong SHS, et al. Association of sedentary time and physical activity with executive function among children. *Acad Pediatr*. 2020;21(1):63-69. doi:10.1016/j.acap.2020.02.027

321. Guerrero MD, Barnes JD, Walsh JJ, Chaput JP, Tremblay MS, Goldfield GS. 24-hour movement behaviors and impulsivity. *Pediatrics*. 2019;144(3). doi:10.1542/peds.2019-0187

322. Walsh JJ, Barnes JD, Cameron JD, et al. Associations between 24 hour movement behaviours and global cognition in US children: a cross-sectional observational study. *The Lancet Child & Adolescent Health*. 2018;2(11):783-791. doi:10.1016/S2352-4642(18)30278-5

323. Walsh JJ, Barnes JD, Tremblay MS, Chaput JP. Associations between duration and type of electronic screen use and cognition in US children. *Comput Human Behav*. 2020;108:106312. doi:10.1016/j.chb.2020.106312

324. Wang S, Song J, Shang X, et al. Physical activity and sedentary behavior can modulate the effect of the PNPLA3 variant on childhood NAFLD: a case-control study in a Chinese population. *BMC Med Genet*. 2016;17(1):90. doi:10.1186/s12881-016-0352-9

325. Burns RD, Youngwon K, Wonwoo B, Brusseau TA. Associations of school day sedentary behavior and physical activity with gross motor skills: use of compositional data analysis. *J Phys Act Health*. 2019;16(10):811-817. doi:10.1123/jpah.2018-0549

326. da Silva ACM, Cureau FV, de Oliveira CL, et al. Physical activity but not sedentary time is associated with vitamin D status in adolescents: study of cardiovascular risk in adolescents (ERICA). *Eur J Clin Nutr*. 2019;73(3):432-440. doi:10.1038/s41430-018-0192-0

327. Vicente-Rodríguez G, Ortega FB, Rey-López JP, et al. Extracurricular physical activity participation modifies the association between high TV watching and low bone mass. *Bone*. 2009;45(5):925-930. doi:10.1016/j.bone.2009.07.084

328. Wu YUE, Goodrich JM, Dolinoy DC, et al. Accelerometer-measured physical activity, reproductive hormones, and DNA methylation. *Med Sci Sports Exercise*. 2020;52(3):598-607. doi:10.1249/MSS.0000000000002175

329. Kieling C, Kieling RR, Rohde LA, et al. The age at onset of attention deficit hyperactivity disorder. *Am J Psychiatry*. 2010;167(1):14-16. doi:10.1176/appi.ajp.2009.09060796

330. Fletcher EA, McNaughton SA, Crawford D, et al. Associations between sedentary behaviours and dietary intakes among adolescents. *Public Health Nutr*. 2018;21(6):1115-1122. doi:10.1017/S136898001700372X

331. Carson V, Hunter S, Kuzik N, et al. Systematic review of physical activity and cognitive development in early childhood. *J Sci Med Sport*. 2016;19(7):573-578. doi:10.1016/j.jsams.2015.07.011

332. Hartwig TB, Sanders T, Vasconcellos D. School-based interventions modestly increase physical activity and cardiorespiratory fitness but are least effective for youth who need them most: an individual participant pooled analysis of 20 controlled trials. *Br J Sports Med*. 2021;55(13):721-729. doi:10.1136/bjsports-2020-102740

333. Bowling A, Slavet J, Miller DP, Haneuse S, Beardslee W, Davison K. Dose-response effects of exercise on behavioral health in children and adolescents. *Ment Health Phys Act*. 2017;12:110-115. doi:10.1016/j.mhpa.2017.03.005

334. Liu M, Wu L, Yao S. Dose–response association of screen time-based sedentary behaviour in children and adolescents and depression: a meta-analysis of observational studies. *Br J Sports Med*. 2016;50(20):1252-1258. doi:10.1136/bjsports-2015-095084

335. Collins H, Booth JN, Duncan A, Fawkner S, Niven A. The effect of resistance training Interventions on "The Self"in youth: a systematic review and meta-analysis. *Sports medicine-open*. 2019;5(1):1-14. doi:10.1186/s40798-019-0205-0

336. Behm DG, Faigenbaum AD, Falk B, Klentrou P. Canadian society for exercise physiology position paper: resistance training in children and adolescents. *Appl Physiol Nutr Metab*. 2008;33(3):547-561. doi:10.1139/H08-020

337. Fairclough SJ, Tyler R, Dainty JR, et al. Cross-sectional associations between 24-hour activity behaviours and mental health indicators in children and adolescents: a compositional data analysis. *J Sports Sci*. 2021;39(14):1602-1614. doi:10.1080/02640414.2021.1890351

338. World Health Organization. *Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age*. World Health Organization; 2019. Accessed May 22, 2020. https://apps.who.int/iris/handle/10665/311664.

339. Dumuid D, Pedišić Ž, Stanford TE, et al. The compositional isotemporal substitution model: a method for estimating changes in a health outcome for reallocation of time between sleep, physical activity and sedentary behaviour. *Stat Methods Med Res*. 2019;28(3):846-857. doi:10.1177/0962280217737805

340. Janssen I, Clarke AE, Carson V, et al. A systematic review of compositional data analysis studies examining associations between sleep, sedentary behaviour, and physical activity with health outcomes in adults. *Appl Physiol Nutr Metab*. 2020;45(10 (Suppl. 2)):S248-S257. doi:10.1139/apnm-2020-0160

341. Stiglic N, Viner RM. Effects of screentime on the health and well-being of children and adolescents: a systematic review of reviews. *BMJ Open*. 2019;9(1):e023191. doi:10.1136/bmjopen-2018-023191

342. Horváth K, Plunkett K. Spotlight on daytime napping during early childhood. *Nat Sci Sleep*. 2018;10:97-104. doi:10.2147/NSS.S126252

343. Leech RM, McNaughton SA, Timperio A. The clustering of diet, physical activity and sedentary behavior in children and adolescents: a review. *Int J Behav Nutr Phys Act*. 2014;11:4. doi:10.1186/1479-5868-11-4

344. Bagley EJ, Fuller-Rowell TE, Saini EK, Philbrook LE, El-Sheikh M. Neighborhood economic deprivation and social fragmentation: associations with children's sleep. *Behav Sleep Med*. 2018;16(6):542-552. doi:10.1080/15402002.2016.1253011

345. Chong KH, Parrish AM, Cliff DP, Kemp BJ, Zhang Z, Okely AD. Changes in physical activity, sedentary behaviour and sleep across the transition from primary to secondary school: a systematic review. *J Sci Med Sport*. 2020;23(5):498-505. doi:10.1016/j.jsams.2019.12.002

346. Lampinen EK, Eloranta AM, Haapala EA, et al. Physical activity, sedentary behaviour, and socioeconomic status among Finnish girls and boys aged 6-8 years. *EJSS* . 2017;17(4):462-472. doi:10.1080/17461391.2017.1294619

347. Jones CHD, Ball H. Exploring socioeconomic differences in bedtime behaviours and sleep duration in English preschool children. *Infant Child Dev*. 2014;23(5):518-531. doi:10.1002/icd.1848

348. Mullan K. *Longitudinal analysis of LSAC time diary data: considerations for data users.* Australian Institutue of Family Studies; 2014.

349. *The Longitudinal Study of Australian Children: An Australian Government Initiative: Data User Guide.* Australian Bureau of Statistics; 2023

350. Corey J, Gallagher J, Davis E, Marquardt M. The times of their lives: Collecting time use data from children in the Longitudinal Study of Australian Children (LSAC). *LSAC technical paper*. 2014;13.

351. van Buuren S, Groothuis-Oudshoorn K. Package “mice.” *Computer* . 2015. https://cran.microsoft.com/snapshot/2014-11-17/web/packages/mice/mice.pdf.

352. Gracia P, Garcia-Roman J, Oinas T, Anttila T. Do boys’ and girls’ daily activities differ? Cross-country evidence. April 2020. doi:10.31235/osf.io/nruq7

353. Baker K, Sipthorp M, Edwards B. *A Longitudinal Measure of Socioeconomic Position in LSAC*. Australian Institute of Family Studies Melbourne, Australia; 2017.

354. Magrini A. *Gbmt: Group-Based Multi-Trajectory Modeling*.; 2021.

355. Klijn SL, Weijenberg MP, Lemmens P, van den Brandt PA, Lima Passos V. Introducing the fit-criteria assessment plot - a visualisation tool to assist class enumeration in group-based trajectory modelling. *Stat Methods Med Res*. 2017;26(5):2424-2436. doi:10.1177/0962280215598665

356. Venables, W. N. & Ripley, B. D. *Modern Applied Statistics with S*.; 2002.

357. Australian Bureau of Statistics. *Australian Statistical Geography Standard (ASGS)*. Accessed April 5, 2023. https://www.abs.gov.au/statistics/statistical-geography/australian-statistical-geography-standard-asgs.

358. Mitchell JA, Morales KH, Williamson AA, et al. Changes in sleep duration and timing during the middle-to-high school transition. *J Adolesc Health*. 2020;67(6):829-836. doi:10.1016/j.jadohealth.2020.04.024

359. Mitchell TB, Steele RG. Latent profiles of physical activity and sedentary behavior in elementary school-age youth: associations with health-related quality of life. *J Pediatr Psychol*. 2017;43(7):723-732. doi:10.1093/jpepsy/jsx149 %J Journal of Pediatric Psychology

360. Cameron AJ, Spence AC, Laws R, Hesketh KD, Lioret S, Campbell KJ. A review of the relationship between socioeconomic position and the early-life predictors of obesity. *Curr Obes Rep*. 2015;4(3):350-362. doi:10.1007/s13679-015-0168-5

361. Bowser J, Martinez-Donate AP, Carrel A, Allen DB, Moberg DP. Disparities in fitness and physical activity among children. *WMJ*. 2016;115(5):245-250. https://www.ncbi.nlm.nih.gov/pubmed/29095586.

362. Thorn JE, DeLellis N, Chandler JP, Boyd K. Parent and child self-reports of dietary behaviors, physical activity, and screen time. *J Pediatr*. 2013;162(3):557-561. doi:10.1016/j.jpeds.2012.08.031

363. LeBlanc AGW, Janssen I. Difference between self-reported and accelerometer measured moderate-to-vigorous physical activity in youth. *Pediatr Exerc Sci*. 2010;22(4):523-534. doi:10.1123/pes.22.4.523

364. Olderbak S, Wilhelm O. Overarching principles for the organization of socioemotional constructs. *Curr Dir Psychol Sci*. 2020;29(1):63-70. doi:10.1177/0963721419884317

365. Berger C, Alcalay L, Torretti A, Milicic N. Socio-emotional well-being and academic achievement: evidence from a multilevel approach. *Psicologia: reflexão e crítica*. 2011;24(2):344-351. https://www.scielo.br/pdf/prc/v24n2/16.pdf.

366. de la Barrera U, Schoeps K, Gil-Gómez JA, Montoya-Castilla I. Predicting adolescent adjustment and well-being: the Interplay between socio-emotional and personal factors. *Int J Environ Res Public Health*. 2019;16(23). doi:10.3390/ijerph16234650

367. McLoyd VC. Socioeconomic disadvantage and child development. *Am Psychol*. 1998;53(2):185-204. doi:10.1037//0003-066x.53.2.185

368. McLoyd VC. The impact of poverty and low socioeconomic status on the socioemotional functioning of African-American children and adolescents: mediating effects. *Social and emotional adjustment and family*. 1997;7:34.

369. Noonan K, Burns R, Violato M. Family income, maternal psychological distress and child socio-emotional behaviour: longitudinal findings from the UK Millennium Cohort Study. *SSM Popul Health*. 2018;4:280-290. doi:10.1016/j.ssmph.2018.03.002

370. López-Gil JF, Roman-Viñas B, Aznar S, Tremblay MS. Meeting 24-h movement guidelines: prevalence, correlates, and associations with socioemotional behavior in Spanish minors. *Scand J Med Sci Sports*. 2022;32(5):881-891. doi:10.1111/sms.14132

371. Stalsberg R, Pedersen AV. Are differences in physical activity across socioeconomic groups associated with choice of physical activity variables to report? *Int J Environ Res Public Health*. 2018;15(5):922. doi:10.3390/ijerph15050922

372. Elhakeem A, Hardy R, Bann D, et al. Intergenerational social mobility and leisure-time physical activity in adulthood: a systematic review. *J Epidemiol Community Health*. 2017;71(7):673-680. doi:10.1136/jech-2016-208052

373. Nagin D. Group-based modeling of development Harvard University Press. *Cambridge, Mass.* 2005.

374. Van Roy B, Veenstra M, Clench-Aas J. Construct validity of the five-factor Strengths and Difficulties Questionnaire (SDQ) in pre-, early, and late adolescence. *J Child Psychol Psychiatry*. 2008;49(12):1304-1312. doi:10.1111/j.1469-7610.2008.01942.x

375. VanderWeele T. *Explanation in Causal Inference: Methods for Mediation and Interaction*. Oxford University Press; 2015.

376. Steen, Loeys, Moerkerke. Medflex: an R package for flexible mediation analysis using natural effect models. *J Stat Econ Meth*. http://138.232.16.156/article/view/v076i11.

377. Berenbaum SA, Beltz AM, Corley R. The importance of puberty for adolescent development: conceptualization and measurement. *Adv Child Dev Behav*. 2015;48:53-92. doi:10.1016/bs.acdb.2014.11.002

378. Dockery AM. Housing quality, remoteness and Indigenous children’s outcomes in Australia. *Econ Anal Policy*. 2022;73:228-241. doi:10.1016/j.eap.2021.11.013

379. Tienda M, Haskins R. Immigrant Children: introducing the Issue. *Future Child*. 2011;21(1):3-18. http://www.jstor.org/stable/41229009.

380. Coley RL. Children’s socialization experiences and functioning in single-mother households: the importance of fathers and other men. *Child Dev*. 1998;69(1):219-230. doi:10.1111/j.1467-8624.1998.tb06144.x

381. Guttmann J, Rosenberg M. Emotional intimacy and children’s adjustment: a comparison between single-parent divorced and intact families. *Educ Psychol Rev*. 2003;23(4):457-472. doi:10.1080/01443410303213

382. Schaid DJ, Sinnwell JP. Penalized models for analysis of multiple mediators. *Genet Epidemiol*. 2020;44(5):408-424. doi:10.1002/gepi.22296

383. Tooth LR, Moss KM, Mishra GD. Screen time and child behaviour and health-related quality of life: effect of family context. *Prev Med*. 2021;153:106795. doi:10.1016/j.ypmed.2021.106795

384. Heshmat R, Qorbani M, Mozaffarian N, et al. Socioeconomic inequality in screen time frequency in children and adolescents: the weight disorders survey of the CASPIAN IV study. *World J Pediatr*. 2018;14(1):66-76. doi:10.1007/s12519-017-0115-5

385. Domingues-Montanari S. Clinical and psychological effects of excessive screen time on children. *J Paediatr Child Health*. 2017;53(4):333-338. doi:10.1111/jpc.13462

386. Meroni EC, Piazzalunga D, Pronzato C. Allocation of time and child socio-emotional skills. *Rev Econ Househ*. September 2021. doi:10.1007/s11150-021-09580-9

387. Soffer-Dudek N, Sadeh A, Dahl RE, Rosenblat-Stein S. Poor sleep quality predicts deficient emotion information processing over time in early adolescence. *Sleep*. 2011;34(11):1499-1508. doi:10.5665/sleep.1386

388. El-Sheikh M, Shimizu M, Philbrook LE, Erath SA, Buckhalt JA. Sleep and development in adolescence in the context of socioeconomic disadvantage. *J Adolesc*. 2020;83:1-11. doi:10.1016/j.adolescence.2020.06.006

389. Benner AD, Boyle AE, Bakhtiari F. Understanding students’ transition to high school: demographic variation and the role of supportive relationships. *J Youth Adolesc*. 2017;46(10):2129-2142. doi:10.1007/s10964-017-0716-2

390. Benner AD. The transition to high school: current knowledge, future directions. *Educ Psychol Rev*. 2011;23(3):299-328. doi:10.1007/s10648-011-9152-0

391. Iimura S. Developmental trajectories of event centrality and socio-emotional well-being after transition to high school. *Br J Dev Psychol*. 2020;38(4):497-511. doi:10.1111/bjdp.12333

392. Martínez RS, Aricak OT, Graves MN, Peters-Myszak J, Nellis L. Changes in perceived social support and socioemotional adjustment across the elementary to junior high school transition. *J Youth Adolesc*. 2011;40(5):519-530. doi:10.1007/s10964-010-9572-z

393. Zhang J, Yang SX, Wang L, Han LH, Wu XY. The influence of sedentary behaviour on mental health among children and adolescents: a systematic review and meta-analysis of longitudinal studies. *J Affect Disord*. 2022;306:90-114. doi:10.1016/j.jad.2022.03.018

394. Owen KB, Foley BC, Bauman A, Bellew B, Reece LJ. Parental awareness and engagement in the Active Kids program across socioeconomic groups. *J Sci Med Sport*. 2020;23(8):753-757. doi:10.1016/j.jsams.2020.01.015

395. Gilgun JF, Sands RG. The contribution of qualitative approaches to developmental intervention research. *Qualitative Social Work*. 2012;11(4):349-361. doi:10.1177/1473325012439737

396. Lissak G. Adverse physiological and psychological effects of screen time on children and adolescents: literature review and case study. *Environ Res*. 2018;164:149-157. doi:10.1016/j.envres.2018.01.015

397. Sanders T, Parker PD, Del Pozo-Cruz B, Noetel M, Lonsdale C. Type of screen time moderates effects on outcomes in 4013 children: evidence from the Longitudinal Study of Australian Children. *Int J Behav Nutr Phys Act*. 2019;16(1):117. doi:10.1186/s12966-019-0881-7

398. Hamlen KR. General problem-solving styles and problem-solving approaches in video games. *Journal of Educational Computing Research*. 2018;56(4):467-484. doi:10.1177/0735633117729221

399. Mollborn S, Limburg A, Pace J, Fomby P. Family socioeconomic status and children's screen time. *J Marriage Fam*. 2022;84(4):1129-1151. doi:10.1111/jomf.12834

400. Rowe SL, Gembeck MJZ, Rudolph J, Nesdale D. A longitudinal study of rejecting and autonomy-restrictive parenting, rejection sensitivity, and socioemotional symptoms in early adolescents. *J Abnorm Child Psychol*. 2015;43(6):1107-1118. doi:10.1007/s10802-014-9966-6

401. Nagin DS, Jones BL, Passos VL, Tremblay RE. Group-based multi-trajectory modeling. *Stat Methods Med Res*. 2018;27(7):2015-2023. doi:10.1177/0962280216673085

402. Hills AP, Dengel DR, Lubans DR. Supporting public health priorities: recommendations for physical education and physical activity promotion in schools. *Prog Cardiovasc Dis*. 2015;57(4):368-374. doi:10.1016/j.pcad.2014.09.010

403. Basch CE. Healthier students are better learners: high-quality, strategically planned, and effectively coordinated school health programs must be a fundamental mission of schools to help close the achievement gap. *J Sch Health*. 2011;81(10):650-662. doi:10.1111/j.1746-1561.2011.00640.x

404. Rasberry CN, Slade S, Lohrmann DK, Valois RF. Lessons learned from the whole child and coordinated school health approaches. *J Sch Health*. 2015;85(11):759-765. doi:10.1111/josh.12307

405. Cheung K, Lesesne CA, Rasberry CN, et al. Barriers and facilitators to sustaining school health teams in coordinated school health programs. *Health Promot Pract*. 2017;18(3):418-427. doi:10.1177/1524839916638817

406. Westrich L, Sanchez M, Strobel K. Coordinated school health and the contribution of a district wellness coordinator. *J Sch Health*. 2015;85(4):260-266. doi:10.1111/josh.12240

407. Reece LJ, McInerney C, Blazek K, et al. Reducing financial barriers through the implementation of voucher incentives to promote children's participation in community sport in Australia. *BMC Public Health*. 2020;20(1):19. doi:10.1186/s12889-019-8049-6

408. Sallis JF, Glanz K. The role of built environments in physical activity, eating, and obesity in childhood. *Future Child*. 2006;16(1):89-108. doi:10.1353/foc.2006.0009

409. Brown S, Wallace JJ, Flueckiger. Active transport requires equitable access to bicycles. Poster presented at: International Society of Behavioral Nutrition and Physical Activity; May 18-21; Phoenix, AZ.

410. Wright R, John L, Alaggia R, Sheel J. Community-based arts program for youth in low-income communities: a multi-method evaluation. *Child Adolesc Social Work J*. 2006;23(5):635-652. doi:10.1007/s10560-006-0079-0

411. Salmon J, Arundell L, Hume C, et al. A cluster-randomized controlled trial to reduce sedentary behavior and promote physical activity and health of 8-9 year olds: the Transform-Us! study. *BMC Public Health*. 2011;11:759. doi:10.1186/1471-2458-11-759

412. Lonsdale C, Sanders T, Cohen KE, et al. Scaling-up an efficacious school-based physical activity intervention: study protocol for the "Internet-based Professional Learning to help teachers support Activity in Youth" (iPLAY) cluster randomized controlled trial and scale-up implementation evaluation. *BMC Public Health*. 2016;16(1):873-873. doi:10.1186/s12889-016-3243-2

413. Koorts H, Timperio A, Abbott G, et al. Is level of implementation linked with intervention outcomes? Process evaluation of the Transform-Us intervention to increase children's physical activity and reduce sedentary behaviour. *Int J Behav Nutr Phys Act*. 2022;19(1):122. doi:10.1186/s12966-022-01354-5

414. Lonsdale C, Sanders T, Parker P. Effect of a scalable school-based intervention on cardiorespiratory fitness in children: a cluster randomized clinical trial. *JAMA Pediatr*. 2021;175(8). doi:10.1001/jamapediatrics.2021.0417

415. Sevil J, García-González L, Abós Á, Generelo E, Aibar A. Can high schools be an effective setting to promote healthy lifestyles? Effects of a multiple behavior change intervention in adolescents. *J Adolesc Health*. 2019;64(4):478-486. doi:10.1016/j.jadohealth.2018.09.027

416. Durlak, Weissberg. *The Impact of After-School Programs That Promote Personal and Social Skills*. ERIC; 2007. Accessed October 19, 2022. https://eric.ed.gov/?id=ED505368.

417. Dauenhauer B, Kulinna P, Marttinen R, Stellino MB. Before- and after-school physical activity: programs and best practices. *Journal of Physical Education, Recreation & Dance*. 2022;93(5):20-26. doi:10.1080/07303084.2022.2053474

418. Grimes A, Lightner J, Miller T, et al. Sports, physical activity, and youth: a qualitative investigation to inform intramural sport participation. Paper presented at: American Public Health Association's 2020 Virtual Annual Meeting and expo; October 24-28, 2020. https://apha.confex.com/apha/2020/meetingapi.cgi/Paper/483217?filename=2020_Abstract483217.pdf&template=Word.

419. Rhodes RE, Guerrero MD, Vanderloo LM, et al. Development of a consensus statement on the role of the family in the physical activity, sedentary, and sleep behaviours of children and youth. *Int J Behav Nutr Phys Act*. 2020;17(1):74. doi:10.1186/s12966-020-00973-0

420. Kohyama J. Which is more important for health: sleep quantity or sleep quality? *Children*. 2021;8(7). doi:10.3390/children8070542

421. Topal I. The effect of sleep quality on academic performance. *Ann Med Res*. 2019;(0):1. doi:10.5455/annalsmedres.2019.05.265

422. The Lancet. Waking up to the importance of sleep. *Lancet*. 2022;400(10357):973. doi:10.1016/S0140-6736(22)01774-3

423. Ma JKH. The digital divide at school and at home: a comparison between schools by socioeconomic level across 47 countries. *Int J Comp Sociol*. 2021;62(2):115-140. doi:10.1177/00207152211023540

424. Mijs JJB, Roe EL. Is America coming apart? Socioeconomic segregation in neighborhoods, schools, workplaces, and social networks, 1970–2020. *Sociol Compass*. 2021;15(6). doi:10.1111/soc4.12884

425. Gibbings J, Blakemore T, Strazdins L. Measuring family socioeconomic position. *Australian Social Policy*. 2009. doi: 10.3316/ielapa.200908262.

Research Portfolio Appendix

Publications

1. Combinations of Physical Activity, Sedentary Behavior, and Sleep and their Associations with Physical, Psychological, and Educational Outcomes in Children and Adolescents: A Systematic Review: Accepted by the *American Journal of Epidemiology* (IF = 5.363)

Wilhite, K, Booker, B, Ho-Huei, B, et al. Combinations of physical activity, sedentary behavior, and sleep and their associations with physical, psychological, and educational outcomes in children and adolescents: A systematic review. *Am J Epidemiol.* (In press).

American Journal of Epidemiology

Preview

From: ajeadmin@jhu.edu

To: taren.sanders@acu.edu.au

CC: katrina.wilhite@acu.edu.au, bridget.booker@acu.edu.au, bhua7802@uni.sydney.edu.au, devan@uow.edu.au, lucy.corbett@sydney.edu.au, philip.parker@acu.edu.au, michael.noetel@acu.edu.au, chris.rissel@flinders.edu.au, chris.lonsdale@acu.edu.au, bdelpozocruz@health.sdu.dk

Subject: AJE-00163-2022.R1 - (Decision)/ American Journal of Epidemiology

Body: 14-Sep-2022

Re: AJE-00163-2022.R1 (Decision)

Dear Dr. Taren Sanders:

I am pleased to tell you that your manuscript (AJE-00163-2022.R1) entitled, "Combinations of Physical Activity, Sedentary Behavior, and Sleep and their Associations with Physical, Psychological, and Educational Outcomes in Children and Adolescents: A Systematic Review", has been accepted for publication in the American Journal of Epidemiology, conditional upon this final technical review. See "Technical Review" attachment - all items must be addressed before this article can be processed for publication.

Please direct any questions concerning this technical review to the Journal Manager: ajeadmin@jhu.edu

We will begin processing this article for publication as soon as these revisions are received.

Please upload your revised manuscript (title page, abstract, text, references, tables, etc. submitted as one file) along with your figure files, and web material (if applicable) at our web site with a cover letter explaining the revisions made or reasons why certain revisions could not be made.

We look forward to receiving your revision.

Congratulations,

Dr. Sunni Mumford
Editor, AJE

American Journal of Epidemiology
https://mc.manuscriptcentral.com/aje

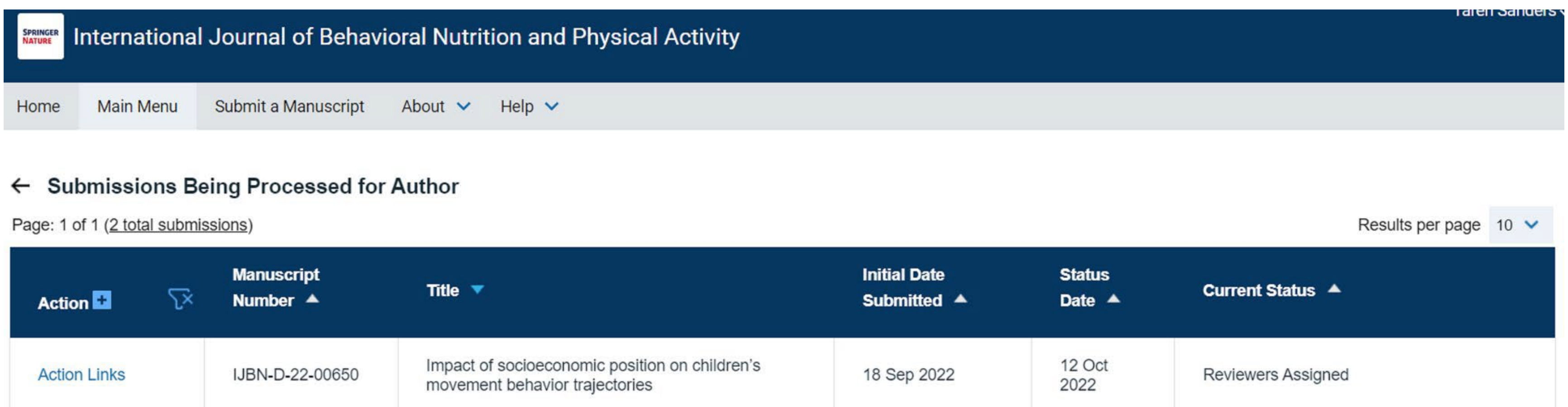
Date Sent: 14-Sep-2022

File 1: AJE-Title-Page-Form.docx

File 2: Technical-Review---AJE-00163-2022.pdf

File 3: * Twitter-Checklist.pdf

2. Impact of Socioeconomic Position on Children's Movement Behavior Trajectories: Submitted and under review at the *International Journal of Behavioral Nutrition and Physical Activity* (IF = 8.915).


International Journal of Behavioral Nutrition and Physical Activity

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Submissions Being Processed for Author

Page: 1 of 1 (2 total submissions)

Results per page 10

Action	Manuscript Number	Title	Initial Date Submitted	Status Date	Current Status
Action Links	IJBN-D-22-00650	Impact of socioeconomic position on children's movement behavior trajectories	18 Sep 2022	12 Oct 2022	Reviewers Assigned

Statement of contribution of authors

Combinations of Physical Activity, Sedentary Behavior, and Sleep and their Associations with Physical, Psychological, and Educational Outcomes in Children and Adolescents: a Systematic Review

I acknowledge that my contribution to the paper is 70%. Conceived and designed the study; conducted searches; performed screening, study selection, and data extraction; analysed and interpreted the data; drafted the manuscript; actioned feedback from co-authors	[redacted] Katrina L Wilhite
I acknowledge that my contribution to the paper is 3%. Performed screening, study selection, and data extraction; critically evaluated manuscript	[redacted] Bridget Booker
I acknowledge that my contribution to the paper is 3%. Performed screening, study selection, and data extraction; critically evaluated manuscript	[redacted] Bo-Huei Huang
I acknowledge that my contribution to the paper is 3%. Performed screening, study selection, and data extraction; critically evaluated manuscript	[redacted] Devan Antczak
I acknowledge that my contribution to the paper is 3%. Performed screening, study selection, and data extraction; critically evaluated manuscript	[redacted] Lucy Corbett
I acknowledge that my contribution to the paper is 3%. Designed the study; helped analyse and interpret the data; provided input on the manuscript draft; critically evaluated manuscript	[redacted] Philip Parker
I acknowledge that my contribution to the paper is 3%.	

Designed the study; helped analyse and interpret the data; provided input on the manuscript draft; critically evaluated manuscript	[redacted] Michael Noetel
I acknowledge that my contribution to the paper is 3%. Conceived and designed the study; critically evaluated manuscript	[redacted] Chris Rissel
I acknowledge that my contribution to the paper is 3%. Conceived and designed the study; provided input on the manuscript draft; critically evaluated manuscript	[redacted] Chris Lonsdale
I acknowledge that my contribution to the paper is 3%. Conceived and designed the study; provided input on the manuscript draft; critically evaluated manuscript	[redacted] Borja del Pozo Cruz
I acknowledge that my contribution to the paper is 3%. Conceived and designed the study; helped analyse and interpret the data; provided input of the manuscript draft; critically evaluated manuscript	[redacted] Taren Sanders

Impact of Socioeconomic Position on Children's Movement Behavior Trajectories

I acknowledge that my contribution to the paper is 72%. Conceived and designed the study; analysed and interpreted the data; drafted the manuscript; actioned feedback from co-authors	[redacted] Katrina L Wilhite
I acknowledge that my contribution to the paper is 4%. Conceived and designed the study; critically evaluated manuscript	[redacted] Borja del Pozo Cruz
I acknowledge that my contribution to the paper is 4%. Helped analyse and interpret the data; critically evaluated manuscript	[redacted] Michael Noetel
I acknowledge that my contribution to the paper is 4%. Conceived and designed the study; provided input on the manuscript draft; critically evaluated manuscript	[redacted] Chris Lonsdale
I acknowledge that my contribution to the paper is 4%. Designed the study; critically evaluated manuscript	[redacted] Nicola D Ridgers
I acknowledge that my contribution to the paper is 4%. Designed the study; critically evaluated manuscript	[redacted] Carol Maher

I acknowledge that my contribution to the paper is 4%. Designed the study; helped interpret data; critically evaluated manuscript	[redacted] Emma Bradshaw
I acknowledge that my contribution to the paper is 4%. Conceived and designed the study; helped analyse and interpret data; provided input on the manuscript draft; critically evaluated manuscript	[redacted] Taren Sanders

Conferences

I presented "Combinations of Physical Activity, Sedentary Behavior, and Sleep and their Associations with Physical, Psychological, and Educational Outcomes in Children and Adolescents: A Systematic Review" at the 2022 International Society of Behavioral Nutrition and Physical Activity conference in Phoenix, Arizona.

From: ISBNPA 2022 Secretariat <annualmeeting@isbnpa.org>
Sent: Saturday, March 12, 2022 9:15 AM
To: Katrina Wilhite <katrina.wilhite@myacu.edu.au>
Subject: Late Abstract Notification - Live poster presentation

Mar 11, 2022
Dear Katrina Wilhite,
Thank you for submitting a late abstract for the **ISBNPA 2022 Annual Meeting** to be held **May 18-21, 2022**, in Phoenix, Arizona, USA.

The review process is now completed, and we are pleased to inform you that the abstract(s) listed below has been selected as a **poster to present live/ in-person.**

Please find your presentation details below:

Title	Combinations of Physical Activity, Sedentary Behavior, and Sleep and their Associations with Health and Non-health Outcomes in Children and Adolescents: A Systematic Review
Paper Number	556
Session Details	Posters - Saturday Saturday, May 21, 2022 10:50 AM - 12:05 PM
Presenting Author	Miss Katrina Wilhite Affiliations: Australian Catholic University

Appendix A.1 School Sedentary Behaviour Recommendations

A healthy school-day includes:

- Breaking up periods of extended sedentary behaviour with both scheduled and unscheduled movement breaks
    - At least once every 30 minutes for ages 5-11 years.
    - At least once every hour for ages 12-18 years.
    - Consider a variety of intensities and durations (e.g., standing, stretching breaks, moving to another classroom, active lessons, active breaks).

- Incorporating different types of movement (e.g., light activities that require movement of any body parts, and moderate to vigorous activities that require greater physical effort) into homework whenever possible, and limiting sedentary homework to no more than 10 minutes per day, per grade level. For example, in Canada this means typically no more than 10 minutes per day in grade 1, or 60 minutes per day in grade 6[1].

- Regardless of the location, school-related screen time should be meaningful, mentally or physically active, and serve a specific pedagogical purpose that enhances learning compared to alternative methods. When school-related screen time is warranted:
    - Limit time on devices, especially for students 5-11 years of age.
    - Take a device break at least once every 30 minutes.
    - Discourage media-multitasking in the classroom and while doing homework.
    - Avoid screen-based homework within an hour of bedtime.

- Replacing sedentary learning activities with movement-based learning activities (including standing) and replacing screen-based learning activities with non-screen-based learning activities (e.g., outdoor lessons), can further support students' health and wellbeing.

[1]. For examples in other countries, visit www.sedentarybehaviour.org.

References

1. Saunders TJ, Rollo S, Kuzik N, et al. International school-related sedentary behaviour recommendations for children and youth. *Int J Behav Nutr Phys Act.* 2022;19(1):39.

Appendix B.1 Search Strategy by Database

MEDLINE:

S1 (MH “Exercise+”)
S2 (MH “Motor Activity+”)
S3 (MH “Physical Exertion+”)
S4 (MH “Sports+)
S5 TI/AB physic* N2 activ*
S6 TI/AB exercis* or sport*
S7 S1 or S2 or S3 or S4 or S5 or S6
S8 (MH “Sedentary Behavior+”)
S9 TI/AB sedentar*
S10 TI/AB low N2 “energy expenditure”
S11 TI/AB television or “screen time”
S12 TI/AB physical* N2 inactiv*
S13 S8 or S9 or S10 or S11 or S12
S14 (MH “Sleep+”)
S15 TI/AB sleep N2 duration
S16 TI/AB sleep
S17 S14 or S15 or S16
S18 (MH “Child+”)
S19 (MH “Adolescent+”)
S20 (MH “Students+”)
S21 TI/AB child* or adolescen* or “school age*” or boy* or girl* or student*
S22 S18 or S19 or S20 or S21
S23 S7 and S13 and S22
S24 S7 and S17 and S22
S25 S13 and S17 and S22
S26 S23 or S24 or S25

Filter: “all child: 0-18 years”

CINAHL:
S1 (MH "Exercise+")
S2 (MH "Motor Activity+")
S3 (MH "Physical Activity+")
S4 (MH "Sports+")
S5 TI/AB exercis* or sport*
S6 TI/AB physic* N2 activ*
S7 S1 or S2 or S3 or S4 or S5 or S6
S8 TI/AB sedentar*
S9 TI/AB “screen time” or television
S10 TI/AB low N2 “energy expenditure”
S11 TI/AB physical* N2 inactiv*
S12 S8 or S9 or S10 or S11
S13 (MH "Sleep+")
S14 TI/AB sleep N2 duration
S15 TI/AB sleep
S16 S13 or S14 or S15
S17 (MH “Child+”)
S18 (MH “Adolescence+”)
S19 (MH “Students+”)
S20 TI/AB child* or adolescen* or student* or “school age*” or boy* or girl*
S21 S17 or S18 or S19 or S20
S22 S7 and S12 and S21
S23 S7 and S16 and S21
S24 S12 and S16 and S21
S25 S22 or S23 or S24

Filter: “all child”

PsycINFO:
S1 (MJ Exercise)
S2 (MJ "Movement Therapy")
S3 (MJ "Physical Activity")
S4 (MJ "Sports")
S5 TI/AB sport* or exercis*
S6 TI/AB physic* N2 activ*
S7 S1 or S2 or S3 or S4 or S5 or S6
S8 (MJ "Sedentary Behavior")
S9 TI/AB sedentar*
S10 TI/AB "screen time" or television
S11 TI/AB low N2 "energy expenditure"
S12 TI/AB physical* N2 inactiv*
S13 S8 or S9 or S10 or S11 or S12
S14 (MJ "Sleep")
S15 (MJ "Sleep Deprivation")
S16 (MJ "Sleep Onset")
S17 TI/AB sleep N2 duration
S18 TI/AB sleep
S19 S14 or S15 or S16 or S17 or S18
S20 (MJ "Child")
S21 (MJ "Adolescent")
S22 (MJ "Students")
S23 TI/AB child* or adolescen* or student* or "school age*" or boy* or girl*
S24 S20 or S21 or S22 or S23
S25 S7 and S13 and S24
S26 S7 and S19 and S24
S27 S13 and S19 and S24
S28 S25 or S26 or S27

Filter: "childhood (birth-12 yrs)", "adolescence (13-17 yrs)"

SPORTDiscus:
S1 (SU "Exercise")
S2 (SU "Physical Activity")
S3 (SU "Sports")
S4 TI/AB sport* or exercis*
S5 TI/AB physic* N2 activ*
S6 S1 or S2 or S3 or S4 or S5
S7 (SU “Sedentary Behavior”)
S8 TI/AB sedentar*
S9 TI/AB “screen time” or television
S10 TI/AB low N2 “energy expenditure”
S11 TI/AB physical* N2 inactiv*
S12 S7 or S8 or S9 or S10 or S11
S13 (SU "Sleep")
S14 (SU "Sleep Deprivation")
S15 (SU “Sleep Stages”)
S16 (SU “Sleep Hygiene”)
S17 TI/AB sleep N2 duration
S18 TI/AB sleep
S19 S13 or S14 or S15 OR S16 or S17 or S18
S20 (SU “Child”)
S21 (SU “Adolescent”)
S22 (SU “Students”)
S23 TI/AB child* or adolescen* or student* or “school age*” or boy* or girl*
S24 S20 or S21 or S22 or S23
S25 S6 and S12 and S24
S26 S6 and S19 and S24
S27 S12 and S19 and S24
S28 S25 or S26 or S27

ERIC:

S1 (SU "Exercise")
S2 (SU "Physical Activity")
S3 (SU "Sports")
S4 TI/AB sport* or exercis*
S5 TI/AB physic* N2 activ*
S6 S1 or S2 or S3 or S4 or S5
S7 TI/AB sedentar*
S8 TI/AB “screen time” or television
S9 TI/AB low N2 “energy expenditure”
S10 TI/AB physical* N2 inactiv*
S11 S7 or S8 or S9 or S10
S12 (SU "Sleep")
S13 TI/AB sleep N2 duration
S14 TI/AB sleep
S15 S12 or S13 or S14
S16 (SU “Child”)
S17 (SU “Adolescents”)
S18 (SU “Students”)
S19 TI/AB child* or adolescen* or student* or “school age*” or boy* or girl*
S20 S16 or S17 or S18 or S19
S21 S6 and S11 and S20
S22 S6 and S15 and S20
S23 S11 and S15 and S20
S24 S21 or S22 or S23

Embase:

S1 (SH "Exercise")
S2 (SH "Motor Activity")
S3 (SH "Physical Activity")
S4 (SH "Sports")
S5 TI/AB sport* or exercis*
S6 TI/AB “physical activity” or “physically active”
S7 S1 or S2 or S3 or S4 or S5 or S6
S8 (SH “Sedentary Behavior”)
S9 TI/AB sedentar*
S10 TI/AB “screen time” or television
S11 TI/AB “low energy expenditure”
S12 TI/AB “physically inactive” or “physical inactivity”
S13 S8 or S9 or S10 or S11 or S12
S14 (SH "Sleep")
S15 (SH "Sleep Deprivation")
S16 (SH “Sleep Latency”)
S17 (SH “Sleep Hygiene”)
S18 TI/AB sleep
S19 S14 or S15 or S16 or S17 or S18
S20 (SH “Child”)
S21 (MH “Adolescent”)
S22 (MH “Students”)
S23 TI/AB child* or adolescen* or student* or “school age*” or boy* or girl*
S24 S20 or S21 or S22 or S23
S25 S7 and S13 and S24
S26 S7 and S19 and S24
S27 S13 and S19 and S24
S28 S25 or S26 or S27

PubMed:

S1 (MH "Exercise")
S2 (MH "Motor Activity")
S3 (MH "Physical Exertion")
S4 (MH "Sports")
S5 TI/AB sport* or exercis*
S6 TI/AB “physically active” or “physical activity”
S7 S1 or S2 or S3 or S4 or S5 or S6
S8 (MH “Sedentary Behavior”)
S9 TI/AB sedentar*
S10 TI/AB “screen time” or television
S11 TI/AB “low energy expenditure”
S12 TI/AB “physically inactive” or “physical inactivity”
S13 S8 or S9 or S10 or S11 or S12
S14 (MH "Sleep")
S15 (MH "Sleep Deprivation")
S16 (MH “Sleep Stages”)
S17 (MH “Sleep Latency”)
S18 (MH “Sleep Hygiene”)
S19 TI/AB sleep
S20 S14 or S15 or S16 or S17 or S18 or S19
S21 (MH “Child”)
S22 (MH “Adolescent”)
S23 (MH “Students”)
S24 TI/AB child* or adolescen* or student* or “school age*” or boy or girl
S25 S21 or S22 or S23 or S24
S26 S7 and S13 and S25
S27 S7 and S20 and S25
S28 S13 and S20 and S25
S29 S26 or S27 or S28

Filter: “child: birth-18 years”

Appendix B.2 Canadian 24-hour Movement Behaviour Guidelines for Children and Youth

A healthy 24 hours includes:

- Uninterrupted 9 to 11 hours of sleep per night for those aged 5-13 years and 8 to 10 hours per night for those aged 14-17 years, with consistent bed and wake-up times;
- An accumulation of at least 60 minutes per day of moderate to vigorous physical activity involving a variety of aerobic activities. Vigorous physical activities and muscle and bone strengthening activities should each be incorporated at least 3 days per week;
- Several hours of a variety of structured and unstructured light physical activities;
- No more than 2 hours per day of recreational screen time;
- Limited sitting time for extended periods. (1)

References

1. Tremblay MS, Carson V, Chaput J-P, Connor Gorber S, Dinh T, Duggan M, et al. Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep. Appl Physiol Nutr Metab. 2016 Jun;41(6 Suppl 3):S311–27.

Appendix B.3 Excluded Studies

Citation	Exclusion Reason
1 Laurson, K, Lee, J, Gentile, D, et al. Concurrent Associations between Physical Activity, Screen Time, and Sleep Duration with Childhood Obesity. *ISRN Obes* 2014;:204540	Effects of Movement Behaviours Could Not be Determined [Near Miss 1]
2 Huang, R, Ho, S, Lo, W, et al. Physical activity and constipation in Hong Kong adolescents.. *PloS one* 2014;9:e90193	Effects of Movement Behaviours Could Not be Determined [Near Miss 1]
3 Faught, E, Ekwaru, J, Gleddie, D, et al. The combined impact of diet, physical activity, sleep and screen time on academic achievement: A prospective study of elementary school students in Nova Scotia, Canada. *The International Journal of Behavioral Nutrition and Physical Activity* 2017;14:	Effects of Movement Behaviours Could Not be Determined [Near Miss 1]
4 Patte, K, Faulkner, G, Qian, W, et al. Are one-year changes in adherence to the 24-hour movement guidelines associated with depressive symptoms among youth?. *BMC Public Health* 2020;20:793	Effects of Movement Behaviours Could Not be Determined [Near Miss 1]
5 Howie, E, Joosten, J, Harris, C, et al. Associations between meeting sleep, physical activity or screen time behaviour guidelines and academic performance in Australian school children. *BMC Public Health* 2020;20:520	Effects of Movement Behaviours Could Not be Determined [Near Miss 1]
6 Katzmarzyk, P, Staiano, A . Relationship Between Meeting 24-Hour Movement Guidelines and Cardiometabolic Risk Factors in Children.. *Journal of physical activity & health* 2017;14:779-784	Effects of Movement Behaviours Could Not be Determined [Near Miss 1]
7 Ferrar, K, Olds, T, Maher, C, et al. Time use clusters of New Zealand adolescents are associated with weight status, diet and ethnicity. 2013;37:39-46	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
8 Zhao, J, Mackay, L, Chang, K, et al. Visualising Combined Time Use Patterns of Children's Activities and Their Association with Weight Status and Neighbourhood Context.. *International journal of environmental research and public health* 2019;16:	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
9 Xiao, Y. Wenhua, L Cumulative Health Risk Behaviors and Adolescent Suicide: The Moderating Role of Future Orientation.. *American Journal of Health Behavior* 2019;43:1086-1102	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
10 Narcisse, M, Long, C, Felix, H, et al. Adherence to sleep guidelines reduces risk of overweight/obesity in addition to 8-5-2-1-0 guidelines among a large sample of adolescents in the United States.. *Sleep health* 2019;5:444-451	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
11 Morales, E, Strachan, D, Asher, I, et al. Combined impact of healthy lifestyle factors on risk of asthma, rhinoconjunctivitis and eczema in school children: ISAAC phase III.. *Thorax* 2019;74:531-538	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]

12 Marques, A, Demetriou, Y, Tesler, R, et al. Healthy Lifestyle in Children and Adolescents and Its Association with Subjective Health Complaints: Findings from 37 Countries and Regions from the HBSC Study.. *International journal of environmental research and public health* 2019;16:	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
13 Magee, C, Caputi, P, Iverson, D. Patterns of health behaviours predict obesity in Australian children. *Journal of Paediatrics and Child Health* 2013;49:291-296	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
14 Loewen, O, Maximova, K, Ekwaru, J, et al. Adherence to Life-Style Recommendations and Attention-Deficit/Hyperactivity Disorder: A Population-Based Study of Children Aged 10 to 11 Years. *Psychosom Med* 2020;82:305-315	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
15 Landsberg, B, Plachta-Danielzik, S, Lange, D, et al. Clustering of lifestyle factors and association with overweight in adolescents of the Kiel Obesity Prevention Study.. *Public health nutrition* 2010;13:1708-1715	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
16 Iannotti, R, Wang, J . Patterns of physical activity, sedentary behavior, and diet in US adolescents. *Journal of Adolescent Health* 2013;53:280-286	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
17 Hu, E, Ramachandran, S, Bhattacharya, K, et al. Obesity Among High School Students in the United States: Risk Factors and Their Population Attributable Fraction.. *Preventing chronic disease* 2018;15:E137	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
18 Hartz J, Yingling L, Ayers C.et al. The relationship between clustering of cardiovascular health behaviors and physical fitness among U.S. adolescents-data from the national health and nutrition examination survey. *Circulation* 2016;134:	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
19 Gubbels, J, Kremers, S, Stafleu, A, et al. Clustering of energy balance-related behaviors in 5-year-old children: Lifestyle patterns and their longitudinal association with weight status development in early childhood. *The International Journal of Behavioral Nutrition and Physical Activity* 2012;9:	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
20 Gopinath, B, Louie, J, Flood, V, et al. Influence of obesogenic behaviors on health-related quality of life in adolescents.. *Asia Pacific journal of clinical nutrition* 2014;23:121-127	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
21 De Visser R, Sylvester R, Jiang Q.et al. Health behaviors predicts cardiovascular risk profile in middle-school children. *Journal of the American College of Cardiology* 2016;67:1920	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
22 Cameron, A, Crawford, D, Salmon, J, et al. Clustering of obesity-related risk behaviors in children and their mothers.. *Annals of epidemiology* 2011;21:95-102	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
23 Zhang, Y, Zhang, D, Li, X, et al. Daily Time-Use Patterns and Obesity and Mental Health among Primary School Students in Shanghai: A Population-Based Cross-Sectional Study. *Sci Rep* 2017;7:16200	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]

24 Yang-Huang, J, van Grieken, A, Wang, L, et al. Clustering of Sedentary Behaviours, Physical Activity, and Energy-Dense Food Intake in Six-Year-Old Children: Associations with Family Socioeconomic Status. *Nutrients* 2020;12:	Effects of Movement Behaviours Could Not be Determined Near Miss 2
25 O'Neill, A, Dowd, K, O'Gorman, C, et al. Activity Profiles and the Associations With Weight Status in Population Studies of Young Children: Are There Gender Differences?. *Pediatric exercise science* 2017;29:131-144	Effects of Movement Behaviours Could Not be Determined Near Miss 2
26 Sevil-Serrano, J, Aibar-Solana, A, Abós, Á, et al. Healthy or Unhealthy? The Cocktail of Health-Related Behavior Profiles in Spanish Adolescents.. *International journal of environmental research and public health* 2019;16:	Effects of Movement Behaviours Could Not be Determined Near Miss 2
27 Werneck, A, Agostinete, R, Cayres, S, et al. Association between Cluster of Lifestyle Behaviors and HOMA-IR among Adolescents: ABCD Growth Study.. *Medicina (Kaunas, Lithuania)* 2018;54:	Effects of Movement Behaviours Could Not be Determined Near Miss 2
28 Wijnhoven, T, van Raaij, J, Yngve, A, et al. WHO European Childhood Obesity Surveillance Initiative: health-risk behaviours on nutrition and physical activity in 6-9-year-old schoolchildren.. *Public health nutrition* 2015;18:3108-3124	Effects of Movement Behaviours Could Not be Determined Near Miss 2
29 Lopez-Gonzalez, D, Partida-Gaytán, A, Wells, J, et al. Obesogenic Lifestyle and Its Influence on Adiposity in Children and Adolescents, Evidence from Mexico. *Nutrients* 2020;12:	Effects of Movement Behaviours Could Not be Determined Near Miss 2
30 Mandic, S, García Bengoechea, E, Coppell, K, et al. Clustering of (un)healthy behaviors in adolescents from Dunedin, New Zealand. *American Journal of Health Behavior* 2017;41:266-275	Effects of Movement Behaviours Could Not be Determined Near Miss 2
31 Dumuid, D, Olds, T, Lewis, L, et al. The adiposity of children is associated with their lifestyle behaviours: A cluster analysis of schoolâ€ aged children from 12 nations. *Pediatric Obesity* 2018;13:111-119	Effects of Movement Behaviours Could Not be Determined Near Miss 2
32 Schröder, H, Bawaked, R, Ribas-Barba, L, et al. Cumulative Effect of Obesogenic Behaviours on Adiposity in Spanish Children and Adolescents.. *Obesity facts* 2017;10:584-596	Effects of Movement Behaviours Could Not be Determined Near Miss 2
33 Martinez-Gomez, D, Moreno, L, Romeo, J, et al. Combined influence of lifestyle risk factors on body fat in Spanish adolescents--the Avena study.. *Obesity facts* 2011;4:105-111	Effects of Movement Behaviours Could Not be Determined Near Miss 2
34 Bélanger, M, Dugas, C, Perron, J, et al. Association between lifestyle habits and adiposity values among children exposed and unexposed to gestational diabetes mellitus in utero.. *Diabetes & metabolic syndrome* 2019;13:2947-2952	Effects of Movement Behaviours Could Not be Determined Near Miss 2
35 Bawaked, R, Fernández-Barrés, S, Navarrete-Muñoz, E, et al. Impact of lifestyle behaviors in early childhood on obesity and cardiometabolic risk in children: Results from the Spanish INMA birth cohort study.. *Pediatric Obesity* 2020;15:N.PAG-N.PAG	Effects of Movement Behaviours Could Not be Determined Near Miss 2
36 Mozzillo, E, Zito, E, Maffeis, C, et al. Unhealthy lifestyle habits and diabetes-specific health-related quality of life in youths with type 1 diabetes.. *Acta diabetologica* 2017;54:1073-1080	Effects of Movement Behaviours Could Not be Determined Near Miss 2

37 de Souza Dantas, M, Dos Santos, M, Lopes, L, et al. Clustering of Excess Body Weight-Related Behaviors in a Sample of Brazilian Adolescents.. *Nutrients* 2018;10:	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
38 Kovács, E, Hunsberger, M, Reisch, L, et al. Adherence to combined lifestyle factors and their contribution to obesity in the IDEFICS study.. *Obesity reviews : an official journal of the International Association for the Study of Obesity* 2015;16 Suppl 2:138-150	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
39 Iaccarino Idelson, P, Scalfi, L, Vaino, N, et al. Healthy behaviours and abdominal adiposity in adolescents from southern Italy.. *Public health nutrition* 2014;17:353-360	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
40 Bel-Serrat, S, Ojeda-Rodríguez, A, Heinen, M, et al. Clustering of Multiple Energy Balance-Related Behaviors in School Children and its Association with Overweight and Obesity-WHO European Childhood Obesity Surveillance Initiative (COSI 2015â »2017).. *Nutrients* 2019;11:	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
41 Burns, R, Pfledderer, C, Fu, Y. Adolescent Health Behaviors and Difficulty Concentrating, Remembering, and Making Decisions. *American Journal of Lifestyle Medicine* 2019;:1559827619860067	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
42 Cabanas-Sánchez, V, Martínez-Gómez, D, Izquierdo-Gómez, R, et al. Association between Clustering of Lifestyle Behaviors and Health-Related Physical Fitness in Youth: The UP&DOWN Study.. *The Journal of pediatrics* 2018;199:41	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
43 Continente, X, Pérez, A, Espelt, A, et al. Multiple lifestyle risk behaviours and excess weight among adolescents in Barcelona, Spain.. *Gaceta sanitaria* 2017;31:332-335	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
44 Cureau, F, Sparrenberger, K, Bloch, K, et al. Associations of multiple unhealthy lifestyle behaviors with overweight/obesity and abdominal obesity among Brazilian adolescents: A country-wide survey. *Nutrition, Metabolism and Cardiovascular Diseases* 2018;28:765-774	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
45 Santaliestra-Pasías, A, Mouratidou, T, Reisch, L, et al. Clustering of lifestyle behaviours and relation to body composition in European children. The IDEFICS study.. *European journal of clinical nutrition* 2015;69:811-816	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
46 Hartz, J, Yingling, L, Ayers, C, et al. Clustering of health behaviors and cardiorespiratory fitness among US adolescents. *Journal of Adolescent Health* 2018;62:583-590	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
47 Leis, R, Jurado-Castro, J, Llorente-Cantarero, F, et al. Cluster Analysis of Physical Activity Patterns, and Relationship with Sedentary Behavior and Healthy Lifestyles in Prepubertal Children: Genobox Cohort.. *Nutrients* 2020;12:1288-1288	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
48 Matias, T, Lopes, M, de Mello, G, et al. Clustering of obesogenic behaviors and association with body image among Brazilian adolescents in the national school-based health survey (PeNSE 2015). *Prev Med Rep* 2019;16:101000	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]

49 Moraes M, Fernandez-Alvira J.M, Da Veiga G.V.et al. Cross-sectional and longitudinal associations between clustering of multiple lifestyle behaviors and adiposity indicators: The Elana middle school cohort. *Annals of Nutrition and Metabolism* 2017;71:544	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
50 Bel-Serrat, S, Mouratidou, T, Santaliestra-Pasías, A, et al. Clustering of multiple lifestyle behaviours and its association to cardiovascular risk factors in children: the IDEFICS study.. *European journal of clinical nutrition* 2013;67:848-854	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
51 Seghers, J, Rutten, C . Clustering of multiple lifestyle behaviours and its relationship with weight status and cardiorespiratory fitness in a sample of Flemish 11- to 12-year-olds.. *Public health nutrition* 2010;13:1838-1846	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
52 Nuutinen, T, Lehto, E, Ray, C, et al. Clustering of energy balance-related behaviours, sleep, and overweight among Finnish adolescents. *International Journal of Public Health* 2017;62:929-938	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
53 Leech, R, McNaughton, S, Timperio, A. Clustering of diet, physical activity and sedentary behaviour among Australian children: Cross-sectional and longitudinal associations with overweight and obesity. *International Journal of Obesity* 2015;39:1079-1085	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
54 Toschke, A, Rückinger, S, Böhler, E, et al. Adjusted population attributable fractions and preventable potential of risk factors for childhood obesity.. *Public health nutrition* 2007;10:902-906	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
55 Xiao, Y, Romanelli, M, Lindsey, M. A latent class analysis of health lifestyles and suicidal behaviors among US adolescents. *Journal of Affective Disorders* 2019;255:116-126	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
56 Moreira, N, da Veiga, G, Santaliestra-Pasías, A, et al. Clustering of multiple energy balance related behaviors is associated with body fat composition indicators in adolescents: Results from the HELENA and ELANA studies. *Appetite* 2018;120:505-513	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
57 Guo, X, Zhang, X, Li, Y, et al. Differences in healthy lifestyles between prehypertensive and normotensive children and adolescents in Northern China.. *Pediatric cardiology* 2012;33:222-228	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
58 Laxer, R, Brownson, R, Dubin, J, et al. Clustering of risk-related modifiable behaviours and their association with overweight and obesity among a large sample of youth in the COMPASS study. *BMC Public Health* 2017;17:102	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
59 Jackson, T. Combined Effects of Restaurant Eating, Television Viewing, and Moderate-to-Vigorous Physical Activity on Obesity among Low-Income Texas 5th Grade School Children. 2017;:49	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]
60 Straker, L, Smith, A, Hands, B. Computer use clusters, sedentary activity and moderate/vigorous physical activity in Australian adolescents. *Journal of Science & Medicine in Sport* 2010;12:e139-e140	Effects of Movement Behaviours Could Not be Determined [Near Miss 2]

61 Adelantado-Renau, M, Beltran-Valls, M, Migueles, J, et al. Associations between objectively measured and selfâ€ reported sleep with academic and cognitive performance in adolescents: DADOS study. *Journal of Sleep Research* 2019;28:1-9	Combination of Movement Behaviors Not Analyzed Near Miss 2
62 Song, J, Song, Q, Wang, S, et al. Physical Activity and Sedentary Behaviors Modify the Association between Melanocortin 4 Receptor Gene Variant and Obesity in Chinese Children and Adolescents.. *PloS one* 2017;12:e0170062	Effects of Movement Behaviours Could Not be Determined
63 Chaput, J, Barnes, J, Tremblay, M, et al. Thresholds of physical activity associated with obesity by level of sedentary behaviour in children. *Pediatric Obesity* 2018;13:450-457	Effects of Movement Behaviours Could Not be Determined
64 Devís-Devís, J, Lizandra, J, Valencia-Peris, A, et al. Longitudinal changes in physical activity, sedentary behavior and body mass index in adolescence: Migrations towards different weight cluster. *PloS one* 2017;12:e0179502	Effects of Movement Behaviours Could Not be Determined
65 Herring, M, Monroe, D, Kline, C, et al. Sleep quality moderates the association between physical activity frequency and feelings of energy and fatigue in adolescents. *European Child & Adolescent Psychiatry* 2018;27:1425-1432	Combination of Movement Behaviors Not Analyzed
66 Broadney, M, Belcher, B, Berrigan, D, et al. Effects of Interrupting Sedentary Behavior With Short Bouts of Moderate Physical Activity on Glucose Tolerance in Children With Overweight and Obesity: A Randomized Crossover Trial.. *Diabetes care* 2018;41:2220-2228	No Outcome Assessed
67 Schwarzfischer, P, Gruszfeld, D, Socha, P, et al. Longitudinal analysis of physical activity, sedentary behaviour and anthropometric measures from ages 6 to 11 years. *The International Journal of Behavioral Nutrition and Physical Activity* 2018;15:	Effects of Movement Behaviours Could Not be Determined
68 Kremer, P, Elshaug, C, Leslie, E, et al. Physical activity, leisure-time screen use and depression among children and young adolescents. *J Sci Med Sport* 2014;17:183-7	Effects of Movement Behaviours Could Not be Determined
69 Peiró-Velert, C, Valencia-Peris, A, González, L, et al. Screen media usage, sleep time and academic performance in adolescents: clustering a self-organizing maps analysis.. *PloS one* 2014;9:e99478	No Outcome Assessed
70 Lucas-de la Cruz, L, Martínez-Vizcaíno, V, Cañete García-Prieto, J, et al. Movement behaviors and cardiometabolic risk in schoolchildren.. *PloS one* 2018;13:e0207300	Combination of Movement Behaviors Not Analyzed
71 Dumuid, D, Pedišić, Ž, Palarea-Albaladejo, J, et al. Compositional Data Analysis in Time-Use Epidemiology: What, Why, How. *Int J Environ Res Public Health* 2020;17:	Effects of Movement Behaviours Could Not be Determined
72 Drenowatz, C, Greier, K . Cross-sectional and longitudinal association of sports participation, media consumption and motor competence in youth.. *Scandinavian journal of medicine & science in sports* 2019;29:854-861	Combination of Movement Behaviors Not Analyzed
73 Moura, B, Rufino, R, Faria, R, et al. Can Replacing Sitting Time with Standing Time Improve Adolescents' Cardiometabolic Health?. *Int J Environ Res Public Health* 2019;16:	Effects of Movement Behaviours Could Not be Determined

74 Huang, W, Wong, S, He, G, et al. Isotemporal Substitution Analysis for Sedentary Behavior and Body Mass Index.. *Medicine and science in sports and exercise* 2016;48:2135-2141	Duplicate
75 Jones, M, Skidmore, P, Stoner, L, et al. Associations of Short Bout Sedentary Behavior and Physical Activity with Adiposity and Fitness in Children: 1895 Board #156 May 31 2:00 PM - 3:30 PM.. *Medicine & Science in Sports & Exercise* ;50:454-455	Duplicate
76 Mitchell, T, Steele, R . Latent Profiles of Physical Activity and Sedentary Behavior in Elementary School-Age Youth:Associations With Health-Related Quality of Life. *Journal of Pediatric Psychology* 2017;43:723-732	Not Original Research
77 TV Viewing and Leg Strength.. *School Health Alert* 2012;28:7-7	Not Original Research
78 Jones P.R, Kvalheim O.M, Resaland G.K.et al. Lipoprotein subclasses and their associations with physical activity, cardiorespiratory fitness and adiposity in Norwegian schoolchildren: The active smarter kids study. *European Heart Journal* 2018;39:1105	Effects of Movement Behaviours Could Not be Determined
79 Omorou, A, Manneville, F, Langlois, J, et al. Physical activity rather than sedentary behaviour is socially determined in French adolescents with overweight and obesity. *Prev Med* 2020;134:106043	Effects of Movement Behaviours Could Not be Determined
80 Nesbit, K, Low, J, Sisson, S. Adolescent BMI trajectories with clusters of physical activity and sedentary behaviour: an exploratory analysis. *Obes Sci Pract* 2016;2:115-122	Combination of Movement Behaviors Not Analyzed
81 Why We Gain Weight.. *IDEA Fitness Journal* 2016;13:87-87	Not Original Research
82 WHO Guidelines Approved by the Guidelines Review Committee. *Guidelines on Physical Activity, Sedentary Behaviour and Sleep for Children under 5 Years of Age* 2019;:	Not Original Research
83 Video game workout?. *Joe Weider's Muscle & Fitness* 1992;53:24	Not Original Research
84 Two Hours of Physical Activity Every Day.. *Motion-Sport in Finland* 2008;:22-23	Not Original Research
85 The early years must be active years.. *Active Living* 2010;19:10-11	Not Original Research
86 Study Snapshot.. *PT: Magazine of Physical Therapy* 2007;15:9-9	Not Original Research
87 Study Snapshot.. *PT: Magazine of Physical Therapy* 2004;12:11-11	Not Original Research
88 Setting Kids Up for Health.. *Vibrant Life* 2014;30:12-12	Not Original Research
89 , .screen time and psychological difficulties in 10-year-olds.. *Brown University Child & Adolescent Behavior Letter* 2011;27:2-2	Not Original Research
90 Research Digest.. *Pediatric Exercise Science* 1998;10:313	Not Original Research

91 Reducing Screen Time: Not an Easy Task.. *School Health Alert* 2012;27:2-2	Not Original Research
92 PT Resource. Physical Activity Fails to Counteract Sedentary Lifestyle in Children.. *PT in Motion* 2012;4:12-12	Not Original Research
93 Prospective associations between measures of gross and fine motor coordination in infants and objectively measured physical activity and sedentary behavior in childhood: Erratum. *Medicine (Baltimore)* 2018;97:e0013	Not Original Research
94 People Are Talking Aboutâ€¦.. *IDEA Fitness Journal* 2008;5:22-22	Not Original Research
95 PeDIATRICS electronic pages.. *Pediatrics* 2006;118:764-787	Not Original Research
96 PE during holidays would tackle 'sedentary lifestyle', campaigners say.. *Community Practitioner* 2016;89:7-7	Not Original Research
97 ParticipACTION hits the media again.. *Active Living* 2007;16:3-3	Not Original Research
98 New study shows sedentary high school girls are at significant risk for future osteoporosis.. *NEWS-Line for Physical Therapists & PT Assistants* 2008;13:6-6	Not Original Research
99 Less sleep = more fat.. *Active Living* 2009;18:30-30	Not Original Research
100 Inactive Kids More Likely to Face Heart Disease.. *IDEA Fitness Journal* 2008;5:16-16	Not Original Research
101 In Briefs.. *American Journal of Health Promotion* 2018;32:505-513	Not Original Research
102 IN BRIEF.. *BMJ: British Medical Journal (Overseas & Retired Doctors Edition)* 2012;345:4-4	Not Original Research
103 How to prevent childhood obesity - news from the IDEFICS study.. *Food Today* ;:2-3	Not Original Research
104 Erratum: Physical Activity and Insomnia, Short Sleep and Insulin Resistance, and Effect of Poor Sleep on Children's Academic Performance. *Am J Respir Crit Care Med* 2016;193:1441	Not Original Research
105 Xu, S, Wan, Y, Xu, Z, et al. [Association between time spent on physical exercise, sleep, homework and suspected myopia among students].. *Zhonghua liu xing bing xue za zhi = Zhonghua liuxingbingxue zazhi* 2016;37:183-186	Combination of Movement Behaviors Not Analyzed
106 Iftikhar, I, Albisher, E, Challapallisri, V, et al. Physical Activity and Insomnia, Short Sleep and Insulin Resistance, and Effect of Poor Sleep on Children's Academic Performance.. *American journal of respiratory and critical care medicine* 2016;193:1058-1060	Combination of Movement Behaviors Not Analyzed
107 Salmon, J, Dunstan, D, Owen, N. Should we be concerned about children spending extended periods of time in sedentary pursuits even among the highly active?. *International journal of pediatric obesity : IJPO : an official journal of the International Association for the Study of Obesity* 2008;3:66-68	Not Original Research

108 Salmon, J. The relationship between children's physical activity, sedentary behaviour, diet and weight status: effectiveness of intervention to increase activity and reduce sedentary behaviour.. *Journal of Science & Medicine in Sport* 2005;8:129-129	No Outcome Assessed
109 Salmon, J, Arundell, L, Hume, C, et al. A cluster-randomized controlled trial to reduce sedentary behavior and promote physical activity and health of 8-9 year olds: the Transform-Us! study.. *BMC public health* 2011;11:759	No Outcome Assessed
110 Park, A. How Exercise Can Help Depression in Kids.. *ASCA Newsletter* 2017;:18-19	Not Original Research
111 Maffeis, C, Tato, L . [What role do physical activity and sedentary life style play in development and maintenance of excess pounds in the child?].. *Archives de pediatrie : organe officiel de la Societe francaise de pediatrie* 1998;5:1191-1196	No full text found
112 Lipman T. Combined influence of physical activity and screen time recommendations on childhood overweight.. *MCN: The American Journal of Maternal Child Nursing* 2009;34:198-198	Not Original Research
113 De O. Forkert E.C, De Moraes A.C.F, Carvalho H.B.et al. Clustering of lifestyle behaviors and abdominal obesity in European and Brazilian adolescents. *European Journal of Epidemiology* 2015;30:791	Effects of Movement Behaviours Could Not be Determined
114 Hillman, C, Schott, N . Der zusammenhang von fitness, kognitiver leistungsfÃ¤higkeit und gehirnzustand im schulkindalter Konsequenzen fÃ¼r die schulische leistungsfÃ¤higkeit = Fitness and cognitive performance in childhood. *Zeitschrift für Sportpsychologie* 2013;20:33-41	Not Original Research
115 Fleming N. Screen time is bad for active kids too.. *New Scientist* 2010;208:16-16	Not Quantitatively Analysed
116 Cliff, D, Dollman, J, Winkler, E. Using pedometers and accelerometers to measure physical activity and sedentary behaviour in children and adults. *Journal of Science & Medicine in Sport* 2010;12:e2-e2	Combination of Movement Behaviors Not Analyzed
117 McNeill, J, Howard, S, Vella, S, et al. Compliance with the 24-Hour movement guidelines for the early years: Cross-sectional and longitudinal associations with executive function and psychosocial health in preschool children. *J Sci Med Sport* 2020;:	Wrong population
118 De Bourdeaudhuij, I, Verloigne, M, Maes, L, et al. Associations of physical activity and sedentary time with weight status among school-aged girls and boys across five European countries. *Journal of Science & Medicine in Sport* 2012;15:S41-S41	Duplicate
119 Altenburg, T, Chinapaw, M, Singh, A. Effects of one versus two bouts of moderate intensity physical activity on selective attention during a school morning in Dutch primary schoolchildren: A randomized controlled trial. *Journal of Science and Medicine in Sport* 2016;19:820-824	Combination of Movement Behaviors Not Analyzed
120 Ajibewa, T, O'Sullivan, M, Nagy, M, et al. The effects of interrupting prolonged sitting with intermittent activity on appetite sensations and subsequent food intake in preadolescent children.. *PloS one* 2017;12:e0188986	Effects of Movement Behaviours Could Not be Determined

121 Brindova, D, Veselska, Z, Klein, D, et al. Is the association between screen-based behaviour and health complaints among adolescents moderated by physical activity?. *International Journal of Public Health* 2015;60:139-145	Effects of Movement Behaviours Could Not be Determined
122 Ayala, A, Salmon, J, Dunstan, D, et al. Does light-intensity physical activity moderate the relationship between sitting time and adiposity markers in adolescents?. *J Sport Health Sci* 2020;:	Effects of Movement Behaviours Could Not be Determined
123 Zhu, Z, Ma, S, Bai, Y, et al. Associations Of Physical Activity And Screen Time With Obesity In Chinese Children And Adolescents: 2854 Board #137 June 1 2:00 PM - 3:30 PM.. *Medicine & Science in Sports & Exercise* ;50:702-702	No full text found
124 Saunders, T, Chaput, J, Goldfield, G, et al. Prolonged sitting and markers of cardiometabolic disease risk in children and youth: a randomized crossover study.. *Metabolism: clinical and experimental* 2013;62:1423-1428	Combination of Movement Behaviors Not Analyzed
125 Park H. Longitudinal relationships between physical activity, sedentary behaviors, and obesity in children and adolescents.. *Longitudinal Relationships Between Physical Activity, Sedentary Behaviors & Obesity in Children & Adolescents* 2007;:302 p-302 p	Effects of Movement Behaviours Could Not be Determined
126 Hovsepian, S, Kelishadi, R, Motlagh, M, et al. Level of physical activity and screen time among Iranian children and adolescents at the national and provincial level: The CASPIAN-IV study. *Med J Islam Repub Iran* 2016;30:422	No Outcome Assessed
127 Hardy, L, Grunseit, A, Khambalia, A, et al. Co-occurrence of obesogenic risk factors among adolescents. *Journal of Adolescent Health* 2012;51:265-271	No Outcome Assessed
128 Gao, Z. Growth trajectories of young children's objectively determined physical activity, sedentary behavior, and body mass index. *Childhood Obesity* 2018;14:259-264	Combination of Movement Behaviors Not Analyzed
129 Corriveau, N, Eagle, T, Jiang, Q, et al. Sustained benefit over four-year follow-up of Michiganâ€™s project healthy schools. *American Journal of Public Health* 2015;105:e19-e25	Combination of Movement Behaviors Not Analyzed
130 Carson, V, Tremblay, M, Chastin, S. Cross-sectional associations between sleep duration, sedentary time, physical activity, and adiposity indicators among Canadian preschool-aged children using compositional analyses.. *BMC public health* 2017;17:848	Wrong population
131 Beets, M, Foley, J . Comparison of 3 different analytic approaches for determining risk-related active and sedentary behavioral patterns in adolescents. *Journal of Physical Activity & Health* 2010;7:381-392	Effects of Movement Behaviours Could Not be Determined
132 Angus, R, Heslegrave, R, Myles, W. Effects of prolonged sleep deprivation, with and without chronic physical exercise, on mood and performance.. *Psychophysiology* 1985;22:276-282	Wrong population
133 Anderson, J, Newby, R, Kehm, R, et al. Taking Steps Together: A Family- and Community-Based Obesity Intervention for Urban, Multiethnic Children. *Health Education & Behavior* 2015;42:194-201	Combination of Movement Behaviors Not Analyzed

134 Aguilar, M, Vergara, F, Velásquez, E, et al. Screen time impairs the relationship between physical fitness and academic attainment in children.. *Jornal de pediatria* 2015;91:339-345	Combination of Movement Behaviors Not Analyzed
135 Lajunen, H, Keski-Rahkonen, A, Pulkkinen, L, et al. Leisure Activity Patterns and Their Associations with Overweight: A Prospective Study among Adolescents. *Journal of Adolescence* 2009;32:1089-1103	Effects of Movement Behaviours Could Not be Determined
136 Schmiege, S, Gance-Cleveland, B, Gilbert, L, et al. Identifying patterns of obesity risk behavior to improve pediatric primary care.. *Journal for Specialists in Pediatric Nursing* 2016;21:18-28	Effects of Movement Behaviours Could Not be Determined
137 Schwarzfischer, P, Weber, M, Gruszfeld, D, et al. BMI and recommended levels of physical activity in school children.. *BMC public health* 2017;17:595	Combination of Movement Behaviors Not Analyzed
138 Saunders, T, Tremblay, M, Mathieu, M, et al. Associations of sedentary behavior, sedentary bouts and breaks in sedentary time with cardiometabolic risk in children with a family history of obesity.. *PloS one* 2013;8:e79143	Combination of Movement Behaviors Not Analyzed
139 Xiao, J, Shen, C, Chu, M, et al. Physical Activity and Sedentary Behavior Associated with Components of Metabolic Syndrome among People in Rural China.. *PloS one* 2016;11:e0147062	Combination of Movement Behaviors Not Analyzed
140 So, W. Physical activity and sedentary behavior's association with body weight in Korean adolescents.. *International journal of sport nutrition and exercise metabolism* 2013;23:1-10	No Outcome Assessed
141 Saunders, T, Gray, C, Poitras, V, et al. Combinations of physical activity, sedentary behaviour and sleep: relationships with health indicators in school-aged children and youth.. *Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme* 2016;41:S283-S293	No Outcome Assessed
142 Thakkar, N, Jamnik, V, Ardern, C. Cross-associations between physical activity and sedentary time on metabolic health: a comparative assessment using self-reported and objectively measured activity.. *Journal of public health (Oxford, England)* 2018;40:e464-e473	Wrong population
143 Santos, R, Zhang, Z, Pereira, J, et al. Compliance with the Australian 24-hour movement guidelines for the early years: associations with weight status.. *BMC public health* 2017;17:867	Wrong population
144 Ruiz, J, Labayen, I, Ortega, F, et al. Physical activity, sedentary time, and liver enzymes in adolescents: the HELENA study.. *Pediatric research* 2014;75:798-802	Combination of Movement Behaviors Not Analyzed
145 Rethorst, C, Moncrieft, A, Gellman, M, et al. Isotemporal Analysis of the Association of Objectively Measured Physical Activity With Depressive Symptoms: Results From Hispanic Community Health Study/Study of Latinos (HCHS/SOL).. *Journal of physical activity & health* 2017;14:733-739	Wrong population
146 Kuriyan, R, Bhat, S, Thomas, T, et al. Television viewing and sleep are associated with overweight among urban and semi-urban South Indian children.. *Nutrition journal* 2007;6:25	Combination of Movement Behaviors Not Analyzed

147 Harrington, S. Relationships of objectively measured physical activity and sleep with BMI and academic outcomes in 8-year-old children.. *Applied nursing research : ANR* 2013;26:63-70	Combination of Movement Behaviors Not Analyzed
148 Countryman, A. Cardiometabolic risk in adolescents: Associations with physical activity, physical fitness, and sleep. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2013;74:	Combination of Movement Behaviors Not Analyzed
149 Peart, T. The association between physical activity, diet, television/video viewing, computer use, and weight status among US adolescents. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2010;71:1652-1652	Combination of Movement Behaviors Not Analyzed
150 Shang, X, Li, Y, Xu, H, et al. The Clustering of Low Diet Quality, Low Physical Fitness, and Unhealthy Sleep Pattern and Its Association with Changes in Cardiometabolic Risk Factors in Children.. *Nutrients* 2020;12:591	Combination of Movement Behaviors Not Analyzed
151 Riso, E, Kull, M, Mooses, K, et al. Physical activity, sedentary time and sleep duration: associations with body composition in 10-12-year-old Estonian schoolchildren.. *BMC public health* 2018;18:496	Combination of Movement Behaviors Not Analyzed
152 Veijalainen, A, Tompuri, T, Haapala, E, et al. Associations of cardiorespiratory fitness, physical activity, and adiposity with arterial stiffness in children.. *Scandinavian journal of medicine & science in sports* 2016;26:943-950	Wrong population
153 Tanaka C, Reilly J.J, Tanaka M.et al. Changes in body weight, objectively measured sedentary behavior and physical activity in the school year and summer vacation in Japanese primary school children. *Obesity Reviews* 2016;17:81	Effects of Movement Behaviours Could Not be Determined
154 Valverde, P, Rivera, F, Moreno, C, et al. AnÃ¡lisis de cluster de la actividad fÃsica y las conductas sedentarias de los adolescentes espaÃ±oles, correlaciÃ³n con la salud biopsicosocial = Cluster analysis of the physical activity and sedentary behaviour of Spanish adolescents with respect to th. *Revista de Psicología del Deporte* 2012;21:99-106	Effects of Movement Behaviours Could Not be Determined
155 Vandendriessche, A, Ghekiere, A, Van Cauwenberg, J, et al. Does Sleep Mediate the Association between School Pressure, Physical Activity, Screen Time, and Psychological Symptoms in Early Adolescents? A 12-Country Study.. *International journal of environmental research and public health* 2019;16:	Combination of Movement Behaviors Not Analyzed
156 Yu, C, Sung, R, So, R, et al. Energy expenditure and physical activity of obese children: cross-sectional study.. *Hong Kong medical journal = Xianggang yi xue za zhi* 2002;8:313-317	Combination of Movement Behaviors Not Analyzed
157 Mota J, Alvares S, Miguel C.et al. Physical activity in children and adolescents with chronic disease. *Nascer e Crescer* 2001;10:274-278	Combination of Movement Behaviors Not Analyzed
158 Viner, R, Gireesh, A, Stiglic, N, et al. Roles of cyberbullying, sleep, and physical activity in mediating the effects of social media use on mental health and wellbeing among young people in England: a secondary analysis of longitudinal data.. *The Lancet. Child & adolescent health* 2019;3:685-696	Combination of Movement Behaviors Not Analyzed

159 Manyanga, T, Barnes, J, Chaput, J, et al. Prevalence and correlates of adherence to movement guidelines among urban and rural children in Mozambique: a cross-sectional study.. *The international journal of behavioral nutrition and physical activity* 2019;16:94	No Outcome Assessed
160 Martinez, S, Tschann, J, McCulloch, C, et al. Temporal associations between circadian sleep and activity patterns in Mexican American children.. *Sleep health* 2019;5:201-207	No Outcome Assessed
161 Li, N, Zhao, P, Diao, C, et al. Joint associations between weekday and weekend physical activity or sedentary time and childhood obesity.. *International journal of obesity (2005)* 2019;43:691-700	Combination of Movement Behaviors Not Analyzed
162 Hardin, O, Perry, T . Associations of Physical Activity and Sedentary Behavior With Atopic Disease in United States Children.. *Pediatrics* 2017;140:S178-S179	No Outcome Assessed
163 Faught, E, Qian, W, Carson, V, et al. The longitudinal impact of diet, physical activity, sleep, and screen time on Canadian adolescents' academic achievement: An analysis from the COMPASS study. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2019;125:24-31	Combination of Movement Behaviors Not Analyzed
164 Are the physically active adolescents belonging to the >>at risk of overweight<>rizika za pretilost<>physically active<>physically inactive<< group was made of their peers who practice sport only as a part of physical education in schools. The standardize. *Collegium Antropologicum* ;37:131-138	Combination of Movement Behaviors Not Analyzed
165 For strong bones, start them young: childhood play may help prevent osteoporosis later in life.. *Active Living* 2004;13:12-12	Not Quantitatively Analysed
166 Identifying and Preventing Overweight in Childhood Clinical Practice Guideline Part II. *Journal of Pediatric Health Care* 2006;20:S15-S64	Not Quantitatively Analysed
167 Is it more important to emphasize reducing sedentary time or increasing physical activity time for optimal health benefits?. *JOPERD: The Journal of Physical Education, Recreation & Dance* 2016;87:59-60	Combination of Movement Behaviors Not Analyzed
168 Psychology and Cultural Aspects of Energy.. *Nutrition Reviews* ;59:S5-S12	Combination of Movement Behaviors Not Analyzed
169 UP1 HomeStyles: Shaping Home Environments and Lifestyle Practices to Prevent Childhood Obesity: A Randomized Controlled Trial.. *Journal of Nutrition Education & Behavior* 2012;44:S81-S81	No Outcome Assessed
170 永松俊哉./ Relationship between mental health and exercise in adolescents.. *Japanese Journal of Physical Fitness & Sports Medicine* 2016;65:375-381	Combination of Movement Behaviors Not Analyzed
171 WU, Y, GOODRICH, J, DOLINOY, D, et al. Accelerometer-measured Physical Activity, Reproductive Hormones, and DNA Methylation.. *Medicine & Science in Sports & Exercise* 2020;52:598-607	Duplicate
172 Woodring, B. Relationship of physical activity and television watching with body weight and level of fatness among children: results from the Third National Health and Nutrition Examination Survey.. *Journal of child and family nursing* 1998;1:78-79	Duplicate
173 Williams F. . Effects of sedentary activity on obesity in adolescents. *West Indian Medical Journal* 2016;65:77	Combination of Movement Behaviors Not Analyzed

174 Weissbluth, M, Poncher, J, Given, G, et al. Sleep duration and television viewing.. *The Journal of pediatrics* 1981;99:486-488	No Outcome Assessed
175 Watach, A. Sleep, Physical Activity, and Executive Function in Obese Adolescents With and Without Obstructive Sleep Apnea Syndrome: A Feasibilty Study.. *Sleep, Physical Activity & Executive Function in Obese Adolescents with & Without Obstructive Sleep Apnea Syndrome: A Feasibilty Study* 2017;:1-1	Combination of Movement Behaviors Not Analyzed
176 Wasserman, D. PrzeglÄ…d zachowaÅ„ zdrowotnych i zachowaÅ„ obciÄ…Å¼onych ryzykiem, problemÃ³w ze zdrowiem psychicznym i zachowaÅ„ samobÃ³jczych u mÅ‚odych EuropejczykÃ³w na podstawie wynikÃ³w badania SEYLE finansowanego przez UE = Review of health and risk-behaviours, m. *Psychiatria Polska* 2016;50:1093-1107	Effects of Movement Behaviours Could Not be Determined
177 Walther, J, Aldrian, U, Stüger, H, et al. Nutrition, lifestyle factors, and mental health in adolescents and young adults living in Austria. *International Journal of Adolescent Medicine and Health* 2014;26:377-386	Wrong population
178 Wallace, I, Danish, S, McClish, D, et al. The relationship of physical activity and television watching with adolescents' intentions and self-efficacy to eat healthy. *Hellenic Journal of Psychology* 2010;7:259-274	Combination of Movement Behaviors Not Analyzed
179 Wafa, S, Hamzaid, N, Talib, R, et al. Objectively measured habitual physical activity and sedentary behaviour and quality of life in obese Malaysian children.. *Obesity Research & Clinical Practice* 2013;7:14-14	Combination of Movement Behaviors Not Analyzed
180 Vlashki E, Cholakovska V.C, Kimovska M.et al. The association of physical activity and sedentary lifestyle with asthma in childhood. *European Respiratory Journal* 2018;52:	Combination of Movement Behaviors Not Analyzed
181 Vázquez, I, Zapico, R, Díez, J, et al. Actividad fÃsica, ocio sedentario, falta de sueÃ±o y sobrepeso infantil = Physical activity, sedentary leisure, short sleeping and childhood overweight. *Psicothema* 2008;20:516-520	Combination of Movement Behaviors Not Analyzed
182 Ulutas A.P, Atla P, Say Z.A.et al. Investigation of the factors affecting the formation of 6-18 years school-age children obesity. *Zeynep Kamil Tip Bulteni* 2014;45:192-196	No Outcome Assessed
183 Tsiros, M, Samaras, M, Coates, A, et al. Use-of-time and health-related quality of life in 10- to 13-year-old children: Not all screen time or physical activity minutes are the same. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care & Rehabilitation* 2017;26:3119-3129	Not Quantitatively Analysed
184 Tatsumi Y, Mohri I, Shimizu S.et al. Daytime physical activity and sleep in pre-schoolers with developmental disorders. *Journal of Paediatrics and Child Health* 2014;:	Combination of Movement Behaviors Not Analyzed
185 Syväoja, H, Kantomaa, M, Ahonen, T, et al. Physical activity, sedentary behavior, and academic performance in Finnish children.. *Medicine and science in sports and exercise* 2013;45:2098-2104	Combination of Movement Behaviors Not Analyzed
186 Straker, L, Howie, E, McVeigh, J, et al. Changing the sedentary time and physical activity trajectories of obese adolescents: Results from the CAFAP controlled clinical trial.. *Journal of Science & Medicine in Sport* ;18:e121-e121	No Outcome Assessed

187 Straatmann V.S, Oliveira A.J, Lopes C.S. Association between psychosocial factors, physical activity and sedentary behaviors: Sex differences in adolescents from Rio de Janeiro-BRAZIL. *European Journal of Epidemiology* 2015;30:927	Effects of Movement Behaviours Could Not be Determined
188 STOJILJKOVIĆ, N, MITIĆ, P, SPORIŠ, G. CAN EXERCISE MAKE OUR CHILDREN SMARTER? / LAHKO OTROCI Z VADBO POSTANEJO PAMETNEJÅ I?. *Annales Kinesiologiae* 2019;10:115-127	No Outcome Assessed
189 Štefan, L, Sorić, M, Devrnja, A, et al. One-year changes in physical activity and sedentary behavior among adolescents: the Croatian Physical Activity in Adolescence Longitudinal Study (CRO-PALS). *Int J Adolesc Med Health* 2018;:	Combination of Movement Behaviors Not Analyzed
190 Sreeramareddy, C, Chew, W, Poulsaeman, V, et al. Blood pressure and its associated factors among primary school children in suburban Selangor, Malaysia: A cross-sectional survey. *J Family Community Med* 2013;20:90-7	Combination of Movement Behaviors Not Analyzed
191 Spittaels, H, Van Cauwenberghe, E, Verbestel, V, et al. Objectively measured sedentary time and physical activity time across the lifespan: a cross-sectional study in four age groups.. *The international journal of behavioral nutrition and physical activity* 2012;9:149	No Outcome Assessed
192 Spagnolo A, Strisciuglio P, Menghetti E. Annual follow-up of children and adolescents in southern Italy for the evaluation of weight and physical activity at three time points. *International Journal of Pediatric Obesity* 2010;5:67	Combination of Movement Behaviors Not Analyzed
193 Sorić, M, Starc, G, Borer, K, et al. Associations of objectively assessed sleep and physical activity in 11-year old children.. *Annals of human biology* 2015;42:31-37	No Outcome Assessed
194 Smith, L, Fisher, A, Hamer, M. Prospective association between objective measures of childhood motor coordination and sedentary behaviour in adolescence and adulthood. *The International Journal of Behavioral Nutrition and Physical Activity* 2015;12:	Wrong population
195 Smith C.L, Hands B, Bulsara M.B.et al. The association between physical activity, sedentary behaviour, aerobic fitness in adolescents with NAFLD. *Journal of Gastroenterology and Hepatology* 2010;25:A109	Combination of Movement Behaviors Not Analyzed
196 Sleddens, E, Gubbels, J, Kremers, S, et al. Bidirectional associations between activity-related parenting practices, and child physical activity, sedentary screen-based behavior and body mass index: A longitudinal analysis. *The International Journal of Behavioral Nutrition and Physical Activity* 2017;14:	No Outcome Assessed
197 Skidmore P.M, Black K.E, Skeaff S.et al. The association between objectively measured sleep, physical activity and sedentary behaviour on cardiorespiratory fitness and health in 9-11 year old New Zealand children. *Circulation* 2017;135:	Effects of Movement Behaviours Could Not be Determined
198 SIT, C, MCKENZIE, T, CERIN, E, et al. Physical Activity and Sedentary Time among Children with Disabilities at School.. *Medicine & Science in Sports & Exercise* 2017;49:292-297	No Outcome Assessed
199 Simon, C, Wagner, A, DiVita, C, et al. Intervention centred on adolescents' physical activity and sedentary behaviour (ICAPS): concept and 6-month results.. *International journal of obesity and related metabolic disorders : journal of the International Association for the Study of Obesity* 2004;28 Suppl 3:S96-S103	No Outcome Assessed

200 Silva, A, Couto, P, Queirós, A, et al. Musculoskeletal Multisite Pain and Patterns of Association After Adjusting for Sleep, Physical Activity, and Screen Time in Adolescents.. *Spine* 2018;43:1432-1437	Effects of Movement Behaviours Could Not be Determined
201 Silva, A, Couto, P, Queirós, A, et al. Chronic pain in high school students is associated with physical activity and sleeping hours but not with screen time. *Int J Adolesc Med Health* 2017;31:	Combination of Movement Behaviors Not Analyzed
202 Siegel B, Phan H. ,. Sleep and physical activity correlates of quality of life in duchenne muscular dystrophy. *Annals of Neurology* 2017;82:S334	Combination of Movement Behaviors Not Analyzed
203 Shimoga, S, Erlyana, E, Rebello, V. Associations of social media use with physical activity and sleep adequacy among adolescents: Cross-sectional survey. *Journal of Medical Internet Research* 2019;21:	Effects of Movement Behaviours Could Not be Determined
204 Shaffer-Hudkins, E. Health-promoting behaviors and subjective well-being among early adolescents. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2012;72:7030-7030	Combination of Movement Behaviors Not Analyzed
205 Serra-Majem L, Ribas L, Perez-Rodrigo C.et al. Determinants of nutrient intake among children and adolescents: Results from the enKid study. *Annals of Nutrition and Metabolism* 2002;46:31-38	Combination of Movement Behaviors Not Analyzed
206 Schwarzfischer, P, Gruszfeld, D, Stolarczyk, A, et al. Physical activity and sedentary behavior from 6 to 11 years. *Pediatrics* 2019;143:	No Outcome Assessed
207 Saris, W, Blair, S, van Baak, M, et al. How much physical activity is enough to prevent unhealthy weight gain? Outcome of the IASO 1st Stock Conference and consensus statement.. *Obesity reviews : an official journal of the International Association for the Study of Obesity* 2003;4:101-114	Not Quantitatively Analysed
208 Sampasa-Kanyinga, H, Colman, I, Hamilton, H, et al. Outdoor physical activity, compliance with the physical activity, screen time, and sleep duration recommendations, and excess weight among adolescents. *Obes Sci Pract* 2020;6:196-206	Combination of Movement Behaviors Not Analyzed
209 Salway, R, Sebire, S, Solomon-Moore, E, et al. Associations within school-based same-sex friendship networks of childrenâ€™s physical activity and sedentary behaviours: A cross-sectional social network analysis. *The International Journal of Behavioral Nutrition and Physical Activity* 2018;15:	No Outcome Assessed
210 Salmon, J, Ball, K, Booth, M, et al. Outcomes of an RCT to promote children's physical activity, reduce sedentary behaviour and prevent unhealthy weight gain : switch-play. (Abstract). *Journal of Science & Medicine in Sport* 2005;8:42-42	Combination of Movement Behaviors Not Analyzed
211 Sacher, P, Kolotourou, M, Chadwick, P, et al. Randomized controlled trial of the MEND program: A family-based community intervention for childhood obesity. *Obesity* 2010;18:S62-S68	Combination of Movement Behaviors Not Analyzed
212 Rundle, A, Goldstein, I, Mellins, R, et al. Physical activity and asthma symptoms among New York City Head Start children. *Journal of Asthma* 2009;46:803-809	Wrong population

213 Ronspies, S, Messerole, M . Relationships Among Body Mass Index, Daily Step Count, and Television Viewing Time in Children Ages 10-13 Years. (Abstract). *Research Quarterly for Exercise & Sport* 2007;78:A-96	Combination of Movement Behaviors Not Analyzed
214 Riley, N, Lubans, D, Morgan, P, et al. Outcomes and process evaluation of a programme integrating physical activity into the primary school mathematics curriculum: The EASY Minds pilot randomised controlled trial. *Journal of Science and Medicine in Sport* 2015;18:656-661	Combination of Movement Behaviors Not Analyzed
215 Riley, N, Lubans, D, Holmes, K, et al. Findings from the EASY minds cluster randomized controlled trial: Evaluation of a physical activity integration program for mathematics in primary schools. *Journal of Physical Activity & Health* 2016;13:198-206	Combination of Movement Behaviors Not Analyzed
216 Riddoch, C, Savage, J, Murphy, N, et al. Long term health implications of fitness and physical activity patterns.. *Archives of disease in childhood* 1991;66:1426-1433	Effects of Movement Behaviours Could Not be Determined
217 Qidwai, W, Ishaque, S, Shah, S, et al. Adolescent lifestyle and behaviour: a survey from a developing country.. *PloS one* 2010;5:e12914	No Outcome Assessed
218 Puder J.J, Marques-Vidal P, Zahner L.et al. A multifactorial approach to prevent adiposity and improve fitness in predominantly migrant preschool children: Cluster-randomized controlled trial (the Ballabeina Study). *Obesity Reviews* 2010;11:468	Effects of Movement Behaviours Could Not be Determined
219 Puder, J, Marques-Vidal, P, Schindler, C, et al. Effect of multidimensional lifestyle intervention on fitness and adiposity in predominantly migrant preschool children (Ballabeina): cluster randomised controlled trial.. *BMJ (Clinical research ed.)* 2011;343:d6195	Combination of Movement Behaviors Not Analyzed
220 Pringsheim, T, Nosratmirshekarlou, E, Doja, A, et al. Physical activity, sleep and neuropsychiatric symptom severity in children with tourette syndrome. *Eur Child Adolesc Psychiatry* 2020;:	Combination of Movement Behaviors Not Analyzed
221 Pozo-Cruz, B, Pozo-Cruz, J, Limones, F, et al. RelaciÃ³n entre el nivel de actividad fÃsica y sedentarismo, sobrepeso y calidad de vida relacionada con la salud en niÃ±os asmÃ¡ticos en edad escolar: un estudio exploratorio en Sevilla. / Relationship between the level of physical activity and sedentar. *Retos: Nuevas Perspectivas de Educación Física, Deporte y Recreación* 2012;:53-56	Combination of Movement Behaviors Not Analyzed
222 Posso, M, Brugulat-Guiteras, P, Puig, T, et al. [Prevalence and determinants of obesity in children and young people in Catalonia, Spain, 2006-2012].. *Medicina clinica* 2014;143:475-483	Combination of Movement Behaviors Not Analyzed
223 Pitanga, F, Alves, C, Pamponet, M, et al. Combined effect of physical activity and reduction of screen time for overweight prevention in adolescents.. *Brazilian Journal of Kineanthropometry & Human Performance* 2019;21:1-10	Duplicate
224 Piola, T, Bacil, E, Silva, M, et al. IMPACT OF PHYSICAL ACTIVITY CORRELATES IN THE ISOLATED AND COMBINED PRESENCE OF INSUFFICIENT LEVEL OF PHYSICAL ACTIVITY AND HIGH SCREEN TIME AMONG ADOLESCENTS.. *Revista paulista de pediatria : orgao oficial da Sociedade de Pediatria de Sao Paulo* 2019;37:194-201	Effects of Movement Behaviours Could Not be Determined

225 Pietila, J, Helander, E, Myllymaki, T, et al. Exploratory analysis of associations between individual lifestyles and heart rate variability -based recovery during sleep.. *Conference proceedings :, . Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Annual Conference* 2015;2015:2339-2342	Combination of Movement Behaviors Not Analyzed
226 Peterson, K, Spadano-Gasbarro, J, Greaney, M, et al. Three-Year Improvements in Weight Status and Weight-Related Behaviors in Middle School Students: The Healthy Choices Study.. *PloS one* 2015;10:e0134470	Combination of Movement Behaviors Not Analyzed
227 Peltzer, K. Leisure time physical activity and sedentary behavior and substance use among in-school adolescents in eight African countries. *International Journal of Behavioral Medicine* 2010;17:271-278	No Outcome Assessed
228 Peltzer K. . Leisure Time Physical Activity and Sedentary Behavior and Substance Use Among In-School Adolescents in Eight African Countries. *International Journal of Behavioral Medicine* 2009;:1-8	Combination of Movement Behaviors Not Analyzed
229 Peach H, Gaultney J.F, Gil-Rivas V. Sleep as a risk factor for adolescent obesity: Differential patterns between boys and girls. *Sleep* 2013;36:A367	Combination of Movement Behaviors Not Analyzed
230 Pavey, T, Parfitt, C, Rowlands, A. CHILDREN'S PSYCHOLOGICAL WELL-BEING, HABITUAL PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOUR.. *Acta Kinesiologiae Universitatis Tartuensis* 2007;12:151-152	Combination of Movement Behaviors Not Analyzed
231 Patel P.G, Perfect M, Patel C.M.et al. Evaluation of the relationship between glucose variability, sleep and activity levels in children with type 1 diabetes mellitus. *Diabetes* 2010;:	Combination of Movement Behaviors Not Analyzed
232 Parker E, McCarty C, Richardson L. Co-Occurrence of Heath Risk Behaviors In Adolescents. *Journal of Adolescent Health* 2019;64:S65-S66	No Outcome Assessed
233 Park, H. Longitudinal relationships between physical activity, sedentary behaviors, and obesity in children and adolescents. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2008;68:7254-7254	Combination of Movement Behaviors Not Analyzed
234 Pantoja I.Y, Sandoval X, Talavera J.O.et al. Physical activity and inactivity and its association with overweight and obesity on children and adolescents between 10 to 14 years old. *FASEB Journal* 2016;30:	Combination of Movement Behaviors Not Analyzed
235 Page, A, Cooper, A, Griew, P, et al. Childrenâ€™s screen viewing is related to psychological difficulties irrespective of physical activity. *Pediatrics* 2010;126:e1011-e1017	Combination of Movement Behaviors Not Analyzed
236 Ottevaere, C, Huybrechts, I, Benser, J, et al. Clustering patterns of physical activity, sedentary and dietary behavior among European adolescents: The HELENA study.. *BMC public health* 2011;11:328	No Outcome Assessed
237 Orsey A.D, Ruiz BS T.L, Wakefield MS D.B. Impact of socioeconomic status (SES) on the relationship between physical activity (PA) and sleep among children with cancer. *Supportive Care in Cancer* 2013;21:S282	No Outcome Assessed

238 Omorou, A, Langlois, J, Lecomte, E, et al. Adolescentsâ€™ physical activity and sedentary behavior: A pathway in reducing overweight and obesity: The PRALIMAP 2-year cluster randomized controlled trial. *Journal of Physical Activity & Health* 2015;12:628-635	Duplicate
239 O'Malley, G. Aerobic exercise enhances executive function and academic achievement in sedentary, overweight children aged 7â€“11 years. *Journal of Physiotherapy (Elsevier)* 2011;57:255-255	Combination of Movement Behaviors Not Analyzed
240 O'Leary, M, Rush, E, Lacey, S, et al. LA SALUD CARDIORRESPIRATORIA DE LOS NIÃ'OS EN EDAD ESCOLAR ES DIRECTAMENTE PROPORCIONAL A LA PROPORCIÃ"N CINTURA-ESTATURA Y AL ESTADO SOCIOECONÃ"MICO DEL COLEGIO. / CARDIORESPIRATORY FITNESS IS POSITIVELY ASSOCIATED WITH WAIST TO HEIGHT RATIO AND SCHOOL S. *Journal of Sport & Health Research* 2018;10:389-401	Combination of Movement Behaviors Not Analyzed
241 O., J. Sleep, Activity and School Achievement.. *School Health Alert* 2013;29:3-3	Not Quantitatively Analysed
242 Novotny, R, Davis, J, Butel, J, et al. Effect of the Children's Healthy Living Program on Young Child Overweight, Obesity, and Acanthosis Nigricans in the US-Affiliated Pacific Region: A Randomized Clinical Trial.. *JAMA network open* 2018;1:e183896	No Outcome Assessed
243 Nonas, C, Silver, L, Kettel Khan, L. Insights and implications for health departments from the evaluation of New York City's regulations on nutrition, physical activity, and screen time in child care centers.. *Preventing chronic disease* 2014;11:E178	Combination of Movement Behaviors Not Analyzed
244 Ng, C, Young, T, Corey, P. Associations of television viewing, physical activity and dietary behaviours with obesity in aboriginal and non-aboriginal Canadian youth.. *Public health nutrition* 2010;13:1430-1437	Combination of Movement Behaviors Not Analyzed
245 Nemet, D. Childhood Obesity, Physical Activity, and Exercise.. *Pediatric Exercise Science* 2016;28:48-51	Combination of Movement Behaviors Not Analyzed
246 Nelson, M, Gordon-Larsen, P . Physical activity and sedentary behavior patterns are associated with selected adolescent health risk behaviors.. *Pediatrics* 2006;117:1281-1290	Combination of Movement Behaviors Not Analyzed
247 Ndiaye, G, Benefice, E . Patterns of daily activity and time spent in bed of adult women and adolescent and preadolescent girls from a rural community in Senegal, West Africa.. *Annals of human biology* 2007;34:454-469	No Outcome Assessed
248 MUTHURI, S, WACHIRA, L, ONYWERA, V, et al. Comparative study of physical activity patterns among school children in Kenya and Canada: Results from the ISCOLE Project.. *African Journal for Physical, Health Education, Recreation & Dance* 2014;20:765-779	No Outcome Assessed
249 Must A.Parisi SM.Must, A, et al. Sedentary behavior and sleep: paradoxical effects in association with childhood obesity.. *International Journal of Obesity* ;33:S82-6	No Outcome Assessed
250 Musaiger A.O. . Health and nutritional profile for adolescent girls in the GCC countries. *Bahrain Medical Bulletin* 1998;20:102-105	No Outcome Assessed

251 Mota, J, Ribeiro, J, Santos, M, et al. Obesity, Physical Activity, Computer Use, and TV Viewing in Portuguese Adolescents.. *Pediatric Exercise Science* 2006;18:113	Combination of Movement Behaviors Not Analyzed
252 Mora-Gonzalez, J, Migueles, J, Esteban-Cornejo, I, et al. Sedentarism, Physical Activity, Steps, and Neurotrophic Factors in Obese Children.. *Medicine and science in sports and exercise* 2019;51:2325-2333	Combination of Movement Behaviors Not Analyzed
253 Molina, M, Faria, C, Montero, M, et al. [Cardiovascular risk factors in 7-to-10-year-old children in VitÃ³ria, EspÃrito Santo State, Brazil].. *Cadernos de saude publica* 2010;26:909-917	Combination of Movement Behaviors Not Analyzed
254 Mohamadirizi S, Kordi M. ,. The relationship between depression, anxiety and life style in female adolescents in Mashhad in 2010-2011. *Iranian Journal of Psychiatry* 2012;7:66-67	Combination of Movement Behaviors Not Analyzed
255 Mittal, V, Gupta, T, Orr, J, et al. Physical activity level and medial temporal health in youth at ultra high-risk for psychosis.. *Journal of abnormal psychology* 2013;122:1101-1110	Combination of Movement Behaviors Not Analyzed
256 Miranda, V, Amorim, P, Bastos, R, et al. Body image disorders associated with lifestyle and body composition of female adolescents. *Public Health Nutr* 2020;:1-11	Effects of Movement Behaviours Could Not be Determined
257 Minges, K, Chao, A, Nam, S, et al. Weight Status, Gender, and Race/Ethnicity: Are There Differences in Meeting Recommended Health Behavior Guidelines for Adolescents?. *Journal of School Nursing* 2015;31:135-145	Combination of Movement Behaviors Not Analyzed
258 Mikkonen, P, Heikkala, E, Paananen, M, et al. Accumulation of psychosocial and lifestyle factors and risk of low back pain in adolescence: a cohort study.. *European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society* 2016;25:635-642	Combination of Movement Behaviors Not Analyzed
259 Miguel Lozano-Sánchez, A, Zurita-Ortega, F, Luis Ubago-Jiménez, J, et al. Videojuegos, prÃ¡ctica de actividad fÃsica, obesidad y hÃ¡bitos sedentarios en escolares de entre 10 y 12 aÃ±os de la provincia de Granada. / Videogames, physical activity practice, obesity, and sedentary habits in schoolchildren aged 10 to 12 years old. *Retos: Nuevas Perspectivas de Educación Física, Deporte y Recreación* 2019;:42-46	Combination of Movement Behaviors Not Analyzed
260 Mcphee P, Verschuren O, Peterson M.et al. The formula for health and well-being: Crosssectional data on physical activity, sleep, and nutrition in individuals with cerebral palsy. *Developmental Medicine and Child Neurology* 2018;60:98-99	Wrong population
261 McMorris, T. Physical activity and cognition in children and adolescents.. *International Journal of Sport & Exercise Psychology* 2019;17:179-181	Combination of Movement Behaviors Not Analyzed
262 McKenzie, T, Baquero, B, Crespo, N, et al. Environmental correlates of physical activity in Mexican American children at home. *Journal of Physical Activity & Health* 2008;5:579-591	Combination of Movement Behaviors Not Analyzed

263 McDougall, J, Duncan, M . Children, video games and physical activity: An exploratory study. *International Journal on Disability and Human Development* 2008;7:89-94	No Outcome Assessed
264 Mayne, S, Virudachalam, S, Fiks, A. Clustering of unhealthy behaviors in a nationally representative sample of U.S. children and adolescents. *Prev Med* 2020;130:105892	No Outcome Assessed
265 Marttila-Tornio, K, Ruotsalainen, H, Miettunen, J, et al. Clusters of health behaviours and their relation to body mass index among adolescents in Northern Finland. *Scand J Caring Sci* 2019;:	Effects of Movement Behaviours Could Not be Determined
266 Martins S.S, Palmeira A.L, Minderico C.S.et al. Differences between BMI, activity patterns, and aerobic capacity accordingly with sleep duration in adolescents. *Obesity Facts* 2013;6:171	Combination of Movement Behaviors Not Analyzed
267 Martinez, L. The relationship between physical activity and academic achievement in rural, low-income, mexican origin, elementary school aged children. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2015;76:	Combination of Movement Behaviors Not Analyzed
268 Marshall SJ.Biddle SJH.Sallis JF,, et al. Clustering of sedentary behaviors and physical activity among youth: a cross-national study.. *Pediatric Exercise Science* 2002;14:401-417	No Outcome Assessed
269 Marks, J, Barnett, L, Strugnell, C, et al. Changing from primary to secondary school highlights opportunities for school environment interventions aiming to increase physical activity and reduce sedentary behaviour: A longitudinal cohort study. *The International Journal of Behavioral Nutrition and Physical Activity* 2015;12:	No Outcome Assessed
270 Mannell, R, Kaczynski, A, Aronson, R. ADOLESCENT PARTICIPATION AND FLOW IN PHYSICALLY ACTIVE LEISURE AND ELECTRONIC MEDIA ACTIVITIES: TESTING THE DISPLACEMENT HYPOTHESIS. / Les adolescents, l'activite physique, les loisirs technologiques et l'experience gratifiante intrinseque: une verificati. *Society & Leisure / Loisir & Société* 2005;28:653-675	No Outcome Assessed
271 Malta, D, de Andreazzi, M, Oliveira-Campos, M, et al. Trend of the risk and protective factors of chronic diseases in adolescents, National Adolescent School-based Health Survey (PeNSE 2009 e 2012).. *Revista brasileira de epidemiologia = Brazilian journal of epidemiology* 2014;17 Suppl 1:77-91	No Outcome Assessed
272 Malden S, Reilly J, Gibson A.et al. Feasibility of the ToyBox-Scotland obesity prevention intervention in preschools: Results of a cluster randomised controlled trial. *Obesity Facts* 2019;12:213	Wrong population
273 Maher, C, Virgara, R, Okely, T, et al. Physical activity and screen time in out of school hours care: an observational study. *BMC Pediatr* 2019;19:283	No Outcome Assessed
274 Lowry, R, Michael, S, Demissie, Z, et al. Associations of Physical Activity and Sedentary Behaviors with Dietary Behaviors among US High School Students.. *Journal of obesity* 2015;2015:876524	No Outcome Assessed
275 Loewen, O, Maximova, K, Ekwaru, J, et al. Lifestyle Behavior and Mental Health in Early Adolescence.. *Pediatrics* 2019;143:	Effects of Movement Behaviours Could Not be Determined
276 Lopes, V, Barnett, L, Rodrigues, L. Is There an Association Among Actual Motor Competence, Perceived Motor Competence, Physical Activity, and Sedentary Behavior in Preschool Children?. *Journal of Motor Learning & Development* 2016;4:129-141	Wrong population

277 Loewen, O, Maximova, K, Ekwaru, J, et al. Adherence to lifestyle recommendations and ADHD: A population-based study of children aged 10-11 years. *Psychosom Med* 2020;:	Duplicate
278 Liu, Y, Zhang, W, Cai, J. Relation of anxiety and depression to lifestyle in junior high school students. *Chinese Mental Health Journal* 2017;31:235-240	Effects of Movement Behaviours Could Not be Determined
279 Liu, W, Peng, S, Earl, K. Associations of Body Mass Index With Physical Activity, Television Watching, and Sports Skill Among Middle School Girls and Boys. (Abstract). *Research Quarterly for Exercise & Sport* 2006;77:A-64	Combination of Movement Behaviors Not Analyzed
280 Lawman, H, Wilson, D . Associations of social and environmental supports with sedentary behavior, light and moderate-to-vigorous physical activity in obese underserved adolescents. *The International Journal of Behavioral Nutrition and Physical Activity* 2014;11:	Combination of Movement Behaviors Not Analyzed
281 Landis AM.Bond EF,. Sleep, obesity, physical activity, and insulin resistance in adolescents.. *Communicating Nursing Research* 2010;43:343-343	Combination of Movement Behaviors Not Analyzed
282 Landis AM. Sleep and obesity in adolescents.. *Sleep & Obesity in Adolescents* 2007;:215 p-215 p	Combination of Movement Behaviors Not Analyzed
283 Kracht, C, Webster, E, Staiano, A. Sociodemographic Differences in Young Children Meeting 24-Hour Movement Guidelines.. *Journal of Physical Activity & Health* 2019;16:908-915	No Outcome Assessed
284 Kong, P. Obesity in adolescents - more than sloth and gluttony. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2015;75:	Duplicate
285 Kong I.G, Lee H.-J, Kim S.Y.et al. Physical Activity, Study Sitting Time, Leisure Sitting Time, and Sleep Time Are Differently Associated with Obesity in Korean Adolescents. *Medicine (United States)* 2015;94:e1965	Combination of Movement Behaviors Not Analyzed
286 Knowles, O, Gastin, P, Kremer, P. Time use and health and wellbeing outcomes of sport school students in Australia.. *Sport Sciences for Health* 2017;13:427-435	Combination of Movement Behaviors Not Analyzed
287 Isabela da Costa, R, Taddei, J, Colugnatti, F. Obesity among children attending elementary public schools in SÃ£o Paulo, Brazil: a case--control study.. *Public health nutrition* 2003;6:659-663	Combination of Movement Behaviors Not Analyzed
288 Iannotti RJ.Janssen I.Haug E,, et al. Interrelationships of adolescent physical activity, screen-based sedentary behaviour, and social and psychological health.. *International Journal of Public Health* ;54:191-198	Effects of Movement Behaviours Could Not be Determined
289 Huang, W, Wong, S . Prospective Associations between Weekend Catch-Up Sleep, Physical Activity, and Childhood Obesity.. *Childhood obesity (Print)* 2019;15:40-47	Combination of Movement Behaviors Not Analyzed
290 Hosker, D, Elkins, R, Potter, M. Promoting mental health and wellness in youth through physical activity, nutrition, and sleep. *Child and Adolescent Psychiatric Clinics of North America* 2019;28:171-193	Not Quantitatively Analysed

291 Holton, K, Nigg, J . The Association of Lifestyle Factors and ADHD in Children. *J Atten Disord* 2016;:	Combination of Movement Behaviors Not Analyzed
292 Hohepa, M, Scragg, R, Schofield, G, et al. Associations between after-school physical activity, television use, and parental strategies in a sample of New Zealand adolescents. *Journal of Physical Activity & Health* 2009;6:299-305	No Outcome Assessed
293 Hinkley, T, Timperio, A, Watson, A, et al. Prospective associations with physiological, psychosocial and educational outcomes of meeting Australian 24-Hour Movement Guidelines for the Early Years.. *International Journal of Behavioral Nutrition & Physical Activity* 2020;17:1-12	Wrong population
294 HINKLEY, T, SALMON, J, OKELY, A, et al. Preschoolers' Physical Activity, Screen Time, and Compliance with Recommendations.. *Medicine & Science in Sports & Exercise* 2012;44:458-465	No Outcome Assessed
295 Hinkley, T, Brown, H . How are young children's outdoor play time and screen time associated with their social skills?. *Journal of Science & Medicine in Sport* ;18:e38-e38	Combination of Movement Behaviors Not Analyzed
296 Hesketh, K, Carlin, J, Wake, M, et al. Predictors of body mass index change in Australian primary school children.. *International journal of pediatric obesity : IJPO : an official journal of the International Association for the Study of Obesity* 2009;4:45-53	Combination of Movement Behaviors Not Analyzed
297 Herring, M, Monroe, D, Kline, C, et al. Sleep Quality Moderates the Association Between Physical Activity Frequency and Feelings of Energy and Fatigue in Adolescents: 446 Board #287 May 30 11:00 AM - 12:30 PM, .American College of Sports Medicine Annual Meeting, May 29-June 2, 2018, Minneapolis. *Medicine & Science in Sports & Exercise* ;50:104-105	Combination of Movement Behaviors Not Analyzed
298 Heikkala, E, Paananen, M, Taimela, S, et al. Associations of co-occurring psychosocial and lifestyle factors with multisite musculoskeletal pain during late adolescence-A birth cohort study. *Eur J Pain* 2019;23:1486-1496	Effects of Movement Behaviours Could Not be Determined
299 Herman, K, Kuk, J . Adolescent Weight Misperceptions: Association with Screen Time But Not Physical Activity.. *Canadian Journal of Diabetes* ;39:S17-S18	Effects of Movement Behaviours Could Not be Determined
300 Hayward, J, Jacka, F, Skouteris, H, et al. Lifestyle factors and adolescent depressive symptomatology: Associations and effect sizes of diet, physical activity and sedentary behaviour. *Australian and New Zealand Journal of Psychiatry* 2016;50:1064-1073	Combination of Movement Behaviors Not Analyzed
301 Harrington, S. Objective physical activity and sleep characteristic measurements using a triaxial accelerometer in eight year olds.. *Objective Physical Activity & Sleep Characteristic Measurements Using a Triaxial Accelerometer in Eight Year Olds* 2011;:294 p-294 p	Combination of Movement Behaviors Not Analyzed
302 Harrington, S. Objective physical activity and sleep characteristic measurements using a triaxial accelerometer in eight year olds. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2012;72:7283-7283	Combination of Movement Behaviors Not Analyzed

303 Harkins, A, Bernent, M, Hunter, S, et al. Relation Between Health, Wellness, and Academic Achievement in Adolescent Females, .ASAHP 2016 Annual Conference, October 19-21, 2016, New Orleans, Louisiana. *Journal of Allied Health* 2016;45:305-305	Combination of Movement Behaviors Not Analyzed
304 Harding, S, Page, A, Falconer, C, et al. Longitudinal changes in sedentary time and physical activity during adolescence. *The International Journal of Behavioral Nutrition and Physical Activity* 2015;12:	No Outcome Assessed
305 Hamer, M, Patalay, P, Bell, S, et al. Change in device-measured physical activity assessed in childhood and adolescence in relation to depressive symptoms: a general population-based cohort study. *J Epidemiol Community Health* 2020;74:330-335	Combination of Movement Behaviors Not Analyzed
306 Guyton, J. Childhood obesity and school-based interventions: An evidence-based best practice guideline.. *Childhood Obesity & School-based Interventions: An Evidence-based Best Practice Guideline* 2010;:113 p-113 p	Combination of Movement Behaviors Not Analyzed
307 Guinhouya, B. [Physical activity of schoolchildren in France. The paradox of a public health priority!].. *Revue d'epidemiologie et de sante publique* 2010;58:255-267	Combination of Movement Behaviors Not Analyzed
308 Guerrero, M, Vanderloo, L, Rhodes, R, et al. Canadian children's and youth's adherence to the 24-h movement guidelines during the COVID-19 pandemic: A decision tree analysis. *J Sport Health Sci* 2020;:	No Outcome Assessed
309 Greer, F , et al. Body composition and physical activity habits in children grades 6-8 in rural Appalachia: health implications. (Poster Session). *CAHPERD Journal/Times* 2003;66:17-17	Combination of Movement Behaviors Not Analyzed
310 Gordon L, Sylvester R, Rogers R.et al. High mobile device usage associated with sedentary behaviors and less physical activity in 6th grade students. *Circulation* 2015;131:	No Outcome Assessed
311 Gopinath, B, Hardy, L, Baur, L, et al. Physical activity and sedentary behaviors and health-related quality of life in adolescents. *Pediatrics* 2012;130:e167-e174	Combination of Movement Behaviors Not Analyzed
312 García-Poole, C, Byrne, S, Rodrigo, M. Adolescent lifestyle profiles and personal and community competences. *European Journal of Developmental Psychology* 2018;15:531-547	Effects of Movement Behaviours Could Not be Determined
313 García-Hermoso, A, Saavedra, J, Ramírez-Vélez, R, et al. Reallocating sedentary time to moderate-to-vigorous physical activity but not to light-intensity physical activity is effective to reduce adiposity among youths: a systematic review and meta-analysis.. *Obesity reviews : an official journal of the International Association for the Study of Obesity* 2017;18:1088-1095	No Outcome Assessed
314 Driskell, M, Dyment, S, Mauriello, L, et al. Relationships among multiple behaviors for childhood and adolescent obesity prevention. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2008;46:209-215	Combination of Movement Behaviors Not Analyzed
315 Drenowatz, C, Carlson, J, Pfeiffer, K, et al. Joint association of physical activity/screen time and diet on CVD risk factors in 10-year-old children.. *Frontiers of medicine* 2012;6:428-435	Combination of Movement Behaviors Not Analyzed

316 Pereira, S, Katzmarzyk, P, Gomes, T, et al. Profiling physical activity, diet, screen and sleep habits in Portuguese children.. *Nutrients* 2015;7:4345-4362	No Outcome Assessed
317 Marques, A, Sallis, J, Martins, J, et al. Correlates of urban children's leisure-time physical activity and sedentary behaviors during school days.. *American journal of human biology : the official journal of the Human Biology Council* 2014;26:407-412	Combination of Movement Behaviors Not Analyzed
318 Stone, M, Stevens, D, Faulkner, G. Maintaining recommended sleep throughout the week is associated with increased physical activity in children. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2013;56:112-117	No Outcome Assessed
319 Slater, S, Chriqui, J, Chaloupka, F, et al. Joint use policies: Are they related to adolescent behavior?. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2014;69:S37-S43	Effects of Movement Behaviours Could Not be Determined
320 de Moraes, A, Fernández-Alvira, J, Rendo-Urteaga, T, et al. Effects of clustering of multiple lifestyle-related behaviors on blood pressure in adolescents from two observational studies. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2016;82:111-117	Combination of Movement Behaviors Not Analyzed
321 Giugliano, R, Carneiro, E . [Factors associated with obesity in school children].. *Jornal de pediatria* 2004;80:17-22	Combination of Movement Behaviors Not Analyzed
322 Gillette, M, Borner, K, Nadler, C, et al. Prevalence and health correlates of overweight and obesity in children with autism spectrum disorder. *Journal of Developmental and Behavioral Pediatrics* 2015;36:489-496	Combination of Movement Behaviors Not Analyzed
323 Friel C.P, Duran A.T, Shechter A.et al. Meeting 24-hour movement guidelines among us children and adolescents: Prevalence and age trends, 2016-2017. *Circulation* 2019;140:	No Outcome Assessed
324 Fairclough, S, Boddy, L, Hackett, A, et al. Associations between children's socioeconomic status, weight status, and sex, with screen-based sedentary behaviours and sport participation. *International Journal of Pediatric Obesity* 2009;4:299-305	Effects of Movement Behaviours Could Not be Determined
325 Esfarjani F, Mansour A, Khalafi M.et al. Assessment of lifestyle status in obese children. *Obesity Reviews* 2010;11:76	No Outcome Assessed
326 Engelhardt, C, Mazurek, M, Sohl, K. Media use and sleep among boys with autism spectrum disorder, ADHD, or typical development.. *Pediatrics* 2013;132:1081-1089	No Outcome Assessed
327 Ekelund U. . Physical activity, sedentary behaviour and cardio-metabolic risk. *International Journal of Pediatric Obesity* 2010;5:6-7	No Outcome Assessed
328 do Valle, M, Noll, M, Tarragô Candotti, C. PrevalÃªncia de dor nas costas e fatores associados em escolares do ensino fundamental de uma escola militar: um estudo transversal. / Prevalence of back pain and associated variables in primary schools in a military school: a cross sectional study.. *Revista Brasileira de Ciência e Movimento: RBCM* 2016;24:26-34	Combination of Movement Behaviors Not Analyzed
329 Dietz, W. The obesity epidemic in young children. Reduce television viewing and promote playing.. *BMJ (Clinical research ed.)* 2001;322:313-314	No Outcome Assessed

330 DE VOS, C, DU TOIT, D, COETZEE, D. VERBAND TUSSEN FISIEKE AKTIWITEIT EN SEDENTÃŠRE TYD, EN AKADEMIESE PRESTASIE BY GRAAD 7-LEERDERS IN POTCHEFSTROOM.. *South African Journal for Research in Sport, Physical Education & Recreation* 2018;40:13-27	Combination of Movement Behaviors Not Analyzed
331 De Giuseppe R, Calcaterra V, Biino G.et al. Active lifestyle on childhood abdominal obesity. *Obesity Facts* 2019;12:211	Effects of Movement Behaviours Could Not be Determined
332 Cuenca-García, M, Huybrechts, I, Ruiz, J, et al. Clustering of multiple lifestyle behaviors and health-related fitness in European adolescents. *Journal of Nutrition Education and Behavior* 2013;45:549-557	Effects of Movement Behaviours Could Not be Determined
333 Cuenca-Garcia M, Ottevaere C, Ruiz J.et al. Clustering of multiple lifestyle behaviours and its relationship to gender, age and physical fitness. *Annals of Nutrition and Metabolism* 2011;58:246-247	Effects of Movement Behaviours Could Not be Determined
334 Collings, P, Brage, S, Ridgway, C, et al. Physical activity intensity, sedentary time, and body composition in preschoolers.. *The American journal of clinical nutrition* 2013;97:1020-1028	Wrong population
335 Collings, P, Brage, S, Bingham, D, et al. Physical Activity, Sedentary Time, and Fatness in a Biethnic Sample of Young Children.. *Medicine and science in sports and exercise* 2017;49:930-938	Wrong population
336 Coleman, C, Wileyto, E, Lenhart, C, et al. Multiple Health Risk Behaviors in Adolescents: An Examination of Youth Risk Behavior Survey Data. *American Journal of Health Education* 2014;45:271-277	No Outcome Assessed
337 Carvalho, A, Fernandes, A, Gallego, A, et al. LA RELACIÃ"N DE LOS DEPORTES CON LA CALIDAD DEL SUEÃ'O Y LAS MEDIDAS ANTROPOMÃ‰TRICAS EN LAS ESCUELAS SECUNDARIAS. / THE RELATION OF SPORTS WITH SLEEP QUALITY AND ANTHROPOMETRIC MEASURES AT SECONDARY SCHOOLS.. *Journal of Sport & Health Research* 2019;11:91-106	Combination of Movement Behaviors Not Analyzed
338 Carli V, Wasserman C, Sarchiapone M.et al. Risk behaviours and psychiatric symptoms among adolescents in European schools. *European Neuropsychopharmacology* 2013;23:S612-S613	No full text found
339 Carlson, J. The relationship between self-reported school referrals and health behaviors among high school students. *Dissertation Abstracts International Section A: Humanities and Social Sciences* 2013;73:	Combination of Movement Behaviors Not Analyzed
340 Butte, N, Puyau, M, Adolph, A, et al. Physical activity in nonoverweight and overweight Hispanic children and adolescents.. *Medicine and science in sports and exercise* 2007;39:1257-1266	Combination of Movement Behaviors Not Analyzed
341 Bustos-Barahona, R, Delgado-Floody, P, Martínez-Salazar, C. Lifestyle associated with physical fitness related to health and cardiometabolic risk factors in Chilean schoolchildren. *Endocrinol Diabetes Nutr* 2020;:	No full text found
342 Busch, V, Van Stel, H, Schrijvers, A, et al. Clustering of health-related behaviors, health outcomes and demographics in Dutch adolescents: a cross-sectional study. *BMC Public Health* 2013;13:1118	Effects of Movement Behaviours Could Not be Determined
343 Burns, R, Fu, Y, Brusseau, T, et al. Relationships among physical activity, sleep duration, diet, and academic achievement in a sample of adolescents. *Prev Med Rep* 2018;12:71-74	Effects of Movement Behaviours Could Not be Determined

344 Burkart, S, St. Laurent, C, Greever, C, et al. Relationships between Physical Activity, Sleep, and Classroom Behavior Variables in Preschool Children.. *Pediatric Exercise Science* 2016;28:23-23	Wrong population
345 Bratteby L.-E, Sandhagen B, Samuelson G. Physical activity, daily energy expenditure, and sports habits in adolescents from two different regions in Sweden. *Scandinavian Journal of Nutrition/Naringsforskning* 1998;42:31-34	Combination of Movement Behaviors Not Analyzed
346 Brandstetter, S, Klenk, J, Berg, S, et al. Overweight prevention implemented by primary school teachers: a randomised controlled trial.. *Obesity facts* 2012;5:1-11	Combination of Movement Behaviors Not Analyzed
347 Brand, S, Gerber, M, Beck, J, et al. High exercise levels are related to favorable sleep patterns and psychological functioning in adolescents: A comparison of athletes and controls. *Journal of Adolescent Health* 2010;46:133-141	Combination of Movement Behaviors Not Analyzed
348 Boone-Heinonen, J, Gordon-Larsen, P, Adair, L. Obesogenic clusters: Multidimensional adolescent obesity-related behaviors in the US. *Annals of Behavioral Medicine* 2008;36:217-230	Combination of Movement Behaviors Not Analyzed
349 Bernard, L, Lavallée, C, Gray-Donald, K, et al. Overweight in Cree schoolchildren and adolescents associated with diet, low physical activity, and high television viewing.. *Journal of the American Dietetic Association* 1995;95:800-802	No Outcome Assessed
350 Ball, G, Lenk, J, Barbarich, B, et al. Overweight children and adolescents referred for weight management: are they meeting lifestyle behaviour recommendations?. *Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme* 2008;33:936-945	Combination of Movement Behaviors Not Analyzed
351 Baker, J, Graham, M, Davies, B, et al. Does physical inactivity in children transcend educational background and physical ability?. *Research in sports medicine (Print)* 2008;16:307-309	Combination of Movement Behaviors Not Analyzed
352 Bai, Y, Allums-Featherston, K, Saint-Maurice, P, et al. Evaluation of Youth Enjoyment Toward Physical Activity and Sedentary Behavior.. *Pediatric exercise science* 2018;30:273-280	No Outcome Assessed
353 Azeredo, C, Levy, R, Peres, M, et al. Patterns of health-related behaviours among adolescents: a cross-sectional study based on the National Survey of School Health Brazil 2012.. *BMJ open* 2016;6:e011571	No Outcome Assessed
354 Asfour, L, Koussa, M, Perrino, T, et al. The association of organized and unorganized physical activity and sedentary behavior with internalizing and externalizing symptoms in hispanic adolescents. *Child and Adolescent Mental Health* 2016;21:109-114	Combination of Movement Behaviors Not Analyzed
355 Ascenso, A, Palmeira, A, Pedro, L, et al. Physical activity and cardiorespiratory fitness, but not sedentary behavior, are associated with carotid intima-media thickness in obese adolescents.. *European journal of pediatrics* 2016;175:391-398	Combination of Movement Behaviors Not Analyzed
356 Asare, M, Danquah, S . The relationship between physical activity, sedentary behaviour and mental health in Ghanaian adolescents. *Child and Adolescent Psychiatry and Mental Health* 2015;9:	Combination of Movement Behaviors Not Analyzed
357 Arundhana A, Hadi H, Julia M. Association of sedentary, physical activity and obesity in elementary school children of Yogyakarta, Indonesia. *Obesity Reviews* 2014;15:100	Combination of Movement Behaviors Not Analyzed

358 Arriscado, D, Knox, E, Zabala, M, et al. Different healthy habits between northern and southern Spanish school children. *Journal of Public Health* 2017;25:653-660	No Outcome Assessed
359 Arora T, Thomas G, Taheri S. Examining the relationships between sleep duration, obesity predictive behaviours and body mass index in UK adolescents. *Sleep* 2012;35:A83	Combination of Movement Behaviors Not Analyzed
360 Arhab, A, Messerli-Bürgy, N, Kakebeeke, T, et al. Association of physical activity with adiposity in preschoolers using different clinical adiposity measures: a cross-sectional study. *BMC Pediatr* 2019;19:397	Wrong population
361 Arbour-Nicitopoulos, K, Faulkner, G, Irving, H. Multiple health-risk behaviour and psychological distress in adolescence. *Journal of the Canadian Academy of Child and Adolescent Psychiatry / Journal de l'Académie canadienne de psychiatrie de l'enfant et de l'adolescent* 2012;21:171-178	Combination of Movement Behaviors Not Analyzed
362 Arat, G, Wong, P . The relationship between physical activity and mental health among adolescents in six middle-income countries: A cross-sectional study. *Child & Youth Services* 2017;38:180-195	Combination of Movement Behaviors Not Analyzed
363 Apriana W, Sofiyya I, Julia M.et al. Relationship between physical activity and concentration of study of teenagers in Yogyakarta, Indonesia. *Pakistan Journal of Nutrition* 2016;15:211-216	Combination of Movement Behaviors Not Analyzed
364 Anshory J, Hardinsyah.Tanziha I.et al. The effect of physical activity (Endurance and strength) and sleep management on bmi and body fat children overweight in makassar city. *Indian Journal of Public Health Research and Development* 2018;9:417-422	Combination of Movement Behaviors Not Analyzed
365 Anonymous, Does television viewing increase obesity and reduce physical activity? Cross-sectional and longitudinal analyses among adolescent girls. *European Journal of Pediatrics* 1993;152:619	Combination of Movement Behaviors Not Analyzed
366 Anderson, S, Economos, C, Must, A. Active play and screen time in US children aged 4 to 11 years in relation to sociodemographic and weight status characteristics: a nationally representative cross-sectional analysis.. *BMC public health* 2008;8:366	No Outcome Assessed
367 Añez, E, Fornieles-Deu, A, Fauquet-Ars, J, et al. Body image dissatisfaction, physical activity and screen-time in Spanish adolescents. *Journal of Health Psychology* 2018;23:36-47	Combination of Movement Behaviors Not Analyzed
368 Andrade de Medeiros Moreira, R, Ricardo Moreira, T, Dias da Costa, G, et al. Multilevel analysis of factors that influence overweight in children: research in schools enrolled in northern Brazil School Health Program. *BMC Pediatr* 2020;20:188	Combination of Movement Behaviors Not Analyzed
369 Andersen, R, Crespo, C, Bartlett, S, et al. Relationship of physical activity and television watching with body weight and level of fatness among children.. *JAMA: Journal of the American Medical Association* 1998;279:938-942	Combination of Movement Behaviors Not Analyzed
370 Andersen, L, Wedderkopp, N, Kristensen, P, et al. Cycling to school and cardiovascular risk factors: a longitudinal study.. *Journal of physical activity & health* 2011;8:1025-1033	Combination of Movement Behaviors Not Analyzed

371 Amisola, R, Jacobson, M . Physical activity, exercise, and sedentary activity: relationship to the causes and treatment of obesity.. *Adolescent medicine (Philadelphia, Pa.)* 2003;14:23-35	Combination of Movement Behaviors Not Analyzed
372 Amigo Vázquez, I, Busto Zapico, R, Herrero Díez, J, et al. [Physical activity, sedentary leisure, short sleeping and childhood overweight].. *Psicothema* 2008;20:516-520	Combination of Movement Behaviors Not Analyzed
373 Amigo, I, Peña, E, Errasti, J, et al. Sedentary versus active leisure activities and their relationship with sleeping habits and body mass index in children of 9 and 10 years of age. *Journal of Health Psychology* 2016;21:1472-1480	Combination of Movement Behaviors Not Analyzed
374 Altindag Ö.Sert C,. Body composition and relation with physical activities in children: a pilot study.. *Turkish Journal of Physical Medicine & Rehabilitation / Turkiye Fiziksel Tip ve Rehabilitasyon Dergisi* 2009;55:60-63	Combination of Movement Behaviors Not Analyzed
375 Allender, S, Kremer, P, de Silva-Sanigorski, A, et al. Associations between activity-related behaviours and standardized BMI among Australian adolescents. *Journal of Science and Medicine in Sport* 2011;14:512-521	Combination of Movement Behaviors Not Analyzed
376 Alhusaini, A, Buragadda, S, Melam, G. Associations among body mass index, sedentary behavior, physical activity, and academic performance in schoolchildren. *J Sports Med Phys Fitness* 2020;:	Combination of Movement Behaviors Not Analyzed
377 Albuquerque C, Cunha M, Duarte J.et al. Impact of lifestyles in school performance in portuguese adolescents. *Atencion Primaria* 2015;47:7	Combination of Movement Behaviors Not Analyzed
378 Alamian, A, Paradis, G . Correlates of multiple chronic disease behavioral risk factors in Canadian children and adolescents.. *American journal of epidemiology* 2009;170:1279-1289	No Outcome Assessed
379 Al Subhi, L, Bose, S, Al Ani, M. Prevalence of physically active and sedentary adolescents in 10 Eastern Mediterranean countries and its relations with age, sex, and body mass index. *Journal of Physical Activity & Health* 2015;12:257-265	Combination of Movement Behaviors Not Analyzed
380 Al-Nakeeb, Y, Lyons, M, Collins, P, et al. Obesity, physical activity and sedentary behavior amongst British and Saudi youth: a cross-cultural study.. *International journal of environmental research and public health* 2012;9:1490-1506	Combination of Movement Behaviors Not Analyzed
381 Al-Hazzaa, H, Abahussain, N, Al-Sobayel, H, et al. Physical activity, sedentary behaviors and dietary habits among Saudi adolescents relative to age, gender and region. *The International Journal of Behavioral Nutrition and Physical Activity* 2011;8:	No Outcome Assessed
382 Al-Hazzaa, H, Musaiger, A, Abahussain, N, et al. Lifestyle correlates of selfâ€ reported sleep duration among Saudi adolescents: A multicentre schoolâ€ based crossâ€ sectional study. *Child: Care, Health and Development* 2014;40:533-542	No Outcome Assessed
383 Al-Hazzaa, H, Al-Sobayel, H, Abahussain, N, et al. Association of dietary habits with levels of physical activity and screen time among adolescents living in Saudi Arabia. *Journal of Human Nutrition and Dietetics* 2014;27:204-213	No Outcome Assessed

384 Ahmad, N, Shariff, Z, Mukhtar, F, et al. Family-based intervention using face-to-face sessions and social media to improve Malay primary school children's adiposity: a randomized controlled field trial of the Malaysian REDUCE programme.. *Nutrition journal* 2018;17:74	Combination of Movement Behaviors Not Analyzed
385 The NEAT Girls Trial: It Is Effective in Reducing Self-Reported Sedentary Behavior But Does Not Change Objectively Measured Physical Activity and Sedentary Behavior.. *Journal of Sport & Exercise Psychology* 2013;35:546-546	Duplicate
386 Aguilar, M, Vergara, F, Velásquez, E, et al. [Physical activity, screen time and sleep patterns in Chilean girls].. *Anales de pediatria (Barcelona, Spain : 2003)* 2015;83:304-310	No Outcome Assessed
387 Spengler, S, Mess, F, Schmocker, E, et al. Longitudinal associations of health-related behavior patterns in adolescence with change of weight status and self-rated health over a period of 6 years: results of the MoMo longitudinal study.. *BMC pediatrics* 2014;14:242	Effects of Movement Behaviours Could Not be Determined
388 Adelantado-Renau, M, Jiménez-Pavón, D, Beltran-Valls, M, et al. Independent and combined influence of healthy lifestyle factors on academic performance in adolescents: DADOS Study. *Pediatr Res* 2019;85:456-462	Effects of Movement Behaviours Could Not be Determined
389 Bélair, M, Kohen, D, Kingsbury, M, et al. Relationship between leisure time physical activity, sedentary behaviour and symptoms of depression and anxiety: evidence from a population-based sample of Canadian adolescents.. *BMJ open* 2018;8:e021119	Combination of Movement Behaviors Not Analyzed
390 Li X.S, Buxton O.M, Lee S.et al. Insomnia symptoms and sleep duration mediate the association between adolescent screen time and depressive symptoms. *Sleep* 2018;41:A298	Combination of Movement Behaviors Not Analyzed
391 Martínez-Gómez, D, Veiga, O, Gómez-Martínez, S, et al. Gender-specific influence of health behaviors on academic performance in Spanish adolescents: the AFINOS study.. *Nutricion hospitalaria* 2012;27:724-730	Effects of Movement Behaviours Could Not be Determined
392 Casey, M, Harvey, J, Telford, A, et al. Patterns of time use among regional and rural adolescent girls: Associations with correlates of physical activity and health-related quality of life. *Journal of Science and Medicine in Sport* 2016;19:931-935	Effects of Movement Behaviours Could Not be Determined
393 Boyle J. . Physical activity and sedentary behavior patterns are associated with selected adolescent health risk behaviors. *American Journal of Health Promotion* 2008;23:57	Combination of Movement Behaviors Not Analyzed
394 Barlett, N, Gentile, D, Barlett, C, et al. Sleep as a mediator of screen time effects on US children's health outcomes: A prospective study. *Journal of Children and Media* 2012;6:37-50	Combination of Movement Behaviors Not Analyzed
395 Dumuid, D, Olds, T, Lewis, L, et al. Health-related quality of life and lifestyle behavior clusters in school-aged children from 12 countries. *The Journal of Pediatrics* 2017;183:178-183	No Outcome Assessed
396 Adelantado-Renau, M, Diez-Fernandez, A, Beltran-Valls, M, et al. The effect of sleep quality on academic performance is mediated by Internet use time: DADOS study.. *Jornal de pediatria* ;95:410-418	Combination of Movement Behaviors Not Analyzed

397 Dhondt K, Vandendriessche A, Ghekiere A.et al. Sleep mediates the association between school pressure, physical activity, screen-time and psychological distress in adolescents. *Journal of Sleep Research* 2018;27:82	Combination of Movement Behaviors Not Analyzed
398 Veloso, S, Matos, M, Carvalho, M, et al. Psychosocial Factors of Different Health Behaviour Patterns in Adolescents: Association with Overweight and Weight Control Behaviours.. *Journal of Obesity* 2012;2012:1-10	Effects of Movement Behaviours Could Not be Determined
399 Carson, V, Salmon, J, Arundell, L, et al. Examination of mid-intervention mediating effects on objectively assessed sedentary time among children in the Transform-Us! cluster-randomized controlled trial. *The International Journal of Behavioral Nutrition and Physical Activity* 2013;10:	No Outcome Assessed
400 Berlin, K, Kamody, R, Thurston, I, et al. Physical activity, sedentary behaviors, and nutritional risk profiles and relations to body mass index, obesity, and overweight in eighth grade. *Behavioral Medicine* 2017;43:31-39	Combination of Movement Behaviors Not Analyzed
401 Androutsos, O, Moschonis, G, Mavrogianni, C, et al. Identification of lifestyle patterns, including sleep deprivation, associated with insulin resistance in children: the Healthy Growth Study.. *European journal of clinical nutrition* 2014;68:344-349	Effects of Movement Behaviours Could Not be Determined
402 Pérez-Rodrigo, C, Gil, Á, González-Gross, M, et al. Clustering of Dietary Patterns, Lifestyles, and Overweight among Spanish Children and Adolescents in the ANIBES Study.. *Nutrients* 2015;8:	Effects of Movement Behaviours Could Not be Determined
403 Cho, K, Lee, S, Kim, Y. Physical Activity and Sedentary Behavior Are Independently Associated with Weight in Korean Adolescents. *J Lifestyle Med* 2014;4:47-54	Effects of Movement Behaviours Could Not be Determined
404 Faulkner, G, Weatherson, K, Patte, K, et al. Are one-year changes in adherence to the 24-hour movement guidelines associated with flourishing among Canadian youth?. *Preventive Medicine* 2020;139:106179	Effects of Movement Behaviours Could Not be Determined
405 Gomes, T, Hedeker, D, Dos Santos, F, et al. Relationship between Sedentariness and Moderate-to-Vigorous Physical Activity in Youth: A Multivariate Multilevel Study.. *International journal of environmental research and public health* 2017;14:	No Outcome Assessed
406 Duncan, J, Schofield, G, Duncan, E, et al. Risk factors for excess body fatness in New Zealand children.. *Asia Pacific journal of clinical nutrition* 2008;17:138-147	Effects of Movement Behaviours Could Not be Determined
407 Santaliestra-Pasías, A, González-Gil, E, Pala, V, et al. Predictive associations between lifestyle behaviours and dairy consumption: The IDEFICS study. *Nutr Metab Cardiovasc Dis* 2020;30:514-522	No Outcome Assessed
408 Rognvaldsdottir, V, Brychta, R, Hrafnkelsdottir, S, et al. Less physical activity and more varied and disrupted sleep is associated with a less favorable metabolic profile in adolescents. *PLoS One* 2020;15:e0229114	Combination of Movement Behaviors Not Analyzed
409 Pearson, N, Sherar, L, Hamer, M. Prevalence and Correlates of Meeting Sleep, Screen-Time, and Physical Activity Guidelines Among Adolescents in the United Kingdom.. *JAMA Pediatrics* 2019;173:993-994	No Outcome Assessed

410 Guijarro-Romero, S, Mayorga-Vega, D, Viciana, J, et al. Students' physical activity intensity and sedentary behaviour by physical self-concept profiles: A latent profile analysis. / Intensidad de la actividad fÃsica y comportamiento sedentario de los estudiantes por perfiles de autoconcepto fÃsico: Un anÃ¡li. *RICYDE. Revista Internacional de Ciencias del Deporte* 2020;16:85-101	Combination of Movement Behaviors Not Analyzed
411 Katzmarzyk P, Staiano A. ,. Relationship between meeting 24-hour movement guidelines and measures of adiposity in children. *Obesity Facts* 2017;10:251	Effects of Movement Behaviours Could Not be Determined
412 Kracht, C, Champagne, C, Hsia, D, et al. Association Between Meeting Physical Activity, Sleep, and Dietary Guidelines and Cardiometabolic Risk Factors and Adiposity in Adolescents.. *Journal of Adolescent Health* 2020;66:733-739	Effects of Movement Behaviours Could Not be Determined
413 Loprinzi, P, Edwards, M . Less sitting, more physical activity and higher cardiorespiratory fitness: associations with weight status among a national sample of children.. *Health Promotion Perspectives* 2017;7:175-177	Effects of Movement Behaviours Could Not be Determined
414 Herman, K, Chaput, J, Sabiston, C, et al. Combined physical activity/sedentary behavior associations with indices of adiposity in 8- to 10-year-old children. *Journal of Physical Activity & Health* 2015;12:20-29	Duplicate
415 Mitchell, T, Steele, R . Latent profiles of physical activity and sedentary behavior in elementary school-age youth: Associations with health-related quality of life. *Journal of Pediatric Psychology* 2018;43:723-732	Duplicate
416 Marques, A, Santos, R, Ekelund, U, et al. Association between Physical Activity, Sedentary Time, and Healthy Fitness in Youth.. *Medicine & Science in Sports & Exercise* 2015;47:575-580	Duplicate
417 Marchant, G, Chevance, G, Boiché, J. Intention and automaticity toward physical and sedentary screen-based leisure activities in adolescents: A profile perspective. *J Sport Health Sci* 2018;7:481-488	Combination of Movement Behaviors Not Analyzed
418 Straker, L, Smith, A, Hands, B, et al. Screen-based media use clusters are related to other activity behaviours and health indicators in adolescents.. *BMC public health* 2013;13:1174	Combination of Movement Behaviors Not Analyzed
419 Mejía, D, Berchtold, A, Bélanger, R, et al. Frequency and effects of meeting health behaviour guidelines among adolescents. *European Journal of Public Health* 2013;23:8-13	Combination of Movement Behaviors Not Analyzed
420 Meyer, U, Schindler, C, Bloesch, T, et al. Combined impact of negative lifestyle factors on cardiovascular risk in children: A randomized prospective study. *Journal of Adolescent Health* 2014;55:790-795	Combination of Movement Behaviors Not Analyzed
421 Sund, A, Larsson, B, Wichstrøm, L. Role of physical and sedentary activities in the development of depressive symptoms in early adolescence. *Social Psychiatry and Psychiatric Epidemiology: The International Journal for Research in Social and Genetic Epidemiology and Mental Health Services* 2011;46:431-441	Combination of Movement Behaviors Not Analyzed
422 Rainey, C, McKeown, R, Sargent, R, et al. Adolescent athleticism, exercise, body image, and dietary practices. *American Journal of Health Behavior* 1998;22:193-205	Effects of Movement Behaviours Could Not be Determined

423 Epstein, L, Valoski, A, Vara, L, et al. Effects of decreasing sedentary behavior and increasing activity on weight change in obese children. *Health Psychology* 1995;14:109-115	Effects of Movement Behaviours Could Not be Determined
424 Marques, A, Peralta, M, Santos, T, et al. Self-rated health and health-related quality of life are related with adolescents' healthy lifestyle. *Public Health* 2019;170:89-94	Effects of Movement Behaviours Could Not be Determined
425 Kim, Y, Umeda, M, Lochbaum, M, et al. Physical activity, screen-based sedentary behavior, and sleep duration in adolescents: Youth risk behavior survey, 2011â€“2013. *Preventing Chronic Disease: Public Health Research, Practice, and Policy* 2016;13:	No Outcome Assessed
426 Fakhouri, T, Hughes, J, Brody, D, et al. Physical activity and screen-time viewing among elementary school-aged children in the United States from 2009 to 2010.. *JAMA pediatrics* 2013;167:223-229	No Outcome Assessed
427 Qiao, Y, Zhang, T, Liu, H, et al. Joint association of birth weight and physical activity/sedentary behavior with obesity in children ages 9-11 years from 12 countries.. *Obesity (Silver Spring, Md.)* 2017;25:1091-1097	Combination of Movement Behaviors Not Analyzed
428 Dumuid, D, Maher, C, Lewis, L, et al. Human development index, childrenâ€™s health-related quality of life and movement behaviors: A compositional data analysis. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care & Rehabilitation* 2018;27:1473-1482	Combination of Movement Behaviors Not Analyzed
429 Taverno Ross, S, Dowda, M, Dishman, R, et al. Classes of physical activity and sedentary behavior in 5th grade children. *American Journal of Health Behavior* 2016;40:352-361	No Outcome Assessed
430 Thivel, D, Tremblay, M, Katzmarzyk, P, et al. Associations between meeting combinations of 24-hour movement recommendations and dietary patterns of children: A 12-country study. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2019;118:159-165	No Outcome Assessed
431 van der Sluis, M, Lien, N, Twisk, J, et al. Longitudinal associations of energy balance-related behaviours and cross-sectional associations of clusters and body mass index in Norwegian adolescents.. *Public health nutrition* 2010;13:1716-1721	Effects of Movement Behaviours Could Not be Determined
432 Shi, X, Tubb, L, Fingers, S, et al. Associations of physical activity and dietary behaviors with children's health and academic problems.. *The Journal of school health* 2013;83:1-7	Combination of Movement Behaviors Not Analyzed
433 Pierce G.L, Pajaniappan M, DiPietro A.et al. Higher habitual physical activity is associated with enhanced left ventricular diastolic function and exercise capacity and lower wave reflection in healthy adolescents independent of time in sedentary activities. *Circulation* 2013;127:	Combination of Movement Behaviors Not Analyzed
434 Wang, C, Chia, Y, Quek, J, et al. Patterns of physical activity, sedentary behaviors, and psychological determinants of physical activity among Singaporean school children. *International Journal of Sport and Exercise Psychology* 2006;4:227-249	No Outcome Assessed
435 Vasankari, V, Husu, P, Vähä-Ypyä, H, et al. Association of objectively measured sedentary behaviour and physical activity with cardiovascular disease risk.. *European journal of preventive cardiology* 2017;24:1311-1318	Wrong population

436 Tambalis, K, Panagiotakos, D, Psarra, G, et al. Association of cardiorespiratory fitness levels with dietary habits and lifestyle factors in schoolchildren.. *Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme* 2019;44:539-545	Combination of Movement Behaviors Not Analyzed
437 Syväoja, H, Tammelin, T, Ahonen, T, et al. The associations of objectively measured physical activity and sedentary time with cognitive functions in school-aged children. *PLoS ONE* 2014;9:	Combination of Movement Behaviors Not Analyzed
438 Strizich, G, Kaplan, R, Sotres-Alvarez, D, et al. Objectively Measured Sedentary Behavior, Physical Activity, and Cardiometabolic Risk in Hispanic Youth: Hispanic Community Health Study/Study of Latino Youth.. *The Journal of clinical endocrinology and metabolism* 2018;103:3289-3298	Combination of Movement Behaviors Not Analyzed
439 San Mauro, I, Megias, A, García de Angulo, B, et al. [The influence of healthy lifestyle habits on weight status in school aged children and adolescents].. *Nutricion hospitalaria* 2015;31:1996-2005	Combination of Movement Behaviors Not Analyzed
440 Regaieg, S, Charfi, N, Elleuch, M, et al. [Obesity, physical activity and sedentary time among school adolescents aged 15 to 18 years in the city of Sfax (Tunisia)].. *The Pan African medical journal* 2015;22:370	Combination of Movement Behaviors Not Analyzed
441 Michels N, Kriemler S, Marques-Vidal P.-M.et al. Psychosocial quality of life, lifestyle and adiposity: A longitudinal study in preschoolers. *Psychosomatic Medicine* 2015;77:A29-A30	Wrong population
442 Vierola, A, Suominen, A, Lindi, V, et al. Associations of sedentary behavior, physical activity, cardiorespiratory fitness, and body fat content with pain conditions in children: The physical activity and nutrition in children study. *The Journal of Pain* 2016;17:845-853	Combination of Movement Behaviors Not Analyzed
443 Michels, N, Sioen, I, Boone, L, et al. Longitudinal association between child stress and lifestyle. *Health Psychology* 2015;34:40-50	Combination of Movement Behaviors Not Analyzed
444 Matias, T, Silva, K, Silva, J, et al. Clustering of diet, physical activity and sedentary behavior among Brazilian adolescents in the national school - based health survey (PeNSE 2015).. *BMC public health* 2018;18:1283	No Outcome Assessed
445 Lee, P. Association between adolescents' physical activity and sedentary behaviors with change in BMI and risk of type 2 diabetes.. *PloS one* 2014;9:e110732	Duplicate
446 Haapala, E, Poikkeus, A, Kukkonen-Harjula, K, et al. Associations of physical activity and sedentary behavior with academic skillsâ€"A follow-up study among primary school children. *PLoS ONE* 2014;9:	Combination of Movement Behaviors Not Analyzed
447 McClain, A, Hsu, Y, Belcher, B, et al. Physical inactivity, but not sedentary behavior or energy intake, is associated with higher fat mass in Latina and African American girls.. *Ethnicity & disease* 2011;21:458-461	Combination of Movement Behaviors Not Analyzed
448 Zabinski, M, Norman, G, Sallis, J, et al. Patterns of sedentary behavior among adolescents. *Health Psychology* 2007;26:113-120	Combination of Movement Behaviors Not Analyzed

449 Kantomaa, M, Purtsi, J, Taanila, A, et al. Suspected motor problems and low preference for active play in childhood are associated with physical inactivity and low fitness in adolescence. *PLoS ONE* 2011;6:	Combination of Movement Behaviors Not Analyzed
450 Bar-Or, O. The effects of sedentarism and physical activity on children's health.. *The West Indian medical journal* ;51 Suppl 1:46-48	No full text found
451 Wong, M, Cheung, G, Lau, E. Interaction of sleep and regular exercise in adolescents' and young adults' working memory. *International Journal of Sport Psychology* 2017;48:1-17	Duplicate
452 Overweight Adolescents: Don't Blame It on the Television!. *Journal of Sport & Exercise Psychology* 2009;31:676-677	No full text found
453 Lowton-Smith S, King A, Duncan M.et al. Relationship between physical activity levels and body fat of children aged 8-9, from UK schools in low socioeconomic areas. *Physiotherapy* 2016;102:e7-e8	Combination of Movement Behaviors Not Analyzed
454 Karachaliou F, Vlachopapadopoulou E, Psaltopoulou T.et al. Prevalence of asthma symptoms and association with obesity, sedentary lifestyle and sociodemographic factors: Data from the hellenic national plan for the assessment, prevention and treatment of childhood obesity. *Hormone Research in Paediatrics* 2015;84:423	Combination of Movement Behaviors Not Analyzed
455 Joensuu, L, Syväoja, H, Kallio, J, et al. Objectively measured physical activity, body composition and physical fitness: Cross-sectional associations in 9- to 15-year-old children.. *European journal of sport science* 2018;18:882-892	Combination of Movement Behaviors Not Analyzed
456 Husu, P, Vähä-Ypyä, H, Vasankari, T. Objectively measured sedentary behavior and physical activity of Finnish 7- to 14-year-old children- associations with perceived health status: a cross-sectional study.. *BMC public health* 2016;16:338	Combination of Movement Behaviors Not Analyzed
457 Hunter, S, Leatherdale, S, Carson, V. The 3-Year Longitudinal Impact of Sedentary Behavior on the Academic Achievement of Secondary School Students. *Journal of School Health* 2018;88:660-668	Combination of Movement Behaviors Not Analyzed
458 Whitaker, K, Pettee Gabriel, K, Buman, M, et al. Associations of Accelerometer-Measured Sedentary Time and Physical Activity With Prospectively Assessed Cardiometabolic RiskÂ Factors: The CARDIA Study.. *Journal of the American Heart Association* 2019;8:e010212	Wrong population
459 De Visser R.S, Sylvester R, Jiang Q.et al. School lunch is associated with increased cardiovascular risk among middle-school children. *Circulation* 2016;133:	Combination of Movement Behaviors Not Analyzed
460 Marques, A, Ekelund, U, Sardinha, L. Associations between organized sports participation and objectively measured physical activity, sedentary time and weight status in youth. *Journal of Science and Medicine in Sport* 2016;19:154-157	Combination of Movement Behaviors Not Analyzed
461 Mason, J, LeBouthillier, D, Asmundson, G. Relationships between health behaviors, posttraumatic stress disorder, and comorbid general anxiety and depression.. *Cognitive behaviour therapy* 2019;48:184-199	Wrong population
462 McCrindle B.W, Tyrrell P, Manlhiot C.et al. Physical activity mediates blood pressure in overweight adolescents without abdominal adiposity. *Cardiology in the Young* 2012;22:S90-S91	Combination of Movement Behaviors Not Analyzed

463 Melo, X, Santa-Clara, H, Pimenta, N, et al. Intima-media thickness in 11- to 13-year-old children: Variation attributed to sedentary behavior, physical activity, cardiorespiratory fitness, and waist circumference. *Journal of Physical Activity & Health* 2015;12:610-617	Combination of Movement Behaviors Not Analyzed
464 Mora-Gonzalez, J, Esteban-Cornejo, I, Cadenas-Sanchez, C, et al. Physical Fitness, Physical Activity, and the Executive Function in Children with Overweight and Obesity.. *The Journal of pediatrics* 2019;208:50	Combination of Movement Behaviors Not Analyzed
465 Mooses, K, Mägi, K, Riso, E, et al. Objectively measured sedentary behaviour and moderate and vigorous physical activity in different school subjects: a cross-sectional study.. *BMC public health* 2017;17:108	Combination of Movement Behaviors Not Analyzed
466 Chen, Y, Tu, Y, Huang, K, et al. Pathway from central obesity to childhood asthma. Physical fitness and sedentary time are leading factors.. *American journal of respiratory and critical care medicine* 2014;189:1194-1203	Combination of Movement Behaviors Not Analyzed
467 Liou, Y, Liou, T, Chang, L. Obesity among adolescents: Sedentary leisure time and sleeping as determinants. *Journal of Advanced Nursing* 2010;66:1246-1256	Combination of Movement Behaviors Not Analyzed
468 Leatherdale, S. Factors associated with communication-based sedentary behaviors among youth: Are talking on the phone, texting, and instant messaging new sedentary behaviors to be concerned about?. *Journal of Adolescent Health* 2010;47:315-318	Combination of Movement Behaviors Not Analyzed
469 Jang, M. Factors associated with body mass index (BMI) in Korean American children. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2016;77:	Combination of Movement Behaviors Not Analyzed
470 Kawada, T. Factors affecting cognitive performance in children with special reference to sleep and sedentary behavior.. *Physiology & behavior* 2016;167:179	Not Quantitatively Analysed
471 Africa, E, van Deventer, k, Barnard, J. GESONDHEIDSRISIKOGEDRAG BY 'N GESELEKTEERDE GROEP ADOLESSENTE DOGTERS. / Health risk behaviours amongst a selected group of adolescent girls.. *South African Journal for Research in Sport, Physical Education & Recreation* 2008;30:1-14	No Outcome Assessed
472 McManus, A, Chu, E, Yu, C, et al. How Children Move: Activity Pattern Characteristics in Lean and Obese Chinese Children.. *Journal of Obesity* 2011;2011:1-6	Combination of Movement Behaviors Not Analyzed
473 Wicoff, M. Early predictors of physical activity and academic achievement in middle school. *Dissertation Abstracts International Section A: Humanities and Social Sciences* 2017;78:	Combination of Movement Behaviors Not Analyzed
474 Lee H, Jeon Y.H. ,. Environmental factors, health behaviors, and psychosocial aspects of allergic diseases in Korean adolescents. *Allergy: European Journal of Allergy and Clinical Immunology* 2018;73:169-170	Combination of Movement Behaviors Not Analyzed
475 Ludwig, D. Weight loss strategies for adolescents: a 14-year-old struggling to lose weight.. *JAMA* 2012;307:498-508	Not Quantitatively Analysed

476 Lätt, E, Mäestu, J, Ortega, F, et al. Vigorous physical activity rather than sedentary behaviour predicts overweight and obesity in pubertal boys: A 2-year follow-up study. *Scandinavian Journal of Public Health* 2015;43:276-282	Combination of Movement Behaviors Not Analyzed
477 Wong, M, Lycett, K, Olds, T, et al. Use of time and adolescent healthâ€ related quality of life/wellâ€ being: A scoping review. *Acta Paediatrica* 2017;106:1239-1245	Not Quantitatively Analysed
478 Iannotti, R, Wang, J . Trends in physical activity, sedentary behavior, diet, and BMI among US adolescents, 2001 â€“2009. *Pediatrics* 2013;132:606-614	No Outcome Assessed
479 McHale, S, Blocklin, M, Walter, K, et al. The role of daily activities in youths' stress physiology. *Journal of Adolescent Health* 2012;51:623-628	Combination of Movement Behaviors Not Analyzed
480 Lui D.P.Y, Szeto G.P.Y, Jones A.Y.M. The pattern of physical activity participation and its association with body weight and self-reported musculoskeletal symptoms in Hong Kong primary 4 to secondary 3 Students. *Hong Kong Physiotherapy Journal* 2010;28:27	Combination of Movement Behaviors Not Analyzed
481 Isasi, C, Ostrovsky, N, Wills, T. The association of emotion regulation with lifestyle behaviors in inner-city adolescents. *Eating Behaviors* 2013;14:518-521	Combination of Movement Behaviors Not Analyzed
482 Marques, E, Pizarro, A, Figueiredo, P, et al. Modifiable lifestyle behavior patterns, sedentary time and physical activity contexts: A cluster analysis among middle school boys and girls in the SALTA study. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2013;56:413-415	Combination of Movement Behaviors Not Analyzed
483 Skrede, T, Stavnsbo, M, Aadland, E, et al. Moderate-to-vigorous physical activity, but not sedentary time, predicts changes in cardiometabolic risk factors in 10-y-old children: the Active Smarter Kids Study.. *The American journal of clinical nutrition* 2017;105:1391-1398	Combination of Movement Behaviors Not Analyzed
484 Lu, A, Wang, R . Moderate-to-vigorous physical activity, but not sedentary time, predicts changes in cardiometabolic risk factors in 10-y-old children: the Active Smarter Kids Study.. *The American journal of clinical nutrition* 2017;106:948	Not Quantitatively Analysed
485 Machado-Rodrigues A.M, Coelho-E-Silva M.J, Padez C.et al. Metabolic syndrome and behabioural risk factors in a sample of girls aged 11-to 17-years. *European Journal of Epidemiology* 2012;27:S116	Combination of Movement Behaviors Not Analyzed
486 MORA-GONZALEZ, J, MIGUELES, J, ESTEBAN-CORNEJO, I, et al. Sedentarism, Physical Activity, Steps, and Neurotrophic Factors in Obese Children.. *Medicine & Science in Sports & Exercise* 2019;51:2325-2333	Combination of Movement Behaviors Not Analyzed
487 Leyton A.L, Baptist A.P. ,. Asthma and physical activity in adolescents: A cross sectional analysis. *Journal of Allergy and Clinical Immunology* 2012;129:AB40	Combination of Movement Behaviors Not Analyzed
488 Regidor, E, Gutiérrez-Fisac, J, Banegas, J, et al. [Life socioeconomic circumstances, physical inactivity and obesity influences on metabolic syndrome]. *Rev Esp Salud Publica* 2007;81:25-31	Wrong population
489 Maffeis, C. Level of physical activity and adiposity in children: relevance of sedentary behaviors.. *The American journal of clinical nutrition* 2005;81:1449	Not Quantitatively Analysed

490 Magee, C, Caputi, P, Iverson, D. Lack of sleep could increase obesity in children and too much television could be partly to blame. *Acta Paediatrica* 2014;103:e27-e31	Combination of Movement Behaviors Not Analyzed
491 Jia, C, Li, S, Han, M, et al. Health-related factors and suicidal ideation in high school students in rural China. *Omega: Journal of Death and Dying* 2016;73:263-274	Combination of Movement Behaviors Not Analyzed
492 Ikävalko, T, Lehto, S, Lintu, N, et al. Healthâ€ related correlates of psychological wellâ€ being among girls and boys 6â€“8 years of age: The physical activity and nutrition in children study. *Journal of Paediatrics and Child Health* 2018;54:506-509	Combination of Movement Behaviors Not Analyzed
493 Mitchell, J. Longitudinal associations between sedentary behavior and health outcomes during childhood. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2012;73:2086-2086	Combination of Movement Behaviors Not Analyzed
494 DE RIDDER, J, STRYDOM, G, GREEFF, M. Physical activity and body composition, a risk profile analysis of learners in selected urban secondary schools in Namibia.. *African Journal for Physical, Health Education, Recreation & Dance* 2012;18:1021-1036	Combination of Movement Behaviors Not Analyzed
495 Miguel-Berges, M, Santaliestra-Pasias, A, Mouratidou, T, et al. Combined Longitudinal Effect of Physical Activity and Screen Time on Food and Beverage Consumption in European Preschool Children: The ToyBox-Study.. *Nutrients* 2019;11:	Wrong population
496 Mi, S, Kelly, N, Brychta, R, et al. Associations of sleep patterns with metabolic syndrome indices, body composition, and energy intake in children and adolescents.. *Pediatric obesity* 2019;14:e12507	Combination of Movement Behaviors Not Analyzed
497 Khambalia, A, Hardy, L, Bauman, A. Accuracy of weight perception, lifeâ€ style behaviours and psychological distress among overweight and obese adolescents. *Journal of Paediatrics and Child Health* 2012;48:220-227	Combination of Movement Behaviors Not Analyzed
498 Karatzi, K, Protogerou, A, Moschonis, G, et al. Prevalence of hypertension and hypertension phenotypes by age and gender among schoolchildren in Greece: The Healthy Growth Study.. *Atherosclerosis* 2017;259:128-133	Combination of Movement Behaviors Not Analyzed
499 Kaar, J, Schmiege, S, Drews, K, et al. Evaluation of the longitudinal change in health behavior profiles across treatment groups in the TODAY clinical trial.. *Pediatric Diabetes* 2020;21:224-232	No Outcome Assessed
500 Jussila, L, Paananen, M, Näyhä, S, et al. Psychosocial and lifestyle correlates of musculoskeletal pain patterns in adolescence: A 2â€ year followâ€ up study. *European Journal of Pain* 2014;18:139-146	Combination of Movement Behaviors Not Analyzed
501 Huang, J, Yuan, C, Xu, X, et al. The relationship between lifestyle factors and clinical symptoms of bipolar disorder patients in a Chinese population.. *Psychiatry research* 2018;266:97-102	Wrong population
502 Hjorth, M, Sørensen, L, Andersen, R, et al. Normal weight children have higher cognitive performanceâ€"Independent of physical activity, sleep, and diet. *Physiology & Behavior* 2016;165:398-404	Combination of Movement Behaviors Not Analyzed

503 Gorely, T, Biddle, S, Marshall, S, et al. The prevalence of leisure time sedentary behaviour and physical activity in adolescent boys: An ecological momentary assessment approach. *International Journal of Pediatric Obesity* 2009;4:289-298	No Outcome Assessed
504 Herzig, M, Dössegger, A, Mäder, U, et al. Differences in weight status and energy-balance related behaviors among schoolchildren in German-speaking Switzerland compared to seven countries in Europe. *The International Journal of Behavioral Nutrition and Physical Activity* 2012;9:	Combination of Movement Behaviors Not Analyzed
505 Fitzpatrick, C, Burkhalter, R, Asbridge, M. Characteristics of Canadian Youth Adhering to Physical Activity and Screen Time Recommendations. *J Sch Nurs* 2019;:1059840519881185	No Outcome Assessed
506 Herrmann, D, Pohlabeln, H, Gianfagna, F, et al. Association between bone stiffness and nutritional biomarkers combined with weight-bearing exercise, physical activity, and sedentary time in preadolescent children. A case-control study.. *Bone* 2015;78:142-149	Combination of Movement Behaviors Not Analyzed
507 Eloranta, A, Sallinen, T, Viitasalo, A, et al. The effects of a 2-year physical activity and dietary intervention on plasma lipid concentrations in children: the PANIC Study. *Eur J Nutr* 2020;:	Combination of Movement Behaviors Not Analyzed
508 McGregor, D, Palarea-Albaladejo, J, Dall, P, et al. Differences in physical activity time-use composition associated with cardiometabolic risks. *Preventive Medicine Reports* 2019;13:23-29	Wrong population
509 Hansen, A, Pritchard, T, Melnic, I, et al. Physical activity, screen time, and school absenteeism: Self-reports from NHANES 2005â€“2008. *Current Medical Research and Opinion* 2016;32:651-659	Combination of Movement Behaviors Not Analyzed
510 Hands, B, Chivers, P, Parker, H, et al. The associations between physical activity, screen time and weight from 6 to 14 yrs: the Raine Study.. *Journal of science and medicine in sport* 2011;14:397-403	Combination of Movement Behaviors Not Analyzed
511 Master, L, Nye, R, Lee, S, et al. Bidirectional, Daily Temporal Associations between Sleep and Physical Activity in Adolescents. *Sci Rep* 2019;9:7732	No Outcome Assessed
512 Burke, V, Beilin, L, Durkin, K, et al. Television, computer use, physical activity, diet and fatness in Australian adolescents. *International Journal of Pediatric Obesity* 2006;1:248-255	Combination of Movement Behaviors Not Analyzed
513 Martinez S.M, Tschann J.M, Butte N.F.et al. Sleep longer, be active, and eat healthily: 24-hour circadian-related behaviors are protective of children's weight status. *Sleep* 2019;42:A321	Combination of Movement Behaviors Not Analyzed
514 Dennison, M, Sisson, S, Stephens, L, et al. Obesogenic Behaviors and Depressive Symptoms' Influence on Cardiometabolic Risk Factors in American Indian Children.. *Journal of allied health* 2019;48:100-107	Combination of Movement Behaviors Not Analyzed
515 Fleary, S. Combined Patterns of Risk for Problem andÂ Obesogenic Behaviors in Adolescents: AÂ Latent Class Analysis Approach. *Journal of School Health* 2017;87:182-193	No Outcome Assessed
516 Frutuoso M.F.P, Bismarck-Nasr E.M, Gambardella A.M.D. Energy expenditure reduction and overweight in adolescents. *Revista de Nutricao* 2003;16:257-263	Combination of Movement Behaviors Not Analyzed

517 Manyanga, T, Barnes, J, Chaput, J, et al. Body mass index and movement behaviors among schoolchildren from 13 countries across a continuum of human development indices: A multinational cross-sectional study. *Am J Hum Biol* 2020;32:e23341	Combination of Movement Behaviors Not Analyzed
518 Berkey, C, Rockett, H, Gillman, M, et al. One-year changes in activity and in inactivity among 10- to 15-year-old boys and girls: relationship to change in body mass index.. *Pediatrics* 2003;111:836-843	Combination of Movement Behaviors Not Analyzed
519 Gubbels, J, van Assema, P, Kremers, S. Physical Activity, Sedentary Behavior, and Dietary Patterns among Children. *Curr Nutr Rep* 2013;2:105-112	No Outcome Assessed
520 Villard, L, Rydén, L, Ohrvik, J, et al. Impact of time trends and increasing age on health behaviour of Swedish school children.. *European journal of cardiovascular prevention and rehabilitation : official journal of the European Society of Cardiology, Working Groups on Epidemiology & Prevention and Cardiac Rehabilitation and Exercise Physiology* 2007;14:326-332	Combination of Movement Behaviors Not Analyzed
521 McCrindle B.W, Manlhiot C, Gibson D.et al. Association between blood pressure, adiposity and lifestyle factors in adolescents: A population-based study. *Journal of Hypertension* 2011;29:e26	Combination of Movement Behaviors Not Analyzed
522 Obese should take it easy.. *Journal of the Royal Society for the Promotion of Health* 2005;125:8-8	No Outcome Assessed
523 Beach L.B, Turner B, Marro R.et al. Diabetes risk behaviors are higher among sexual minority u.s. high school students. *Diabetes* 2018;67:A441	Combination of Movement Behaviors Not Analyzed
524 Atkin, A, Corder, K, Goodyer, I, et al. Perceived family functioning and friendship quality: Cross-sectional associations with physical activity and sedentary behaviours. *The International Journal of Behavioral Nutrition and Physical Activity* 2015;12:	Combination of Movement Behaviors Not Analyzed
525 Asut O, Abuduxike G, Acar-Vaizoglu S.et al. Relationships between screen time, internet addiction and other lifestyle behaviors with obesity among secondary school students in the Turkish Republic of Northern Cyprus. *Turkish Journal of Pediatrics* 2019;61:568-579	Combination of Movement Behaviors Not Analyzed
526 Tremblay, M, Willms, J . Is the Canadian childhood obesity epidemic related to physical inactivity?. *International journal of obesity and related metabolic disorders : journal of the International Association for the Study of Obesity* 2003;27:1100-1105	Combination of Movement Behaviors Not Analyzed
527 Tappy, L. Low resting energy expenditure in constitutionally lean children: may a high energy efficiency be a factor maintenance of a low body weight?. *Clinical nutrition (Edinburgh, Scotland)* 2003;22:341-342	Not Quantitatively Analysed
528 Exelmans, L, Van den Bulck, J . Self-control depletion and sleep duration: the mediating role of television viewing.. *Psychology & health* 2018;33:1251-1268	Wrong population
529 Hagar, K, Yun, J . The Relationship of Sleep Pattern and Physical Activity in Children With Autism. (Abstract). *Research Quarterly for Exercise & Sport* 2005;76:A-114	Combination of Movement Behaviors Not Analyzed
530 Beebe D.W, McAlister S, Van Dyk T.R.et al. Inducing more sleep on school nights reduces sedentary behavior without affecting more vigorous physical activity in short-sleeping adolescents. *Sleep* 2017;40:A360	No Outcome Assessed

531 Wells, J, Hallal, P, Reichert, F, et al. Sleep patterns and television viewing in relation to obesity and blood pressure: evidence from an adolescent Brazilian birth cohort. *International Journal of Obesity* 2008;32:1042-1049	Combination of Movement Behaviors Not Analyzed
532 Borghese, M, Tremblay, M, Katzmarzyk, P, et al. Mediating role of television time, diet patterns, physical activity and sleep duration in the association between television in the bedroom and adiposity in 10 year-old children. *The International Journal of Behavioral Nutrition and Physical Activity* 2015;12:	Combination of Movement Behaviors Not Analyzed
533 Brazendale, K. Children's obesogenic behaviors during summer versus school. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2018;79:	Combination of Movement Behaviors Not Analyzed
534 Rockett, H. Commentary on lack of association between television viewing, soft drinks, physical activity and body mass index in children.. *Acta paediatrica (Oslo, Norway : 1992)* 2008;97:699-700	No Outcome Assessed
535 Sirri, L, Garotti, M, Grandi, S, et al. Adolescents' hypochondriacal fears and beliefs: Relationship with demographic features, psychological distress, well-being and health-related behaviors. *Journal of Psychosomatic Research* 2015;79:259-264	Combination of Movement Behaviors Not Analyzed
536 Sheldrick, M, Maitland, C, Mackintosh, K, et al. Associations between the Home Physical Environment and Children's Home-Based Physical Activity and Sitting.. *International journal of environmental research and public health* 2019;16:	Combination of Movement Behaviors Not Analyzed
537 Stracciolini, A, Stein, C, Kinney, S, et al. Associations Between Sedentary Behaviors, Sleep Patterns, and BMI in Young Dancers Attending a Summer Intensive Dance Training Program.. *Journal of dance medicine & science : official publication of the International Association for Dance Medicine & Science* 2017;21:102-108	Combination of Movement Behaviors Not Analyzed
538 Velásquez-Rodríguez, C, Velásquez-Villa, M, Gómez-Ocampo, L, et al. Abdominal obesity and low physical activity are associated with insulin resistance in overweight adolescents: a cross-sectional study.. *BMC pediatrics* 2014;14:258	Combination of Movement Behaviors Not Analyzed
539 Singh A.S, Brug J, Van Stralen M.et al. Differences in prevalence rates of overweight and energy balance-related behaviors across seven European countries: Findings from the ENERGY project. *Obesity Reviews* 2011;12:25	No Outcome Assessed
540 Nihill, G, Lubans, D, Plotnikoff, R. Associations between sedentary behavior and self-esteem in adolescent girls from schools in low-income communities. *Mental Health and Physical Activity* 2013;6:30-35	Combination of Movement Behaviors Not Analyzed
541 Marques, A, Loureiro, N, Avelar-Rosa, B, et al. Adolescents' healthy lifestyle. *J Pediatr (Rio J)* 2020;96:217-224	No Outcome Assessed
542 Mäestu, J, Lätt, E, Rääsk, T, et al. Ace I/D polymorphism is associated with habitual physical activity in pubertal boys.. *The journal of physiological sciences : JPS* 2013;63:427-434	Combination of Movement Behaviors Not Analyzed
543 Bergmann, G, Bertoldi, A, Mielke, G, et al. [Physical activity, screen time, and use of medicines among adolescents: the 1993 Pelotas (Brazil) birth cohort study].. *Cadernos de saude publica* 2016;32:e00011715	Combination of Movement Behaviors Not Analyzed

544 Morrissey, B, Malakellis, M, Whelan, J, et al. Sleep duration and risk of obesity among a sample of Victorian school children.. *BMC public health* 2016;16:245	Combination of Movement Behaviors Not Analyzed
545 Handjieva-Darlenska T, Kuzeva A, Handjiev S. Positive trend towards a healthier nutrition in school-aged children from sofa. Results from the EPHE study. *Obesity Facts* 2017;10:247-248	Combination of Movement Behaviors Not Analyzed
546 Haughton, C, Wang, M, Lemon, S. Racial/Ethnic Disparities in Meeting 5-2-1-0 Recommendations among Children and Adolescents in the United States.. *The Journal of pediatrics* 2016;175:188	No Outcome Assessed
547 Henriksson, P, Henriksson, H, Labayen, I, et al. Correlates of ideal cardiovascular health in European adolescents: The HELENA study.. *Nutrition, metabolism, and cardiovascular diseases : NMCD* 2018;28:187-194	Combination of Movement Behaviors Not Analyzed
548 Maher, C, Williams, M, Olds, T, et al. Physical and Sedentary Activity in Adolescents with Cerebral Palsy. *Developmental Medicine & Child Neurology* 2007;49:450-457	Combination of Movement Behaviors Not Analyzed
549 Saraiva D.J.B, Avezum A, Timerman A.et al. Sedentarism as a stress generator in a young population of campinas, sp-Brazil. *Cardiology (Switzerland)* 2013;125:477	Combination of Movement Behaviors Not Analyzed
550 Son K, Yun J.M, Park H.J. Comparison of effect of TV viewing time and computer use time on physical inactivity according to body mass index in Korean adolescents. *Diabetes Technology and Therapeutics* 2019;21:A89	Combination of Movement Behaviors Not Analyzed
551 Hooper A.E.C, Hooper P.L. ,. Physical activity, sedentary behavior and pubertal maturation among the Tsimane'. *American Journal of Physical Anthropology* 2016;159:107	No Outcome Assessed
552 Kim, Y, Hibbing, P, Saint-Maurice, P, et al. Surveillance of Youth Physical Activity and Sedentary Behavior With Wrist Accelerometry.. *American journal of preventive medicine* 2017;52:872-879	No Outcome Assessed
553 IglayReger H, Peterson M, Sallinen B.J.et al. Sleep, physical activity and cardiometabolic risk in obese adolescents: Sex matters. *Obesity* 2011;19:S221-S222	Combination of Movement Behaviors Not Analyzed
554 Herman, K, Sabiston, C, Tremblay, A, et al. Self-rated health in children at risk for obesity: Associations of physical activity, sedentary behavior, and BMI. *Journal of Physical Activity & Health* 2014;11:543-552	Combination of Movement Behaviors Not Analyzed
555 Lee E.-Y, Carson V, Jeon J.Y.et al. Levels and correlates of 24-hour movement behaviors among South Koreans: Results from the Korea National Health and Nutrition Examination Surveys, 2014 and 2015. *Journal of Sport and Health Science* 2019;8:376-385	No Outcome Assessed
556 Starkoff, B, Petosa, R, Balk, E, et al. Sedentary and Physical Activity Habits of Obese Adolescents. *American Journal of Health Education* 2014;45:335-341	No Outcome Assessed
557 Saunders T.J, Chaput J.-P, Tremblay M.S. Sedentary behaviour as an emerging risk factor for cardiometabolic diseases in children and youth. *Canadian Journal of Diabetes* 2014;38:53-61	No Outcome Assessed

558 Must, A, Parisi, S . Sedentary behavior and sleep: paradoxical effects in association with childhood obesity.. *International journal of obesity (2005)* 2009;33 Suppl 1:S82-S86	Not Quantitatively Analysed
559 Kriska, A, Delahanty, L, Edelstein, S, et al. Sedentary behavior and physical activity in youth with recent onset of type 2 diabetes. *Pediatrics* 2013;131:e850-e856	Combination of Movement Behaviors Not Analyzed
560 Hicks, K, Pitts, S, Lazorick, S, et al. Examining the Association Between Screen Time, Beverage and Snack Consumption, and Weight Status Among Eastern North Carolina Youth.. *North Carolina medical journal* 2019;80:69-75	Combination of Movement Behaviors Not Analyzed
561 Herman, K, Paradis, G, Mathieu, M, et al. Association between accelerometer-measured physical activity intensities and sedentary time in 8- to 10-year-old children.. *Pediatric exercise science* 2014;26:76-85	No Outcome Assessed
562 Herman, K, Hopman, W, Sabiston, C. Physical activity, screen time and self-rated health and mental health in Canadian adolescents. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2015;73:112-116	Combination of Movement Behaviors Not Analyzed
563 Harrison, M, Burns, C, McGuinness, M, et al. Influence of a health education intervention on physical activity and screen time in primary school children: 'Switch Off--Get Active'.. *Journal of science and medicine in sport* 2006;9:388-394	Combination of Movement Behaviors Not Analyzed
564 Haapala, E, Lintu, N, Eloranta, A, et al. Mediating effects of motor performance, cardiorespiratory fitness, physical activity, and sedentary behaviour on the associations of adiposity and other cardiometabolic risk factors with academic achievement in children.. *Journal of sports sciences* 2018;36:2296-2303	Combination of Movement Behaviors Not Analyzed
565 Gerber, M, Holsboer-Trachsler, E, Pühse, U, et al. Elite sport is not an additional source of distress for adolescents with high stress levels. *Perceptual and Motor Skills* 2011;112:581-599	Combination of Movement Behaviors Not Analyzed
566 Hammerberg, D. The association between television viewing and related video activities, physical activity level, and weight, in obese and nonobese fourth-grade children. *Dissertation Abstracts International Section A: Humanities and Social Sciences* 1993;53:3802-3802	Combination of Movement Behaviors Not Analyzed
567 Groth, S, Morrison-Beedy, D . Obesity risk in urban adolescent girls: nutritional intentions and health behavior correlates.. *The Journal of the New York State Nurses' Association* 2011;42:15-20	No Outcome Assessed
568 Graff, M, North, K, Richardson, A, et al. Screen time behaviours may interact with obesity genes, independent of physical activity, to influence adolescent BMI in an ethnically diverse cohort. *Pediatric Obesity* 2013;8:e74-e79	Combination of Movement Behaviors Not Analyzed
569 Gorely, T, Atkin, A, Biddle, S, et al. Family circumstance, sedentary behaviour and physical activity in adolescents living in England: Project STIL. *The International Journal of Behavioral Nutrition and Physical Activity* 2009;6:	No Outcome Assessed
570 Gonzalez Gil E, Revenga Frauca J, Aguilera Garcia C.et al. Sedentary behaviours and inflammatory status in children and adolescents. *Annals of Nutrition and Metabolism* 2011;58:221	Combination of Movement Behaviors Not Analyzed

571 Giopp F, Rosi A, Scazzina F. Observational study on adolescents' lifestyle of Parma: Adherence to Mediterranean diet, physical activity and time and quality of sleep. *Nutrition, Metabolism and Cardiovascular Diseases* 2019;29:883-884	Combination of Movement Behaviors Not Analyzed
572 Esmaeilzadeh, S, Ebadollahzadeh, K . Physical Fitness, Physical Activity and Sedentary Activities of 7 to 11 Year Old Boys with Different Body Mass Indexes.. *Asian Journal of Sports Medicine* 2012;3:105-112	Combination of Movement Behaviors Not Analyzed
573 Lin, Y, Fung, X, Tsai, M, et al. Insufficient physical activity and overweight: Does caregiver screen-viewing matter?. *Journal of Child and Family Studies* 2019;28:286-297	No Outcome Assessed
574 Leung, L, Sung, R, So, H, et al. Prevalence and risk factors for hypertension in Hong Kong Chinese adolescents: waist circumference predicts hypertension, exercise decreases risk.. *Archives of disease in childhood* 2011;96:804-809	Combination of Movement Behaviors Not Analyzed
575 Leme, A, Philippi, S . The "Healthy Habits, Healthy Girls" randomized controlled trial for girls: study design, protocol, and baseline results.. *Cadernos de saude publica* 2015;31:1381-1394	Combination of Movement Behaviors Not Analyzed
576 Legnani R.F.S, Legnani E, Da Silva M.P.et al. Clustered risk factors to health in children. *Medicina (Brazil)* 2015;48:328-335	Combination of Movement Behaviors Not Analyzed
577 Lee S, Swahn M, Yao H. Sleep, physical activity, and well-being: An exploratory study of U.S. Adolescents. *Sleep* 2012;35:A399-A400	Combination of Movement Behaviors Not Analyzed
578 Lee, P. Physical activity, sedentary behaviors, and Epstein-Barr virus antibodies in young adults. *Physiology & Behavior* 2016;164:390-394	Combination of Movement Behaviors Not Analyzed
579 Kinder, J. Investigating the relationship between physical activity and sleep in children, using accelerometers.. *Investigating the Relationship Between Physical Activity & Sleep in Children, Using Accelerometers* 2010;:75 p-75 p	No Outcome Assessed
580 Kim, Y, Lochbaum, M, Al-Abri, A, et al. Objectively Measured Physical Activity and Self-Reported Screen Time Behaviors in Omani Children: A Cross-Sectional Study: 1907 Board #168 May 31 2:00 PM - 3:30 PM.. *Medicine & Science in Sports & Exercise* ;50:458-458	Combination of Movement Behaviors Not Analyzed
581 Katzmarzyk, P, Barreira, T, Broyles, S, et al. Physical Activity, Sedentary Time, and Obesity in an International Sample of Children.. *Medicine and science in sports and exercise* 2015;47:2062-2069	Combination of Movement Behaviors Not Analyzed
582 Karatzi, K, Moschonis, G, Botelli, S, et al. Physical activity and sedentary behavior thresholds for identifying childhood hypertension and its phenotypes: The Healthy Growth Study. *J Am Soc Hypertens* 2018;12:714-722	Combination of Movement Behaviors Not Analyzed
583 Kain J, Andrade M. ,. Characteristics of the diet and patterns of physical activity in obese Chilean preschoolers. *Nutrition Research* 1999;19:203-215	Combination of Movement Behaviors Not Analyzed

584 Jones, M, Skidmore, P, Stoner, L, et al. Associations of Short Bout Sedentary Behavior and Physical Activity with Adiposity and Fitness in Children: 1895 Board #156 May 31 2:00 PM - 3:30 PM, .American College of Sports Medicine Annual Meeting, May 29-June 2, 2018, Minneapolis, Minnesota. *Medicine & Science in Sports & Exercise* ;50:454-455	Duplicate
585 Jodkowska, M, Oblacińska, A, Dzielska, A, et al. Behavioural factors as predictors of self-rated health among polish adolescent girls.. *Developmental period medicine* 2019;23:109-116	Combination of Movement Behaviors Not Analyzed
586 Jirillo E, Vitale E, Magrone T. Immune dysfunctions in childhood obesity. *Annals of Nutrition and Metabolism* 2015;67:42	Combination of Movement Behaviors Not Analyzed
587 JENKINS, G, EVENSON, K, HERRING, A, et al. Cardiometabolic Correlates of Physical Activity and Sedentary Patterns in U.S. Youth.. *Medicine & Science in Sports & Exercise* 2017;49:1826-1833	Combination of Movement Behaviors Not Analyzed
588 Jia, X, Wang, H, Wang, D, et al. [Analysis of physical activity and sedentary behaviors in children and adolescents from 12 provinces/municipalities in China].. *Wei sheng yan jiu = Journal of hygiene research* 2016;45:394-397	No full text found
589 Janssen I, Roberts K.C, Thompson W. Respect par les Canadiens de 10 a 17 ans des Directives canadiennes en matiere de mouvement sur 24 heures pour les enfants et les jeunes, Adherence to the 24-Hour Movement Guidelines among 10- to 17-year-old Canadians. *Health promotion and chronic disease prevention in Canada : research, policy and practice* 2017;37:369-375	No Outcome Assessed
590 Jackson, D, Vaughn, M . Adolescent health lifestyles and educational risk: Findings from the Monitoring the Future study, 2010â€“2016. *American Journal of Preventive Medicine* 2019;57:470-477	Effects of Movement Behaviours Could Not be Determined
591 Iwasa, Y, Nakayasu, K, Nomura, M, et al. The relationship between autonomic nervous activity and physical activity in children.. *Pediatrics international : official journal of the Japan Pediatric Society* 2005;47:361-371	Combination of Movement Behaviors Not Analyzed
592 Gunnell, K, Flament, M, Buchholz, A, et al. Examining the bidirectional relationship between physical activity, screen time, and symptoms of anxiety and depression over time during adolescence. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2016;88:147-152	Combination of Movement Behaviors Not Analyzed
593 Groth, S, Rhee, H, Kitzman, H. Relationships among obesity, physical activity and sedentary behavior in young adolescents with and without lifetime asthma. *Journal of Asthma* 2016;53:19-24	Combination of Movement Behaviors Not Analyzed
594 Gallant, F, Thibault, V, Hebert, J, et al. One size does not fit all: identifying clusters of physical activity, screen time, and sleep behaviour co-development from childhood to adolescence.. *International Journal of Behavioral Nutrition & Physical Activity* 2020;17:1-14	No Outcome Assessed
595 Fulton, J, Dai, S, Steffen, L, et al. Physical activity, energy intake, sedentary behavior, and adiposity in youth. *American Journal of Preventive Medicine* 2009;37:s40-s49	Combination of Movement Behaviors Not Analyzed

596 Forshee, R, Anderson, P, Storey, M. Associations of various family characteristics and time use with children's body mass index. *Journal of Community Health Nursing* 2009;26:77-86	Combination of Movement Behaviors Not Analyzed
597 Foerste, T, Sabin, M, Reid, S, et al. Understanding the causes of obesity in children with trisomy 21: Hyperphagia vs physical inactivity. *Journal of Intellectual Disability Research* 2016;60:856-864	Combination of Movement Behaviors Not Analyzed
598 Flashner, B, Rifas-Shiman, S, Oken, E, et al. Obesity, sedentary lifestyle, and exhaled nitric oxide in an early adolescent cohort. *Pediatr Pulmonol* 2020;55:503-509	Combination of Movement Behaviors Not Analyzed
599 Firouzi, S, Poh, B, Ismail, M, et al. Sleep habits, food intake, and physical activity levels in normal and overweight and obese Malaysian children.. *Obesity research & clinical practice* 2014;8:e70-e78	Combination of Movement Behaviors Not Analyzed
600 Filardi, M, Pizza, F, Antelmi, E, et al. Physical Activity and Sleep/Wake Behavior, Anthropometric, and Metabolic Profile in Pediatric Narcolepsy Type 1. *Front Neurol* 2018;9:707	Combination of Movement Behaviors Not Analyzed
601 Ferrari, G, Solé, D, Pires, C, et al. Correlates of body fat and waist circumference in children from SÃ£o Caetano do Sul, Brazil.. *Ciencia & saude coletiva* 2019;24:4019-4030	Combination of Movement Behaviors Not Analyzed
602 Faught, E, Gleddie, D, Storey, K, et al. Healthy lifestyle behaviours are positively and independently associated with academic achievement: An analysis of self-reported data from a nationally representative sample of Canadian early adolescents.. *PloS one* 2017;12:e0181938	Combination of Movement Behaviors Not Analyzed
603 Eisenmann, J, Bartee, R, Wang, M. Physical activity, TV viewing, and weight in U.S. youth: 1999 Youth Risk Behavior Survey.. *Obesity research* 2002;10:379-385	Combination of Movement Behaviors Not Analyzed
604 Duncan, M, Al-Hazzaa, H, Al-Nakeeb, Y, et al. Anthropometric and lifestyle characteristics of active and inactive Saudi and British adolescents.. *American journal of human biology : the official journal of the Human Biology Council* 2014;26:635-642	Combination of Movement Behaviors Not Analyzed
605 Hahn, S, Borton, K, Sonneville, K. Cross-sectional associations between weight-related health behaviors and weight misperception among U.S. adolescents with overweight/obesity.. *BMC public health* 2018;18:514	Combination of Movement Behaviors Not Analyzed
606 Poulain, T, Peschel, T, Vogel, M, et al. Cross-sectional and longitudinal associations of screen time and physical activity with school performance at different types of secondary school.. *BMC public health* 2018;18:563	Combination of Movement Behaviors Not Analyzed
607 Lazzeri, G, Azzolini, E, Pammolli, A, et al. Correlation between physical activity and sedentary behavior with healthy and unhealthy behaviors in Italy and Tuscan region: a cross sectional study.. *Journal of preventive medicine and hygiene* 2013;54:41-48	Combination of Movement Behaviors Not Analyzed
608 Lopes, L. Motor coordination in children: The associations with body composition, sedentary behaviour and academic achievement. *Dissertation Abstracts International Section C: Worldwide* 2018;75:	Combination of Movement Behaviors Not Analyzed

609 Liu, J, Hay, J, Joshi, D, et al. Sleep difficulties and obesity among preadolescents.. *Canadian journal of public health = Revue canadienne de sante publique* 2011;102:139-143	Combination of Movement Behaviors Not Analyzed
610 Leech, R, McNaughton, S, Timperio, A. The clustering of diet, physical activity and sedentary behavior in children and adolescents: a review.. *The international journal of behavioral nutrition and physical activity* 2014;11:4	Not Quantitatively Analysed
611 Lee, J. Sleep duration's association with diet, physical activity, mental status, and weight among Korean high school students.. *Asia Pacific journal of clinical nutrition* 2017;26:906-913	Combination of Movement Behaviors Not Analyzed
612 Lee, E, Hesketh, K, Hunter, S, et al. Meeting new Canadian 24-Hour Movement Guidelines for the Early Years and associations with adiposity among toddlers living in Edmonton, Canada.. *BMC public health* 2017;17:840	Wrong population
613 Langlois, J, Omorou, A, Vuillemin, A, et al. Association of socioeconomic, school-related and family factors and physical activity and sedentary behaviour among adolescents: multilevel analysis of the PRALIMAP trial inclusion data.. *BMC public health* 2017;17:175	No Outcome Assessed
614 Landis A.M. . Sleep, obesity, physical activity, and insulin resistance in adolescents. *Obesity* 2011;19:S226	Combination of Movement Behaviors Not Analyzed
615 Kwon, S, Lee, J, Carnethon, M. Developmental trajectories of physical activity and television viewing during adolescence among girls: National Growth and Health Cohort Study.. *BMC public health* 2015;15:667	No Outcome Assessed
616 Kovács, E, Siani, A, Konstabel, K, et al. Adherence to the obesity-related lifestyle intervention targets in the IDEFICS study.. *International journal of obesity (2005)* 2014;38 Suppl 2:S144-S151	No Outcome Assessed
617 Kim C.-W, Park K.-H, Kang J.-H. Longitudinal association of sleep duration with incident obesity in primary schoolchildren. *Obesity* 2011;19:S137	Combination of Movement Behaviors Not Analyzed
618 Khoury M, Manlhiot C, Gibson D.et al. Associations between disordered eating behaviours and dietary intake, lifestyle behaviours and cardiometabolic risk. *Canadian Journal of Cardiology* 2014;30:S190	Combination of Movement Behaviors Not Analyzed
619 Kamal A.F, Downs S, Berry T.et al. Behavioural and environmental factors associated with body mass index during adolescence. *Clinical Nutrition* 2014;33:S239	Combination of Movement Behaviors Not Analyzed
620 Jirout, J, LoCasale-Crouch, J, Turnbull, K, et al. How Lifestyle Factors Affect Cognitive and Executive Function and the Ability to Learn in Children.. *Nutrients* 2019;11:	Not Quantitatively Analysed
621 Hjorth, M, Chaput, J, Michaelsen, K, et al. Seasonal variation in objectively measured physical activity, sedentary time, cardio-respiratory fitness and sleep duration among 8-11Â year-old Danish children: a repeated-measures study.. *BMC public health* 2013;13:808	No Outcome Assessed

622 Martínez-Sánchez, S, Martínez-García, T, Bueno-Antequera, J, et al. Feasibility and effect of a Pilates program on the clinical, physical and sleep parameters of adolescents with anorexia nervosa.. *Complementary Therapies in Clinical Practice* 2020;39:N.PAG-N.PAG	Combination of Movement Behaviors Not Analyzed
623 Jáuregui, A, Salvo, D, García-Olvera, A, et al. Physical activity, sedentary time and cardiometabolic health indicators among Mexican children. *Clin Obes* 2020;10:e12346	Combination of Movement Behaviors Not Analyzed
624 Kawada, T. Sleep duration, physical activity, and metabolic syndrome for adolescents. *Annals of Behavioral Medicine* 2013;46:401-402	Not Quantitatively Analysed
625 Tse, C, Lee, H, Chan, K, et al. Examining the Impact of Physical Activity on Sleep Quality and Executive Functions in Children with Autism Spectrum Disorder: A Randomized Controlled Trial. *Autism: The International Journal of Research and Practice* 2019;23:1699-1710	Combination of Movement Behaviors Not Analyzed
626 Jakubec, L, Frömel, K, Chmelík, F, et al. Physical Activity in 15-17-Year-Old Adolescents as Compensation for Sedentary Behavior in School. *Int J Environ Res Public Health* 2020;17:	No Outcome Assessed
627 Jacques-Tiura, A, Greenwald, M . Behavioral Economic Factors Related to Pediatric Obesity. *Pediatr Clin North Am* 2016;63:425-46	Not Quantitatively Analysed
628 Jacobsen, P, Le-Rademacher, J, Jim, H, et al. Exercise and stress management training prior to hematopoietic cell transplantation: Blood and Marrow Transplant Clinical Trials Network (BMT CTN) 0902.. *Biology of blood and marrow transplantation : journal of the American Society for Blood and Marrow Transplantation* 2014;20:1530-1536	Wrong population
629 Jackson, D, Djafarian, K, Stewart, J, et al. Increased television viewing is associated with elevated body fatness but not with lower total energy expenditure in children.. *The American journal of clinical nutrition* 2009;89:1031-1036	Wrong population
630 Ishii, K, Shibata, A, Adachi, M, et al. Association of physical activity and sedentary behavior with psychological well-being among Japanese children: A two-year longitudinal study. *Perceptual and Motor Skills* 2016;123:445-459	Combination of Movement Behaviors Not Analyzed
631 Schweighardt, S. Natural play, healthy play: Environmental determinants of young children's outdoor physical activity. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2016;76:	Combination of Movement Behaviors Not Analyzed
632 Husárová, D, Veselská, Z, Sigmundová, D, et al. Age and Gender Differences in Prevalence of Screen Based Behaviour, Physical Activity and Health Complaints among Slovak School-aged Children.. *Central European journal of public health* 2015;23 Suppl:S30-S36	No Outcome Assessed
633 Ajejas Bazán, M, Sellán Soto, M, Sellán, A, et al. Factores asociados al sobrepeso y la obesidad infantil en EspaÃ±a, segÃºn la Ãºltima encuesta nacional de salud (2011).. *Anna Nery School Journal of Nursing / Escola Anna Nery Revista de Enfermagem* 2018;22:1-6	Duplicate
634 Thasanasuwan, W, Srichan, W, Kijboonchoo, K, et al. Low Sleeping Time, High TV Viewing Time, and Physical Inactivity in School Are Risk Factors for Obesity in Pre-Adolescent Thai Children.. *Journal of the Medical Association of Thailand = Chotmaihet thangphaet* 2016;99:314-321	Combination of Movement Behaviors Not Analyzed

635 Song, Y, Zhang, X, Ma, J, et al. [Behavioral risk factors for overweight and obesity among Chinese primary and middle school students in 2010].. *Zhonghua yu fang yi xue za zhi [Chinese journal of preventive medicine]* 2012;46:789-795	Combination of Movement Behaviors Not Analyzed
636 Hume, C, Timperio, A, Veitch, J, et al. Physical activity, sedentary behaviour and depressive symptoms among adolescents. *Journal of Science & Medicine in Sport* 2010;12:e142-e142	Combination of Movement Behaviors Not Analyzed
637 Burrows R, Correa P, Reyes M.et al. Cardiometabolic risk in healthy Chilean adolescents: Influence of physical inactivity and sarcopeni1. *Pediatric Diabetes* 2014;15:106	Effects of Movement Behaviours Could Not be Determined
638 Carter, C, Micheli, L . The effect of a modern lifestyle on children's physical fitness levels.. *Pediatric annals* 2013;42:53	Effects of Movement Behaviours Could Not be Determined
639 Chan, K, Tong, K, Yip, S. Relationship of serum brain-derived neurotrophic factor (BDNF) and health-related lifestyle in healthy human subjects.. *Neuroscience letters* 2008;447:124-128	Wrong population
640 Chaput, J, Saunders, T, Carson, V. Interactions between sleep, movement and other non-movement behaviours in the pathogenesis of childhood obesity.. *Obesity reviews : an official journal of the International Association for the Study of Obesity* 2017;18 Suppl 1:7-14	No Outcome Assessed
641 Chaput, J, Carson, V, Gray, C, et al. Importance of all movement behaviors in a 24 hour period for overall health.. *International journal of environmental research and public health* 2014;11:12575-12581	No Outcome Assessed
642 Chaput, J, Dutil, C . Lack of sleep as a contributor to obesity in adolescents: Impacts on eating and activity behaviors. *The International Journal of Behavioral Nutrition and Physical Activity* 2016;13:	No Outcome Assessed
643 Cohler C, Wakefield D.B, Orsey A.D. Physical activity (PA) and sleep among children and adolescents with cancer. *Pediatric Blood and Cancer* 2012;59:1116	No Outcome Assessed
644 Aguilar-Farias, N, Martino-Fuentealba, P, Chandia-Poblete, D. Correlates of device-measured physical activity, sedentary behaviour and sleeping in children aged 9-11 years from Chile: ESPACIOS study. / Factores asociados con actividad fÃsica, conducta sedentaria y sueÃ±o medidos con acelerÃ³metros en niÃ±os de 9-11. *Retos: Nuevas Perspectivas de Educación Física, Deporte y Recreación* 2020;:1-10	Combination of Movement Behaviors Not Analyzed
645 Ahmed D. . Risk factors for cardiovascular diseases among urban schoolchildren from affluent families. *Bangladesh Medical Research Council Bulletin* 2017;43:26-30	Combination of Movement Behaviors Not Analyzed
646 Alain, L, Sonia, L, Françoise, C. Loisirs numÃ©riques et performances cognitives et scolaires: Une Ã©tude chez 27 000 Ã©lÃ¨ves de la 3e des collÃ¨ges = Digital leisure activities and school/cognitive performances: A 27000 students survey. *Bulletin de Psychologie* 2014;67:99-125	Combination of Movement Behaviors Not Analyzed
647 Alricsson, M, Domalewski, D, Romild, U, et al. Physical activity, health, body mass index, sleeping habits and body complaints in Australian senior high school students. *International Journal of Adolescent Medicine and Health* 2008;20:501-512	Combination of Movement Behaviors Not Analyzed

648 EDWARDS, J, MAUCH, L, WINKELMAN, M. Relationship of Nutrition and Physical Activity Behaviors and Fitness Measures to Academic Performance for Sixth Graders in a Midwest City School District.. *Journal of School Health* 2011;81:65-73	Combination of Movement Behaviors Not Analyzed
649 Ee, J, Parry, S, Oliveira, B, et al. Does a Classroom Standing Desk Intervention Modify Standing and Sitting Behaviour and Musculoskeletal Symptoms during School Time and Physical Activity during Waking Time?. *International journal of environmental research and public health* 2018;15:	No Outcome Assessed
650 Gordon-Larsen, P, McMurray, R, Popkin, B. Adolescent physical activity and inactivity vary by ethnicity: The National Longitudinal Study of Adolescent Health.. *The Journal of pediatrics* 1999;135:301-306	No Outcome Assessed
651 Hankonen, N, Heino, M, Araujo-Soares, V, et al. 'Let's Move It' - a school-based multilevel intervention to increase physical activity and reduce sedentary behaviour among older adolescents in vocational secondary schools: a study protocol for a cluster-randomised trial.. *BMC public health* 2016;16:451	Not Quantitatively Analysed
652 Sampasa-Kanyinga, H, Colman, I, Goldfield, G, et al. Combinations of physical activity, sedentary time, and sleep duration and their associations with depressive symptoms and other mental health problems in children and adolescents: a systematic review.. *International Journal of Behavioral Nutrition & Physical Activity* 2020;17:1-16	No Outcome Assessed
653 Hoare E, Skouteris H, Fuller-Tyszkiewicz M.et al. Associations between obesogenic risk factors and depression among adolescents: A systematic review. *Obesity Research and Clinical Practice* 2013;7:e53-e54	No Outcome Assessed
654 D'Souza, N, Kuswara, K, Zheng, M, et al. A systematic review of lifestyle patterns and their association with adiposity in children aged 5-12 years. *Obes Rev* 2020;:	No Outcome Assessed
655 Tremblay, M, Carson, V, Chaput, J, et al. Canadian 24-Hour Movement Guidelines for Children and Youth: An Integration of Physical Activity, Sedentary Behaviour, and Sleep.. *Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme* 2016;41:S311-S327	Not Quantitatively Analysed
656 Summerbell, C, Moore, H, Vögele, C, et al. Evidence-based recommendations for the development of obesity prevention programs targeted at preschool children.. *Obesity reviews : an official journal of the International Association for the Study of Obesity* 2012;13 Suppl 1:129-132	Not Quantitatively Analysed
657 Vermorel, M, Lazzer, S, Bitar, A, et al. Contributing factors and variability of energy expenditure in non-obese, obese, and post-obese adolescents.. *Reproduction, nutrition, development* 2005;45:129-142	Combination of Movement Behaviors Not Analyzed
658 Kabra R, Di Figlia-Peck S, Leung T.M.et al. Assessing Compliance With The 5-2-1-0 Message In The Overweight And Obese Child And Adolescent Population. *Journal of Adolescent Health* 2019;64:S73-S74	No Outcome Assessed
659 Martin, A, Booth, J, Laird, Y, et al. Physical activity, diet and other behavioural interventions for improving cognition and school achievement in children and adolescents with obesity or overweight.. *The Cochrane database of systematic reviews* 2018;1:CD009728	Duplicate
660 Rich, C, Griffiths, L, Dezateux, C. Seasonal variation in accelerometer-determined sedentary behaviour and physical activity in children: A review. *The International Journal of Behavioral Nutrition and Physical Activity* 2012;9:	Combination of Movement Behaviors Not Analyzed

661 Oosman, S. Kica-wasimisinanahk Miyo-Ayawin ~ our children's health promoting physical activity and nutrition through a health promoting school-based intervention in a Metis community. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2013;74:	No Outcome Assessed
662 Hopkins, N, Stratton, G, Ridgers, N, et al. Lack of relationship between sedentary behaviour and vascular function in children.. *European journal of applied physiology* 2012;112:617-622	Combination of Movement Behaviors Not Analyzed
663 Bar-Or, O, Foreyt, J, Bouchard, C, et al. Physical activity, genetic, and nutritional considerations in childhood weight management. *Medicine & Science in Sports & Exercise* 1998;30:2-10	Not Quantitatively Analysed
664 Lv, Y, Cai, L, Gui, Z, et al. Effects of physical activity and sedentary behaviour on cardiometabolic risk factors and cognitive function in children: protocol for a cohort study. *BMJ Open* 2019;9:e030322	Not Quantitatively Analysed
665 Pearson, N, Braithwaite, R, Biddle, S, et al. Associations between sedentary behaviour and physical activity in children and adolescents: a meta-analysis.. *Obesity reviews : an official journal of the International Association for the Study of Obesity* 2014;15:666-675	No Outcome Assessed
666 Yoong, S, Chai, L, Williams, C, et al. Systematic review and meta-analysis of interventions targeting sleep and their impact on child body mass index, diet, and physical activity.. *Obesity (Silver Spring, Md.)* 2016;24:1140-1147	Combination of Movement Behaviors Not Analyzed
667 Grgic, J, Dumuid, D, Bengoechea, E, et al. Health outcomes associated with reallocations of time between sleep, sedentary behaviour, and physical activity: a systematic scoping review of isotemporal substitution studies.. *International Journal of Behavioral Nutrition & Physical Activity* 2018;15:N.PAG-N.PAG	Not Quantitatively Analysed
668 Guinhouya, B, Apété, G, Zitouni, D, et al. [An alternative method to describe an "obesogenic" environment for children: Relevance of a multiple correspondence analysis (MCA) (corrected)].. *Sante publique (Vandoeuvre-les-Nancy, France)* 2010;22:165-179	No Outcome Assessed
669 Rozida, J, Vera, S . OBESITY, DIET, PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOR AMONG YOUTH IN THE REPUBLIC OF MACEDONIA.. *Activities in Physical Education & Sport* 2017;7:104-106	Combination of Movement Behaviors Not Analyzed
670 Hart, C, Hawley, N, Davey, A, et al. Effect of experimental change in children's sleep duration on television viewing and physical activity. *Pediatric Obesity* 2017;12:462-467	No Outcome Assessed
671 Foti, K, Eaton, D, Lowry, R, et al. Sufficient sleep, physical activity, and sedentary behaviors. *American Journal of Preventive Medicine* 2011;41:596-602	No Outcome Assessed
672 White K, Mackay L, Wooller L.et al. Fundamental movement skills, sedentary behaviour and weight status in preschool children. *Journal of Science and Medicine in Sport* 2012;15:S61	Wrong population
673 Firestone K, Jones K, Wilson A. Functional disability in adolescents is predicted by self-report of sleep problems, depressive symptoms, low physical activity and worst pain intensity levels. *Arthritis and Rheumatology* 2015;67:	Combination of Movement Behaviors Not Analyzed
674 Heath M, Virtanen S, Kuula-Paavola L.et al. A study of physical activity, sleep and mood in Finnish adolescents. *Journal of Sleep Research* 2018;27:352	Combination of Movement Behaviors Not Analyzed

675 Hoare, E, Crooks, N, Hayward, J, et al. Associations between combined overweight and obesity, lifestyle behavioural risk and quality of life among Australian regional school children: Baseline findings of the Goulburn Valley health behaviours monitoring study. *Health and Quality of Life Outcomes* 2019;17:	Combination of Movement Behaviors Not Analyzed
676 Gaina A, Sekine M, Kanayama H.et al. Short-long sleep latency and associated factors in Japanese junior high school children. *Sleep and Biological Rhythms* 2005;3:162-165	Combination of Movement Behaviors Not Analyzed
677 Hayes, J, Balantekin, K, Altman, M, et al. Sleep patterns and quality are associated with severity of obesity and weight-related behaviors in adolescents with overweight and obesity. *Childhood Obesity* 2018;14:11-17	Combination of Movement Behaviors Not Analyzed
678 Hickie I. . Sleep-wake cycle, patterns of physical activity and circadian rhythm disruption in young people with emerging mood disorders. *Neuropsychopharmacology* 2012;38:S9-S10	Combination of Movement Behaviors Not Analyzed
679 Healy, S, Aigner, C, Haegele, J, et al. Meeting the 24-hr movement guidelines: An update on US youth with autism spectrum disorder from the 2016 National Survey of Children's Health. *Autism Res* 2019;12:941-951	No Outcome Assessed
680 Victo, E, Ferrari, G, Silva, J, et al. LIFESTYLE INDICATORS AND CARDIORESPIRATORY FITNESS IN ADOLESCENTS.. *Revista paulista de pediatria : orgao oficial da Sociedade de Pediatria de Sao Paulo* 2017;35:61-68	Combination of Movement Behaviors Not Analyzed
681 Tambalis, K, Panagiotakos, D, Psarra, G, et al. Insufficient Sleep Duration Is Associated With Dietary Habits, Screen Time, and Obesity in Children.. *Journal of clinical sleep medicine : JCSM : official publication of the American Academy of Sleep Medicine* 2018;14:1689-1696	Combination of Movement Behaviors Not Analyzed
682 Gopinath, B, Baur, L, Wang, J, et al. Influence of physical activity and screen time on the retinal microvasculature in young children.. *Arteriosclerosis, thrombosis, and vascular biology* 2011;31:1233-1239	Combination of Movement Behaviors Not Analyzed
683 Hattori, S, Otabe, Y, Yamatsu, K. Associated factors of sitting time in Japanese junior high school students.. *Science & Sports* 2014;29:S18-S18	Combination of Movement Behaviors Not Analyzed
684 Hashem, R, Rey-López, J, Hamer, M, et al. Associations between objectively assessed and questionnaire-based sedentary behaviour with body mass index and systolic blood pressure in Kuwaiti adolescents.. *BMC research notes* 2019;12:588	Combination of Movement Behaviors Not Analyzed
685 Hanley, A, Harris, S, Gittelsohn, J, et al. Overweight among children and adolescents in a Native Canadian community: prevalence and associated factors.. *The American journal of clinical nutrition* 2000;71:693-700	Combination of Movement Behaviors Not Analyzed
686 Duncan, M, Kline, C, Vandelanotte, C, et al. Cross-sectional associations between multiple lifestyle behaviors and health-related quality of life in the 10,000 Steps cohort.. *PloS one* 2014;9:e94184	Wrong population
687 French, S, Mitchell, N, Hannan, P. Decrease in Television Viewing Predicts Lower Body Mass Index at 1-Year Follow-Up in Adolescents, but Not Adults. *Journal of Nutrition Education and Behavior* 2012;44:415-422	Combination of Movement Behaviors Not Analyzed

688 McLennan, J. Obesity in children. Tackling a growing problem.. *Australian family physician* 2004;33:33-36	Not Quantitatively Analysed
689 González-Gross, M, Meléndez, A . Sedentarism, active lifestyle and sport: Impact on health and obesity prevention.. *Nutricion hospitalaria* 2013;28 Suppl 5:89-98	Not Quantitatively Analysed
690 Zuo, H, Shi, Z, Yuan, B, et al. Interaction between physical activity and sleep duration in relation to insulin resistance among non-diabetic Chinese adults.. *BMC public health* 2012;12:247	Wrong population
691 Esbersen S, Herlin T, Mahler B.T. Daily physical activity and sleep in children with juvenile idiopathic arthritis and healthy children in relation to pain. *Pediatric Rheumatology* 2018;16:	Combination of Movement Behaviors Not Analyzed
692 Ercan O, Erginoz E, Alikasifoglu M.et al. Factors associated with overweight and obesity among Turkish adolescents. *Journal of Adolescent Health* 2011;48:S57	Combination of Movement Behaviors Not Analyzed
693 Elsenburg, L, Corpeleijn, E, van Sluijs, E, et al. Clustering and correlates of multiple health behaviours in 9-10 year old children.. *PloS one* 2014;9:e99498	No Outcome Assessed
694 Ellis, G. Body mass index, physical activity, and working memory in a sample of children with down syndrome: Can physical activity improve learning in children with intellectual disabilities?. *Dissertation Abstracts International Section A: Humanities and Social Sciences* 2014;75:	Combination of Movement Behaviors Not Analyzed
695 Ekstedt, M, Nyberg, G, Ingre, M, et al. Sleep, physical activity and BMI in six to ten-year- old children measured by accelerometry: A cross-sectional study. *The International Journal of Behavioral Nutrition and Physical Activity* 2013;10:	Combination of Movement Behaviors Not Analyzed
696 Duncan, S, Duncan, E, Fernandes, R, et al. Modifiable risk factors for overweight and obesity in children and adolescents from SÃ£o Paulo, Brazil.. *BMC public health* 2011;11:585	Combination of Movement Behaviors Not Analyzed
697 Dubuc, M, Aubertin-Leheudre, M, Karelis, A. Lifestyle Habits Predict Academic Performance in High School Students: The Adolescent Student Academic Performance Longitudinal Study (ASAP). *Int J Environ Res Public Health* 2019;17:	Combination of Movement Behaviors Not Analyzed
698 Al-Domi, H, Faqih, A, Jaradat, Z, et al. Physical activity, sedentary behaviors and dietary patterns as risk factors of obesity among Jordanian schoolchildren.. *Diabetes & metabolic syndrome* ;13:189-194	Combination of Movement Behaviors Not Analyzed
699 Aires, L, Pratt, M, Lobelo, F, et al. Associations of cardiorespiratory fitness in children and adolescents with physical activity, active commuting to school, and screen time.. *Journal of physical activity & health* 2011;8 Suppl 2:S198-S205	Combination of Movement Behaviors Not Analyzed
700 Aifa Lu.Ru Wang.Ekelund, U, et al. Moderate-to-vigorous physical activity, but not sedentary time, predicts changes in cardiometabolic risk factors in 10-y-old children: the Active Smarter Kids Study, .Skrede T, Stavnsbo M, Aadland E, Aadland KN, Anderssen SA, Resaland GK, Ekelund U. Moder. *American Journal of Clinical Nutrition* 2017;106:948-949	Combination of Movement Behaviors Not Analyzed
701 Aguilar R.M, Lastre-Amell G, Vasquez A.P. Lifestyles related to cardiovascular risk factors. *Archivos Venezolanos de Farmacologia y Terapeutica* 2018;37:54-62	Combination of Movement Behaviors Not Analyzed

702 . Capping Children's Daily Screen Time at 2 Hours Linked With Better Cognition.. *ASHA Leader* 2018;23:18-18	Combination of Movement Behaviors Not Analyzed
703 Cook, B, Li, D, Heinrich, K. Obesity, Physical Activity, and Sedentary Behavior of Youth with Learning Disabilities and ADHD. *Journal of Learning Disabilities* 2015;48:563-576	Combination of Movement Behaviors Not Analyzed
704 de Lira, C, Andrade, M, de Mello, M, et al. Physical exercise to manage sleep problems in pediatric patients with epilepsy and ADHD.. *Epilepsy & behavior : E&B* 2017;75:271-272	Not Quantitatively Analysed
705 Delaney, C, Quick, V, Byrd-Bredbenner, C. Eating, Sleeping and Physical Activity (PA) Behaviors and Cognitions of Parents with Preschool-aged Children Differ by Race/Ethnicity.. *Journal of the Academy of Nutrition & Dietetics* 2017;117:A54-A54	Wrong population
706 Martin, A, Booth, J, Laird, Y, et al. Physical activity, diet and other behavioural interventions for improving cognition and school achievement in children and adolescents with obesity or overweight.. *The Cochrane database of systematic reviews* 2018;3:CD009728	Combination of Movement Behaviors Not Analyzed
707 Dencker, M, Andersen, L . Health-related aspects of objectively measured daily physical activity in children.. *Clinical physiology and functional imaging* 2008;28:133-144	Combination of Movement Behaviors Not Analyzed
708 Dendana, E, Ghammem, R, Sahli, J, et al. Clustering of chronic diseases risk factors among adolescents: a quasi-experimental study in Sousse, Tunisia. *Int J Adolesc Med Health* 2017;31:	Combination of Movement Behaviors Not Analyzed
709 Ahmed, N, Ahmed, S, Carmichael, Z, et al. Measuring Healthy Lifestyle and Mental Health Indicators in South Asian Women Using the "Your Health: Quality of Life and Well-Being" Questionnaire.. *Annals of global health* ;83:463-470	Combination of Movement Behaviors Not Analyzed
710 Nyberg, G, Ekblom, O, Marcus, C. A 4-Year Cluster-Randomised Controlled Intervention Study on Physical Activity Pattern and Sedentary Behaviour in Children.. *Medicine & Science in Sports & Exercise* 2011;43:24-24	Combination of Movement Behaviors Not Analyzed
711 Froberg, K. RELATIONS BETWEEN PHYSICAL ACTIVITY, FITNESS, MUSCLE STRENGTH AND HEALTH: FINDINGS FROM THE EUROPEAN YOUTH HEART STUDY (EYHS).. *Education. Physical Training. Sport* 2014;93:10-20	Combination of Movement Behaviors Not Analyzed
712 Adams A.Receveur O.Mundt M,, et al. Healthy lifestyle indicators in children (grades 4 to 6) from the Kahnawake Schools Diabetes Prevention Project.. *Canadian Journal of Diabetes* 2005;29:403-409	No Outcome Assessed
713 Godin R, Roy J, Gaudreault P.et al. Teen sleep patterns and enjoyment in sports. *Sleep* 2018;41:A319	No Outcome Assessed
714 Davis, A, Boles, R, James, R, et al. Health behaviors and weight status among urban and rural children.. *Rural and remote health* 2008;8:810	Combination of Movement Behaviors Not Analyzed

715 Dalene, K, Anderssen, S, Andersen, L, et al. Cross-sectional and prospective associations between sleep, screen time, active school travel, sports/exercise participation and physical activity in children and adolescents.. *BMC public health* 2018;18:705	No Outcome Assessed
716 da Silva Brito, A, Hardman, C, de Barros, M. [Prevalence and factors associated with the co-occurrence of health risk behaviors in adolescents].. *Revista paulista de pediatria : orgao oficial da Sociedade de Pediatria de Sao Paulo* 2015;33:423-430	No Outcome Assessed
717 Sahai V.S, Barnett R.C, Roy C.R.et al. A profile of cardiovascular disease in Northern Ontario: Public health planning implications. *Canadian Journal of Public Health* 2000;91:435-440	No Outcome Assessed
718 Chaput, J, Janssen, I, Spence, J. Time spent sedentary and active and cardiometabolic risk factors in children. *Jama* 2012;307:2024; author reply 2024-5	No Outcome Assessed
719 . Ready, set, go for physical activity.. *Lancet (London, England)* 2013;381:1960	No Outcome Assessed
720 Adsiz E, Dorak F, Ozsaker M.et al. The influence of physical activity on attention in Turkish children. *HealthMED* 2012;6:1384-1389	Combination of Movement Behaviors Not Analyzed
721 Flashner B, Rifas-Shiman S.L, Oken E.et al. Obesity, sedentary lifestyle, and exhaled nitric oxide in an early adolescent cohort. *American Journal of Respiratory and Critical Care Medicine* 2017;195:	Combination of Movement Behaviors Not Analyzed
722 Fadzlina, A, Harun, F, Nurul Haniza, M, et al. Metabolic syndrome among 13 year old adolescents: prevalence and risk factors.. *BMC public health* 2014;14 Suppl 3:S7	Combination of Movement Behaviors Not Analyzed
723 Epstein, L, Paluch, R, Consalvi, A, et al. Effects of manipulating sedentary behavior on physical activity and food intake.. *The Journal of pediatrics* 2002;140:334-339	Combination of Movement Behaviors Not Analyzed
724 GOPINATH, B, HARDY, L, KIFLEY, A, et al. Activity Behaviors in Schoolchildren and Subsequent 5-yr Change in Blood Pressure.. *Medicine & Science in Sports & Exercise* 2014;46:724-729	Combination of Movement Behaviors Not Analyzed
725 Dewar, D, Morgan, P, Plotnikoff, R, et al. Exploring changes in physical activity, sedentary behaviors and hypothesized mediators in the NEAT girls group randomized controlled trial. *Journal of Science and Medicine in Sport* 2014;17:39-46	No Outcome Assessed
726 Ullrich-French, S, Power, T, Daratha, K, et al. Examination of adolescents' screen time and physical fitness as independent correlates of weight status and blood pressure.. *Journal of sports sciences* 2010;28:1189-1196	Combination of Movement Behaviors Not Analyzed
727 Händel, M, Larsen, S, Rohde, J, et al. Effects of the Healthy Start randomized intervention trial on physical activity among normal weight preschool children predisposed to overweight and obesity.. *PloS one* 2017;12:e0185266	Wrong population
728 Turner, K, Dwyer, J, Edwards, A, et al. Clustering of specific health-related behaviours among Toronto adolescents.. *Canadian journal of dietetic practice and research : a publication of Dietitians of Canada = Revue*	No Outcome Assessed

canadienne de la pratique et de la recherche en dietetique : une publication des Dietetistes du Canada 2011;72:e155-e160	
729 Sigmundová, D, Sigmund, E, Badura, P, et al. Parent-child behavioural patterns related to pre-schoolers' overweight/obesity.. *Acta Gymnica* 2017;47:53-63	Combination of Movement Behaviors Not Analyzed
730 Kuzik, N, Clark, D, Ogden, N, et al. Physical activity and sedentary behaviour of toddlers and preschoolers in child care centres in Alberta, Canada.. *Canadian journal of public health = Revue canadienne de sante publique* 2015;106:e178-e183	Wrong population
731 Aeberli, I, Kaspar, M, Zimmermann, M. Dietary intake and physical activity of normal weight and overweight 6 to 14 year old Swiss children.. *Swiss medical weekly* 2007;137:424-430	Combination of Movement Behaviors Not Analyzed
732 Anderson, A. Activity profiles.. *JOPERD: The Journal of Physical Education, Recreation & Dance* 1998;69:50	No Outcome Assessed
733 Dlugosz A, Niedzwiedzka E, Wadolowska L. Physical activity patterns and their association with metabolic profiles of Polish adolescents from less-urbanized regions. *Annals of Nutrition and Metabolism* 2015;67:265-266	Combination of Movement Behaviors Not Analyzed
734 de Moraes Ferrari, G, Oliveira, L, Araujo, T, et al. Moderate-to-vigorous physical activity and sedentary behavior: Independent associations with body composition variables in Brazilian children. *Pediatric Exercise Science* 2015;27:380-389	Combination of Movement Behaviors Not Analyzed
735 Tomaz, S, Prioreschi, A, Watson, E, et al. Body Mass Index, Physical Activity, Sedentary Behavior, Sleep, and Gross Motor Skill Proficiency in Preschool Children From a Low- to Middle-Income Urban Setting.. *Journal of physical activity & health* 2019;16:525-532	Wrong population
736 Watanabe, E, Lee, J, Mori, K, et al. Clustering patterns of obesity-related multiple lifestyle behaviours and their associations with overweight and family environments: a cross-sectional study in Japanese preschool children.. *BMJ open* 2016;6:e012773	Wrong population
737 Tucker, P, Maltby, A, Burke, S, et al. Comparing physical activity and sedentary time among overweight and nonoverweight preschoolers enrolled in early learning programs: a cross-sectional study.. *Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme* 2016;41:971-976	Wrong population
738 Romero, V, Mitchell, J, Dowda, M, et al. Objectively Measured Sedentary Time, Physical Activity And Markers Of Total And Central Body Fat In Preschool Children.. *Medicine & Science in Sports & Exercise* 2011;43:537-537	Wrong population
739 de Lima, V, Mascarenhas, L, Decimo, J, et al. Physical Activity Levels of Adolescents with Type 1 Diabetes Physical Activity in T1D.. *Pediatric exercise science* 2017;29:213-219	Combination of Movement Behaviors Not Analyzed
740 de Jong, E, Visscher, T, HiraSing, R, et al. Association between TV viewing, computer use and overweight, determinants and competing activities of screen time in 4- to 13-year-old children.. *International journal of obesity (2005)* 2013;37:47-53	Combination of Movement Behaviors Not Analyzed

741 De Bourdeaudhuij, I, Lefevre, J, Deforche, B, et al. Physical Activity and Psychosocial Correlates in Normal Weight and Overweight 11 to 19 Year Olds. *Obesity Research* 2005;13:1097-1105	Combination of Movement Behaviors Not Analyzed
742 De Bourdeaudhuij I, Cardon G, De Craemer M.et al. Pre-school children's physical activity and sedentary behaviours. *Annals of Nutrition and Metabolism* 2013;63:65	Wrong population
743 De Baere, S, Seghers, J, Philippaerts, R, et al. Intensity- and domain-specific levels of physical activity and sedentary behavior in 10- to 14-year-old children. *Journal of Physical Activity & Health* 2015;12:1543-1550	No Outcome Assessed
744 Dalton, W, Schetzina, K, Pfortmiller, D, et al. Health behaviors and health-related quality of life among middle school children in Southern Appalachia: Data from the Winning with Wellness Project. *Journal of Pediatric Psychology* 2011;36:677-685	Combination of Movement Behaviors Not Analyzed
745 D'ascenzi F, Zaca' V, Maiorca S.et al. Circulating progenitor cells in competitive athletes and in sedentary subjects: Impact of training and physical inactivity in adolescents. *European Journal of Preventive Cardiology* 2012;19:S102	Wrong population
746 . The Effect of Kaiser Permanente Kids in Dynamic Shape (KP KIDS) on Body Mass Index, Healthy Eating, Screen Time and Exercise in Overweight Children Aged 4-14 Years.. *Clinical Journal of Sport Medicine* 2010;20:146-146	No full text found
747 WONG, M, CHEUNG, G, LAU, E. Interaction of sleep and regular exercise in adolescents' and young adults' working memory.. *International Journal of Sport Psychology* 2017;48:1-17	No full text found
748 Biddle, S. Social psychology of physical activity and sedentary behaviour in young people. (Abstract). *Revista Portuguesa de Ciencias do Desporto* 2003;3:15-17	No full text found
749 . Obesity & Diabetes: The New Epidemics.. *PT: Magazine of Physical Therapy* 2003;:12-12	Combination of Movement Behaviors Not Analyzed
750 Zapico, R, Vázquez, I, Díez, J, et al. La relaciÃ³n entre la falta de sueÃ±o, el ocio sedentario y el sobrepeso infantil = The relationship between lack of sleep, sedentary leisure and childhood overweight. *Análisis y Modificación de Conducta* 2006;32:391-401	Combination of Movement Behaviors Not Analyzed
751 Haapala, E, Wiklund, P, Lintu, N, et al. Cardiorespiratory Fitness, Physical Activity, and Insulin Resistance in Children. *Med Sci Sports Exerc* 2020;52:1144-1152	Combination of Movement Behaviors Not Analyzed
752 Locard, E, Mamelle, N, Billette, A, et al. Risk factors of obesity in a five year old population. Parental versus environmental factors.. *International journal of obesity and related metabolic disorders : journal of the International Association for the Study of Obesity* 1992;16:721-729	Combination of Movement Behaviors Not Analyzed
753 Verburgh, L, Scherder, E, Van Lange, P, et al. Do elite and amateur soccer players outperform non-athletes on neurocognitive functioning? A study among 8-12 year old children. *PLoS ONE* 2016;11:	Combination of Movement Behaviors Not Analyzed
754 Nevill, A, Duncan, M, Sandercock, G. The dose-response association between VÌ‡O(2peak) and self-reported physical activity in children. *J Sports Sci* 2020;:1-7	Combination of Movement Behaviors Not Analyzed

755 Sato A.F, Tortolani C, Jelalian E.et al. Impact of weight control intervention on adolescents' physical activity and sedentary behavior. *Obesity* 2010;18:S100	Combination of Movement Behaviors Not Analyzed
756 Wong, N, Hei, T, Qaqundah, P, et al. Television viewing and pediatric hypercholesterolemia.. *Pediatrics* 1992;90:75-79	Combination of Movement Behaviors Not Analyzed
757 . Intelligence predicts lower physical activity levels in adolescence. *Journal of Sport & Exercise Psychology* 2012;34:846-846	Combination of Movement Behaviors Not Analyzed
758 Menghetti E, Cairella G, Castoro F.et al. Increase of hypertension among roman adolescents. *Minerva Pediatrica* 2007;59:1-5	Combination of Movement Behaviors Not Analyzed
759 Goldfield, G, Mallory, R, Parker, T, et al. Effects of open-loop feedback on physical activity and television viewing in overweight and obese children: a randomized, controlled trial.. *Pediatrics* 2006;118:e157-e166	Combination of Movement Behaviors Not Analyzed
760 Heskey C, Sirirat R, Chen-Chen P.et al. Association between sleep, and dietary habits and exercise among adolescents. *FASEB Journal* 2014;28:	Combination of Movement Behaviors Not Analyzed
761 Vorwerg Y, Petroff D, Kiess W.et al. Physical activity in preschoolers: Direct accelerometry in the course of the week and relation to weight status, TV consumption, and socioeconomic factors. *Hormone Research in Paediatrics* 2012;78:80	Combination of Movement Behaviors Not Analyzed
762 Tandon, P, Sasser, T, Gonzalez, E, et al. Physical Activity, Screen Time, and Sleep in Children With ADHD.. *Journal of physical activity & health* 2019;16:416-422	No Outcome Assessed
763 Santos, A, Silva-Santos, S, Duncan, M, et al. Relationship Among Changes in Sedentary Time, Physical Activity, and Body Mass Index in Young Schoolchildren: A 3-Year Longitudinal Study.. *Pediatric exercise science* 2018;30:426-432	Combination of Movement Behaviors Not Analyzed
764 Lee, E, Kim, J, Kwon, S. Academic Achievement of Korean Adolescents from Multicultural Families: National Survey Results. *Child & Youth Care Forum* 2018;47:499-515	Combination of Movement Behaviors Not Analyzed
765 Stamatakis, E, Coombs, N, Tiling, K, et al. Sedentary time in late childhood and cardiometabolic risk in adolescence. *Pediatrics* 2015;135:e1432-e1441	Combination of Movement Behaviors Not Analyzed
766 Saunders, T. The health impact of sedentary behaviour in children and youth. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2014;75:	Combination of Movement Behaviors Not Analyzed
767 Syväoja, H, Kankaanpää, A, Kallio, J, et al. The relation of physical activity, sedentary behaviors, and academic achievement is mediated by fitness and bedtime. *Journal of Physical Activity & Health* 2018;15:135-143	Combination of Movement Behaviors Not Analyzed

768 Sonneville, K, Gortmaker, S . Total energy intake, adolescent discretionary behaviors and the energy gap.. *International journal of obesity (2005)* 2008;32 Suppl 6:S19-S27	Combination of Movement Behaviors Not Analyzed
769 Robertson, M, Song, J, Taylor, W, et al. Urban-Rural Differences in Aerobic Physical Activity, Muscle Strengthening Exercise, and Screen-Time Sedentary Behavior.. *The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association* 2018;34:401-410	Combination of Movement Behaviors Not Analyzed
770 Sampasa-Kanyinga, H, Chaput, J . Use of social networking sites and adherence to physical activity and screen time recommendations in adolescents. *Journal of Physical Activity & Health* 2016;13:474-480	Combination of Movement Behaviors Not Analyzed
771 Sardinha, L, Andersen, L, Anderssen, S, et al. Objectively measured time spent sedentary is associated with insulin resistance independent of overall and central body fat in 9- to 10-year-old Portuguese children.. *Diabetes care* 2008;31:569-575	Combination of Movement Behaviors Not Analyzed
772 Schreck, M, Althoff, R, Bartels, M, et al. Withdrawn behavior, leisure-time exercise behavior, and screen-time sedentary behavior in a clinical sample of youth. *Journal of Clinical Sport Psychology* 2016;10:206-221	Combination of Movement Behaviors Not Analyzed
773 . Plenary conference 1: More physical activity and less sitting in children: Why and how?. *Science & Sports* 2014;29:N.PAG	No Outcome Assessed
774 RODRIGUEZ-AYLLON, M, Esteban-Cornejo, I, VERDEJO-ROMÁN, J, et al. Physical Activity, Sedentary Behavior, and White Matter Microstructure in Children with Overweight or Obesity.. *Medicine & Science in Sports & Exercise* 2020;52:1218-1226	Combination of Movement Behaviors Not Analyzed
775 Slemenda, C, Miller, J, Hui, S, et al. Role of physical activity in the development of skeletal mass in children.. *Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research* 1991;6:1227-1233	Combination of Movement Behaviors Not Analyzed
776 Ridgers, N, Timperio, A, Cerin, E, et al. Compensation of physical activity and sedentary time in primary school children.. *Medicine and science in sports and exercise* 2014;46:1564-1569	No Outcome Assessed
777 Wafa, S, Hamzaid, H, Talib, R, et al. Objectively measured habitual physical activity and sedentary behaviour in obese and non-obese Malaysian children.. *Journal of tropical pediatrics* 2014;60:161-163	Combination of Movement Behaviors Not Analyzed
778 Robinson, T, Killen, J . Ethnic and Gender Differences in the Relationships between Television Viewing and Obesity, Physical Activity, and Dietary Fat Intake.. *Journal of Health Education* 1995;26:	Combination of Movement Behaviors Not Analyzed
779 Tee, J, Gan, W, Tan, K, et al. Obesity and unhealthy lifestyle associated with poor executive function among Malaysian adolescents.. *PloS one* 2018;13:e0195934	Combination of Movement Behaviors Not Analyzed
780 Portella, A, Paquet, C, Bischoff, A, et al. Multi-behavioral obesogenic phenotypes among school-aged boys and girls along the birth weight continuum.. *PloS one* 2019;14:e0212290	Combination of Movement Behaviors Not Analyzed

781 Ying, L, Zhu, X, Haegele, J, et al. Movement in High School: Proportion of Chinese Adolescents Meeting 24-Hour Movement Guidelines. *Int J Environ Res Public Health* 2020;17:	No Outcome Assessed
782 Smith M, Berdel D, Heinrich J.et al. Levels and sources of physical activity in German adolescents. *European Journal of Epidemiology* 2015;30:989-990	No Outcome Assessed
783 Wu, X, Bastian, K, Ohinmaa, A, et al. Influence of physical activity, sedentary behavior, and diet quality in childhood on the incidence of internalizing and externalizing disorders during adolescence: a population-based cohort study.. *Annals of epidemiology* 2018;28:86-94	Combination of Movement Behaviors Not Analyzed
784 Sandercock, G, Ogunleye, A . Independence of physical activity and screen time as predictors of cardiorespiratory fitness in youth.. *Pediatric research* 2013;73:692-697	Combination of Movement Behaviors Not Analyzed
785 Zhou, Z, Li, S, Yin, J, et al. Impact on Physical Fitness of the Chinese CHAMPS: A Clustered Randomized Controlled Trial.. *International journal of environmental research and public health* 2019;16:	Combination of Movement Behaviors Not Analyzed
786 Tamura, K, Duncan, D, Athens, J, et al. Do sedentary behavior and physical activity spatially cluster? Analysis of a population-based sample of Boston adolescents. *GeoJournal* 2018;83:775-782	No Outcome Assessed
787 Schroder H, Bawaked R.A, Ribas-Barba L.et al. Cumulative Effect of Obesogenic Behaviours on Adiposity in Spanish Children and Adolescents. *Obesity Facts* 2018;10:584-596	Effects of Movement Behaviours Could Not be Determined
788 Machado-Rodrigues A.M, Coelho-E-Silva M.J, Mota J.et al. Cardiorespiratory fitness, weight status and objectively measured sedentary behaviour and physical activity in adolescents from different geographic communities. *European Journal of Epidemiology* 2012;27:S130	Combination of Movement Behaviors Not Analyzed
789 Santos Silva, D, Pelegrini, A, da Silva Lopes, A, et al. Changes in health-related behaviors and their effect on dissatisfaction with body weight in youths. / MudanÃ§as nas condutas de saÃºde e o seu efeito na insatisfaÃ§Ã£o com peso corporal em adolescentes.. *Brazilian Journal of Kineanthropometry & Human Performance* 2014;16:80-90	Combination of Movement Behaviors Not Analyzed
790 Zhang, J, Feng, X, Zhai, Y, et al. Clustering of unhealthy lifestyle behaviours and associations with perceived and actual weight status among primary school children in China: A nationally representative cross-sectional study.. *Preventive medicine* 2018;112:6-14	Combination of Movement Behaviors Not Analyzed
791 Siegel, S, Malina, R, Reyes, M, et al. Correlates of physical activity and inactivity in urban Mexican youth.. *American journal of human biology : the official journal of the Human Biology Council* 2011;23:686-692	Combination of Movement Behaviors Not Analyzed
792 Valencia-Peris, A, Devís-Devís, J, García-Massó, X, et al. Competing Effects Between Screen Media Time and Physical Activity in Adolescent Girls: Clustering a Self-Organizing Maps Analysis.. *Journal of physical activity & health* 2016;13:579-586	Combination of Movement Behaviors Not Analyzed
793 Rodrigues de Lima, T, Santos Silva, D . Clusters of negative health-related physical fitness indicators and associated factors in adolescents. / CombinaÃ§Ã£o de indicadores negativos da aptidÃ£o fÃsica e fatores associados em adolescentes.. *Brazilian Journal of Kineanthropometry & Human Performance* 2017;19:436-449	Combination of Movement Behaviors Not Analyzed

794 Swaminathan, S, Thomas, T, Yusuf, S, et al. Clustering of diet, physical activity and overweight in parents and offspring in South India.. *European journal of clinical nutrition* 2013;67:128-134	Combination of Movement Behaviors Not Analyzed
795 Straatmann, V, Oliveira, A, Rostila, M, et al. Changes in physical activity and screen time related to psychological well-being in early adolescence: findings from longitudinal study ELANA.. *BMC public health* 2016;16:977	Combination of Movement Behaviors Not Analyzed
796 Roydhouse, J, Allman-Farinelli, M, McGeechan, K, et al. An exploratory analysis of active and low energy behaviour in Australian adolescents.. *Australian journal of primary health* 2012;18:248-257	No Outcome Assessed
797 Tandon, P, Grow, H, Couch, S, et al. Physical and social home environment in relation to children's overall and home-based physical activity and sedentary time. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2014;66:39-44	No Outcome Assessed
798 Sharma, B, Nam, E, Kim, D, et al. Role of gender, family, lifestyle and psychological factors in self-rated health among urban adolescents in Peru: a school-based cross-sectional survey.. *BMJ open* 2016;6:e010149	Combination of Movement Behaviors Not Analyzed
799 Yamakita, M, Ando, D, Akiyama, Y, et al. Association of objectively measured physical activity and sedentary behavior with bone stiffness in peripubertal children.. *Journal of bone and mineral metabolism* 2019;37:1095-1103	Combination of Movement Behaviors Not Analyzed
800 Vangeepuram, N, McGovern, K, Teitelbaum, S, et al. Asthma and physical activity in multiracial girls from three US sites.. *The Journal of asthma : official journal of the Association for the Care of Asthma* 2014;51:193-199	Combination of Movement Behaviors Not Analyzed
801 Sandercock G.R.H, Alibrahim M, Bellamy M. Media device ownership and media use: Associations with sedentary time, physical activity and fitness in English youth. *Preventive Medicine Reports* 2016;4:162-168	No Outcome Assessed
802 Purslow, L, Hill, C, Saxton, J, et al. Differences in physical activity and sedentary time in relation to weight in 8â€“9 year old children. *The International Journal of Behavioral Nutrition and Physical Activity* 2008;5:	Combination of Movement Behaviors Not Analyzed
803 Tan V.P, Macdonald H.M, A. McKay H. Sedentary time negates the positive influence of moderate-to-vigorous physical activity but not vigorous physical activity on bone strength in adolescent girls. *Osteoporosis International* 2014;25:576	Combination of Movement Behaviors Not Analyzed
804 Torres-Lopez, L, Cadenas-Sanchez, C, Migueles, J, et al. Associations of Sedentary Behaviour, Physical Activity, Cardiorespiratory Fitness and Body Composition with Risk of Sleep-Related Breathing Disorders in Children with Overweight/Obesity: A Cross-Sectional Study. *J Clin Med* 2020;9:	Combination of Movement Behaviors Not Analyzed
805 Tabacchi G, Filippi A.R, Napoli G.et al. Associations between weight status and combined predictors in adolescents from the ASSO project. *Annals of Nutrition and Metabolism* 2015;67:344	Combination of Movement Behaviors Not Analyzed
806 Veijalainen, A, Haapala, E, Väistö, J, et al. Associations of physical activity, sedentary time, and cardiorespiratory fitness with heart rate variability in 6- to 9-year-old children: the PANIC study.. *European journal of applied physiology* 2019;119:2487-2498	Combination of Movement Behaviors Not Analyzed

807 Silva, M, Pacífico, A, Piola, T, et al. ASSOCIATION BETWEEN PHYSICAL ACTIVITY PRACTICE AND CLUSTERING OF HEALTH RISK BEHAVIORS IN ADOLESCENTS. *Rev Paul Pediatr* 2020;38:e2018247	Combination of Movement Behaviors Not Analyzed
808 Lätt, E, Mäestu, J, Jürimäe, J. Associations of Accumulated Time in Bouts of Sedentary Behavior and Moderate-to-Vigorous Physical Activity With Cardiometabolic Health in 10- to 13-Year-Old Boys.. *Journal of Physical Activity & Health* 2019;16:52-59	Combination of Movement Behaviors Not Analyzed
809 van der Niet, A, Smith, J, Scherder, E, et al. Associations between daily physical activity and executive functioning in primary school-aged children. *Journal of Science and Medicine in Sport* 2015;18:673-677	Combination of Movement Behaviors Not Analyzed
810 Sun Y. . Associations between active commuting to school, body fat, and mental wellbeing: Population based, cross sectional study in China. *Journal of Adolescent Health* 2016;58:S54	Combination of Movement Behaviors Not Analyzed
811 Sibley M.H, Dick A, Graziano P.et al. Clinical and Neurocognitive Profiles of Adolescents With Late-Onset ADHD Symptoms. *Journal of the American Academy of Child and Adolescent Psychiatry* 2018;57:S299	Combination of Movement Behaviors Not Analyzed
812 Weston, E, Nagy, M, Ajibewa, T, et al. Acute Effects of Interrupting Prolonged Sitting With Intermittent Physical Activity on Blood Pressure in Preadolescent Children.. *Pediatric Exercise Science* 2019;31:408-415	Effects of Movement Behaviours Could Not be Determined
813 Williamson W, Doherty A, Foster C.et al. Physical activity, self-efficacy and perceptions of illness in adolescents with chronic musculoskeletal disease. *Rheumatology (United Kingdom)* 2014;53:	No Outcome Assessed
814 Smith C.L, Hands B, Bulsara M.K.et al. The association between physical activity, sedentary behaviour, aerobic fitness in adolescents with nonalcoholic fatty liver disease. *Hepatology* 2010;52:629A	Combination of Movement Behaviors Not Analyzed
815 Sirard, J, Laska, M, Patnode, C, et al. Adolescent physical activity and screen time: Associations with the physical home environment. *The International Journal of Behavioral Nutrition and Physical Activity* 2010;7:	Combination of Movement Behaviors Not Analyzed
816 Simon, C, Kellou, N, Dugas, J, et al. A socio-ecological approach promoting physical activity and limiting sedentary behavior in adolescence showed weight benefits maintained 25 years after intervention cessation. *International Journal of Obesity* 2014;38:936-943	Combination of Movement Behaviors Not Analyzed
817 Van den Bulck, J. Is television bad for your health? Behavior and body image of the adolescent 'couch potato'. *Journal of Youth and Adolescence* 2000;29:273-288	Combination of Movement Behaviors Not Analyzed
818 Smith, N, Rhodes, R, Naylor, P, et al. Exploring moderators of the relationship between physical activity behaviors and television viewing in elementary school children. *American Journal of Health Promotion* 2008;22:231-236	No Outcome Assessed
819 Zhang, J, Zhang, Y, Jiang, Y, et al. Effect of Sleep Duration, Diet, and Physical Activity on Obesity and Overweight Elementary School Students in Shanghai. *Journal of School Health* 2018;88:112-121	Combination of Movement Behaviors Not Analyzed

820 Zapico, R, Vázquez, I, Rodríguez, C, et al. Actividades extraescolares, ocio sedentario y horas de sueÃ±o como determinantes del sobrepeso infantil = The relationship between extra school activities, short sleeping, sedentary leisure and childhood overweight. *International Journal of Psychology & Psychological Therapy* 2009;9:59-66	Combination of Movement Behaviors Not Analyzed
821 Strom, M, Silverberg, J . Associations of Physical Activity and Sedentary Behavior with Atopic Disease in United States Children.. *The Journal of pediatrics* 2016;174:247	Combination of Movement Behaviors Not Analyzed
822 Ribeyre, J, Fellmann, N, Montaurier, C, et al. Daily energy expenditure and its main components as measured by whole-body indirect calorimetry in athletic and non-athletic adolescents.. *The British journal of nutrition* 2000;83:355-362	No Outcome Assessed
823 Spruyt, K, Gozal, D . The underlying interactome of childhood obesity: the potential role of sleep.. *Childhood obesity (Print)* 2012;8:38-42	Combination of Movement Behaviors Not Analyzed
824 Thomas, A, Janusek, L . Obesity Prevention Behaviors in Asian Indian Adolescent Girls: A Pilot Study.. *Journal of pediatric nursing* ;42:9-15	No Outcome Assessed
825 Tatsumi, Y, Mohri, I, Shimizu, S, et al. Daytime physical activity and sleep in preâ€ schoolers with developmental disorders. *Journal of Paediatrics and Child Health* 2015;51:396-402	No Outcome Assessed
826 Underbrink, E. Summer treatment program for adhd and asd: The role of physical activity, sleep and inhibitory control. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2019;80:	Combination of Movement Behaviors Not Analyzed
827 Warren, C, Riggs, N, Pentz, M. Executive function mediates prospective relationships between sleep duration and sedentary behavior in children. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2016;91:82-88	Combination of Movement Behaviors Not Analyzed
828 Vlaski E, Seckova L, Stavric K.et al. Allergic diseases in urban/rural environment: Are there differences in diet, body mass index and physical activity?. *European Respiratory Journal* 2012;40:	No Outcome Assessed
829 Vincent, S, Jopling, M . The health and wellâ€ being of children and young people who are looked after: Findings from a faceâ€ toâ€ face survey in Glasgow. *Health & Social Care in the Community* 2018;26:182-190	No Outcome Assessed
830 Stroebele, N, McNally, J, Plog, A, et al. The Association of Self-Reported Sleep, Weight Status, and Academic Performance in Fifth-Grade Students. *Journal of School Health* 2013;83:77-84	Combination of Movement Behaviors Not Analyzed
831 Sandercock G, Ogunleye A. ,. Sleep-wake habits: Associations with weight status, physical activity and screen-time in British 11-16 year olds. *Journal of Science and Medicine in Sport* 2012;15:S279	Combination of Movement Behaviors Not Analyzed
832 Yan, H, Zhang, R, Oniffrey, T, et al. Associations among Screen Time and Unhealthy Behaviors, Academic Performance, and Well-Being in Chinese Adolescents.. *International journal of environmental research and public health* 2017;14:	Combination of Movement Behaviors Not Analyzed
833 Smith, D, McFall, S . The relationship of diet and exercise for weight control and the quality of life gap associated with diabetes.. *Journal of psychosomatic research* 2005;59:385-392	Wrong population

834 Tekliuk, R, Serheta, I, Serebrennikova, O. Health-related behaviour in adolescents who have received basic instruction in health promotion.. *Wiadomosci lekarskie (Warsaw, Poland : 1960)* 2019;72:12-16	Combination of Movement Behaviors Not Analyzed
835 ter Wolbeek, M, van Doornen, L, Kavelaars, A, et al. Fatigue, depressive symptoms, and anxiety from adolescence up to young adulthood: A longitudinal study. *Brain, Behavior, and Immunity* 2011;25:1249-1255	Combination of Movement Behaviors Not Analyzed
836 Roberge, J, Van Hulst, A, Barnett, T, et al. Lifestyle Habits, Dietary Factors, and the Metabolically Unhealthy Obese Phenotype in Youth.. *The Journal of pediatrics* 2019;204:46	Combination of Movement Behaviors Not Analyzed
837 Ren, H, Zhou, Z, Liu, W, et al. Excessive homework, inadequate sleep, physical inactivity and screen viewing time are major contributors to high paediatric obesity.. *Acta paediatrica (Oslo, Norway : 1992)* 2017;106:120-127	Combination of Movement Behaviors Not Analyzed
838 Twenge, J, Hisler, G, Krizan, Z. Associations between screen time and sleep duration are primarily driven by portable electronic devices: Evidence from a population-based study of US children ages 0â€“17. *Sleep Medicine* 2019;56:211-218	No Outcome Assessed
839 Shou, H, Cui, L, Hickie, I, et al. Dysregulation of objectively assessed 24-hour motor activity patterns as a potential marker for bipolar I disorder: results of a community-based family study.. *Translational psychiatry* 2017;7:e1211	No Outcome Assessed
840 Smith, L, Jacob, L, Grabovac, I, et al. Violence and obesogenic behavior among adolescents aged 12-15Â years from 62 countries: A global perspective. *Prev Med* 2020;137:106123	Combination of Movement Behaviors Not Analyzed
841 Zhang, T, Wang, P, Liu, H, et al. Physical Activity, TV Watching Time, Sleeping, and Risk of Obesity and Hyperglycemia in the Offspring of Mothers with Gestational Diabetes Mellitus.. *Scientific reports* 2017;7:41115	Wrong population
842 Vanhelst, J, Bui-Xuan, G, Fardy, P, et al. Relationship between sleep habits, anthropometric characteristics and lifestyle habits in adolescents with intellectual disabilities. *Research in Developmental Disabilities* 2013;34:2614-2620	Combination of Movement Behaviors Not Analyzed
843 . The Digest. *Journal of Sport & Exercise Psychology* 2010;32:739-748	No Outcome Assessed
844 Porter E, Hogan A.D. ,. The association between BMI, vigorous physical activity and television viewing and the risk of symptoms of asthma, rhinoconjunctivitis and eczema in children and adolescents: ISAAC phase three. *Pediatrics* 2013;132:S39-S40	Combination of Movement Behaviors Not Analyzed
845 Sharma, B, Cosme Chavez, R, Jeong, A, et al. Television Viewing and Its Association with Sedentary Behaviors, Self-Rated Heath and Academic Performance among Secondary School Students in Peru.. *International journal of environmental research and public health* 2017;14:	No Outcome Assessed
846 Zwolinsky, S, McKenna, J, Pringle, A, et al. Physical Activity and Sedentary Behavior Clustering: Segmentation to Optimize Active Lifestyles.. *Journal of physical activity & health* 2016;13:921-928	Wrong population
847 Schlarb A.A, Schwedler V, Feichtinger P. Late night sport, sleep, sleep hygiene and mental well-being in adolescent footballers: A pilot study. *Somnologie* 2012;16:275-280	Combination of Movement Behaviors Not Analyzed

848 Sellami M, Fazaa A, Miladi S.et al. Physical activity in children and adolescents with juvenile idiopathic arthritis. *Annals of the Rheumatic Diseases* 2018;77:495	Combination of Movement Behaviors Not Analyzed
849 Hoefelmann, L, Samara Silva, K, Barbosa Filho, V, et al. Behaviors associated to sleep among high school students: cross-sectional and prospective analysis.. *Brazilian Journal of Kineanthropometry & Human Performance* 2014;16:68-77	No Outcome Assessed
850 Ribeiro R.Q.D.C. . Effectiveness evaluation of a school program for obesity prevention. *Circulation* 2012;125:e730	No Outcome Assessed
851 Ribeiro, R, Lotufo, P, Lamounier, J, et al. [Additional cardiovascular risk factors associated with excess weight in children and adolescents: the Belo Horizonte heart study].. *Arquivos brasileiros de cardiologia* 2006;86:408-418	Combination of Movement Behaviors Not Analyzed
852 Wasserman, D. Physical activity improves mental health.. *Acta paediatrica (Oslo, Norway : 1992)* 2019;108:984-985	No Outcome Assessed
853 Rosi, A, Calestani, M, Parrino, L, et al. Weight Status Is Related with Gender and Sleep Duration but Not with Dietary Habits and Physical Activity in Primary School Italian Children.. *Nutrients* 2017;9:	Combination of Movement Behaviors Not Analyzed
854 Sigmundová, D, Sigmund, E, Hamrik, Z, et al. Trends of overweight and obesity, physical activity and sedentary behaviour in Czech schoolchildren: HBSC study. *European Journal of Public Health* 2014;24:210-215	Combination of Movement Behaviors Not Analyzed
855 Wyszyńska, J, Podgórska-Bednarz, J, Dereń, K, et al. The Relationship between Physical Activity and Screen Time with the Risk of Hypertension in Children and Adolescents with Intellectual Disability.. *BioMed research international* 2017;2017:1940602	Combination of Movement Behaviors Not Analyzed
856 Tambalis, K, Panagiotakos, D, Psarra, G, et al. Current data in Greek children indicate decreasing trends of obesity in the transition from childhood to adolescence; results from the National Action for Children's Health (EYZHN) program.. *Journal of preventive medicine and hygiene* 2018;59:E36-E47	Combination of Movement Behaviors Not Analyzed
857 Tsiachris D, Tsioufis C, Syrseloudis D.et al. Interrelationship of lifestyle characteristics with dietary habits and childhood obesity among Greek adolescents. Preliminary data from the 3L Study. *European Heart Journal* 2009;30:440	Combination of Movement Behaviors Not Analyzed
858 Thibault, H, Contrand, B, Saubusse, E, et al. Risk factors for overweight and obesity in French adolescents: physical activity, sedentary behavior and parental characteristics.. *Nutrition (Burbank, Los Angeles County, Calif.)* 2010;26:192-200	No Outcome Assessed
859 Sanchez, A, Norman, G, Sallis, J, et al. Patterns and Correlates of Physical Activity and Nutrition Behaviors in Adolescents. *American Journal of Preventive Medicine* 2007;32:124-130	No Outcome Assessed
860 Yamano E, Fukuda S, Mizuno K.et al. Risk factors of sleep disturbance among school children in Japan: The 2-year follow-up study. *Sleep and Biological Rhythms* 2011;9:383	Combination of Movement Behaviors Not Analyzed

861 Van Hoye, A, Fenton, S, Krommidas, C, et al. Physical activity and sedentary behaviours among grassroots football players: A comparison across three European countries. *International Journal of Sport and Exercise Psychology* 2013;11:341-350	No Outcome Assessed
862 Ruiz, J, Ortega, F, Castillo, R, et al. Physical activity, fitness, weight status, and cognitive performance in adolescents. *The Journal of Pediatrics* 2010;157:917-922	Combination of Movement Behaviors Not Analyzed
863 Stasiak A, March M, Gurm R.et al. Prevalence of high health-habit achievers among middle school children and associated measures of cardiovascular health: A report from project healthy schools. *Circulation: Cardiovascular Quality and Outcomes* 2013;6:	Effects of Movement Behaviours Could Not be Determined
864 Soos, I, Biddle, S, Ling, J, et al. Physical activity, sedentary behaviour, use of electronic media, and snacking among youth: An International study. *Kinesiology* 2014;46:155-163	No Outcome Assessed
865 Prieto-Benavides, D, Correa-Bautista, J, Ramírez-Vélez, R. [PHYSICAL ACTIVITY LEVELS, PHYSICAL FITNESS AND SCREE TIME AMONG CHILDREN AND ADOLESCENTS FROM BOGOTÃ , COLOMBIA].. *Nutricion hospitalaria* 2015;32:2184-2192	Combination of Movement Behaviors Not Analyzed
866 Rey-López, J, Ruiz, J, Vicente-Rodríguez, G, et al. Physical activity does not attenuate the obesity risk of TV viewing in youth. *Pediatric Obesity* 2012;7:240-250	Combination of Movement Behaviors Not Analyzed
867 Nikolic M, Jovanovic R. ,. Prevalence of physical inactivity and associated factors among adolescents in Pancevo, Serbia. *Obesity Facts* 2012;5:261	No Outcome Assessed
868 Prentice, A, Jebb, S . TV and inactivity are separate contributors to metabolic risk factors in children. *PLoS Med* 2006;3:e481	Not Quantitatively Analysed
869 Platat, C, Wagner, A, Klumpp, T, et al. Relationships of physical activity with metabolic syndrome features and low-grade inflammation in adolescents.. *Diabetologia* 2006;49:2078-2085	Combination of Movement Behaviors Not Analyzed
870 Page RM.Zarco EP,. Physical activity and television viewing linked to body mass index among Philippine high school students: signaling of an emerging epidemic of obesity?. *International Quarterly of Community Health Education* 2000;20:145-156	Combination of Movement Behaviors Not Analyzed
871 Pinto, R, Sarkin, A . Interpersonal deficits and time spent in exercise or active recreation.. *Psychological reports* 1996;78:323-328	Combination of Movement Behaviors Not Analyzed
872 Phillips, K. A Zero-Hour Physical Activity Program's Benefit on Academic Achievement in Elementary Aged School Children. *ProQuest LLC* 2017;:	Combination of Movement Behaviors Not Analyzed
873 Palmer, K, Moore, R, Webster, E, et al. The relationship between body fat percentage and physical activity in school-aged children.. *Pediatric Exercise Science* 2016;28:54-54	Combination of Movement Behaviors Not Analyzed
874 Osborn, W, Simm, P, Olds, T, et al. Bone health, activity and sedentariness at age 11-12â€¯years: Cross-sectional Australian population-derived study.. *Bone* 2018;112:153-160	Combination of Movement Behaviors Not Analyzed

875 Ortega, F, Konstabel, K, Pasquali, E, et al. Objectively measured physical activity and sedentary time during childhood, adolescence and young adulthood: a cohort study.. *PloS one* 2013;8:e60871	No Outcome Assessed
876 Orsey, A, Wakefield, D, Cloutier, M. Physical activity (PA) and sleep among children and adolescents with cancer. *Pediatr Blood Cancer* 2014;61:956	No Outcome Assessed
877 Olds, T, Sanders, I, Maher, C, et al. Does compliance with healthy lifestyle behaviours cluster within individuals in Australian primary schoolâ€ aged children?. *Child: Care, Health and Development* 2018;44:117-123	No Outcome Assessed
878 Nielsen, M, Quist, J, Chaput, J, et al. Physical Activity, Sedentary Time, and Sleep and the Association With Inflammatory Markers and Adiponectin in 8- to 11-Year-Old Danish Children.. *Journal of physical activity & health* 2016;13:733-739	Combination of Movement Behaviors Not Analyzed
879 Mutz, M, Müller, J, Göring, A. Outdoor adventures and adolescentsâ€™ mental health: Daily screen time as a moderator of changes. *Journal of Adventure Education and Outdoor Learning* 2019;19:56-66	Combination of Movement Behaviors Not Analyzed
880 Mitts, M. Effect of Sensory Stimulation in Physical Activity on Academic Achievement and Classroom Behavior in Elementary Students. *ProQuest LLC* 2018;:	Combination of Movement Behaviors Not Analyzed
881 Mark, A. Physical activity, sedentary behaviour, and health in children and youth. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2009;70:966-966	Combination of Movement Behaviors Not Analyzed
882 Mitchell, J, Dowda, M, Pate, R, et al. Physical Activity and Pediatric Obesity: A Quantile Regression Analysis.. *Medicine and science in sports and exercise* 2017;49:466-473	Combination of Movement Behaviors Not Analyzed
883 Hume, C, Timperio, A, Veitch, J, et al. Physical activity, sedentary behavior, and depressive symptoms among adolescents.. *Journal of physical activity & health* 2011;8:152-156	Combination of Movement Behaviors Not Analyzed
884 Medicis C.T, Pelaez C.A, Cordero S.P.et al. Relation between the academic performance with the nutritional status and the physical activity of schooled teenagers in the Educational Unit Remigio Romero y Cordero, Cuenca 2014. *Archivos Venezolanos de Farmacologia y Terapeutica* 2017;36:142-147	Combination of Movement Behaviors Not Analyzed
885 May, A. Individual and family level correlates of obesity among African American adolescents. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2009;69:7190-7190	Combination of Movement Behaviors Not Analyzed
886 Hoelscher, D, Barroso, C, Springer, A, et al. Prevalence of self-reported activity and sedentary behaviors among 4th-, 8th-, and 11th-grade Texas public school children: The School Physical Activity and Nutrition study. *Journal of Physical Activity & Health* 2009;6:535-547	No Outcome Assessed
887 Rodriguez-Ayllon, M, Cadenas-Sánchez, C, Estévez-López, F, et al. Role of Physical Activity and Sedentary Behavior in the Mental Health of Preschoolers, Children and Adolescents: A Systematic Review and Meta-Analysis.. *Sports medicine (Auckland, N.Z.)* 2019;49:1383-1410	Combination of Movement Behaviors Not Analyzed

888 Fulton, J, Burgeson, C, Perry, G, et al. Assessment of Physical Activity and Sedentary Behavior in Preschool-Age Children: Priorities for Research.. *Pediatric Exercise Science* 2001;13:113	Wrong population
889 Dengel, D, Hearst, M, Murray, D, et al. Longitudinal Effects of Screen Time and Physical Activity on Blood Pressure in Adolescents.. *Medicine & Science in Sports & Exercise* 2011;43:390-390	Combination of Movement Behaviors Not Analyzed
890 Corazza, P, Tadiotto, M, Junior, F, et al. Cardiorespiratory Fitness and Metabolic Profile in Adolescents with High Sedentary Behavior and Low Level of Physical Activity.. *Journal of Professional Exercise Physiology* 2019;16:84-94	Combination of Movement Behaviors Not Analyzed
891 Parmar, A, Yeh, E, Korczak, D, et al. Depressive symptoms, sleep patterns, and physical activity in adolescents with narcolepsy.. *Sleep* 2019;42:	Combination of Movement Behaviors Not Analyzed
892 Parletta N, Aljeesh Y, Baune B.T. Health behaviors, knowledge, life satisfaction, and wellbeing in people with mental illness across four countries and comparisons with normative sample. *Frontiers in Psychiatry* 2016;7:145	Wrong population
893 Parent, J, Sanders, W, Forehand, R. Youth screen time and behavioral health problems: The role of sleep duration and disturbances. *Journal of Developmental and Behavioral Pediatrics* 2016;37:277-284	Combination of Movement Behaviors Not Analyzed
894 Pantea-Stoian A, Chilianu S, Stefanca F.et al. The impact of nutrition, sedentary behaviour and lifestyle on school-age children. *Romanian Journal of Diabetes, Nutrition and Metabolic Diseases* 2015;22:241-249	No Outcome Assessed
895 Otabe, Y, Hattori, S, Yamatsu, K. Sedentary behavior and academic performance in Japanese junior high school students.. *Science & Sports* 2014;29:S19-S19	Combination of Movement Behaviors Not Analyzed
896 Orden, A, Lamarque, M, Chan, D, et al. Short sleep and low milk intake are associated with obesity in a community of school aged children from Argentina.. *American journal of human biology : the official journal of the Human Biology Council* 2019;31:e23224	Combination of Movement Behaviors Not Analyzed
897 Omorou A.Y, Langlois J, Lecomte E.et al. Erratum: Adolescents' Physical Activity and Sedentary Behavior: A Pathway in Reducing Overweight and Obesity. The PRALIMAP 2-Year Cluster Randomized Controlled Trial (Journal of physical activity & health). *Journal of physical activity & health* 2015;12:628-635	Combination of Movement Behaviors Not Analyzed
898 Olds, T, Maher, C, Dumuid, D. Life on holidays: differences in activity composition between school and holiday periods in Australian children.. *BMC public health* 2019;19:450	No Outcome Assessed
899 Olds, T, Maher, C . Screen time is more strongly associated than physical activity with weight status in Australian adolescents. *Journal of Science & Medicine in Sport* 2010;12:e134-e134	Combination of Movement Behaviors Not Analyzed
900 Okely, A, Tremblay, M, Reilly, J, et al. Physical activity, sedentary behaviour, and sleep: movement behaviours in early life.. *The Lancet. Child & adolescent health* 2018;2:233-235	Not Quantitatively Analysed
901 Noonan, R, Christian, D, Boddy, L, et al. Accelerometer and self-reported measures of sedentary behaviour and associations with adiposity in UK youth.. *Journal of sports sciences* 2019;37:1919-1925	Combination of Movement Behaviors Not Analyzed

902 Nilsson S, Bergstrom A, Wickman M.et al. Physical activity and inactivity in relation to asthma among 16 year olds in a Swedish birth cohort study. *Allergy: European Journal of Allergy and Clinical Immunology* 2013;68:535	Combination of Movement Behaviors Not Analyzed
903 Ness, M, Barradas, D, Irving, J, et al. Correlates of overweight and obesity among American Indian/Alaska Native and non-Hispanic White children and adolescents: National Survey of Childrenâ€™s Health, 2007. *Maternal and Child Health Journal* 2012;16:S268-S277	Combination of Movement Behaviors Not Analyzed
904 Siyez, D. Health-enhancing behaviors among high school students in Turkey. *The High School Journal* 2008;92:46-55	No Outcome Assessed
905 Villagrán Pérez S.Rodríguez-Martín A.Novalbos Ruiz JP,, et al. HÃ¡bitos y estilos de vida modificables en niÃ±os con sobrepeso y obesidad.. *Nutricion Hospitalaria* 2010;25:823-831	Combination of Movement Behaviors Not Analyzed
906 Lowe, J, Watkins, W, Kotecha, S, et al. Physical activity in school-age children born preterm.. *The Journal of pediatrics* 2015;166:877-883	No Outcome Assessed
907 Loprinzi, P. Association of family functioning on youth physical activity and sedentary behavior. *Journal of Physical Activity & Health* 2015;12:642-648	No Outcome Assessed
908 de Faria, W, de Farias, J, Vaz Ronque, E, et al. Comparison of physical activity, sedentary behavior and physical fitness between fulltime and part-time students.. *Brazilian Journal of Kineanthropometry & Human Performance* 2015;17:418-427	No Outcome Assessed
909 Lizandra, J, Devís-Devís, J, Valencia-Peris, A, et al. Screen time and moderate-to-vigorous physical activity changes and displacement in adolescence: A prospective cohort study.. *European journal of sport science* 2019;19:686-695	Combination of Movement Behaviors Not Analyzed
910 Cureau, F, Duarte, P, Santos, D, et al. Clustering of Risk Factors for Noncommunicable Diseases in Brazilian Adolescents: Prevalence and Correlates.. *Journal of Physical Activity & Health* 2014;11:942-949	No Outcome Assessed
911 Fialho Pombeiro, M, de Matos, M, Alves Diniz, J. Teenagers Lifestyles at Public and Private Schools: Screen Time and Physical Activity. / Estilos de vida de los adolescentes en las escuelas pÃºblicas y privadas: tiempo de pantalla y actividad fÃsica.. *Retos: Nuevas Perspectivas de Educación Física, Deporte y Recreación* 2017;31:275-281	No Outcome Assessed
912 Kim, J, So, W, Kim, Y. Association between asthma and physical activity in Korean adolescents: The 3rd Korea Youth Risk Behavior Web-based Survey (KYRBWS-III). *European Journal of Public Health* 2012;22:864-868	No Outcome Assessed
913 Machado-Rodrigues, A, Coelho-e-Silva, M, Mota, J, et al. Cardiorespiratory fitness, weight status and objectively measured sedentary behaviour and physical activity in rural and urban Portuguese adolescents. *Journal of Child Health Care* 2012;16:166-177	Combination of Movement Behaviors Not Analyzed
914 Maia, E, Mendes, L, Pimenta, A, et al. Cluster of risk and protective factors for obesity among Brazilian adolescents. *International Journal of Public Health* 2018;63:481-490	Combination of Movement Behaviors Not Analyzed
915 Dennison, M. Obesogenic behaviors, depression and cardio-metabolic disease in American Indian children. *Dissertation Abstracts International: Section B: The Sciences and Engineering* 2018;78:	Combination of Movement Behaviors Not Analyzed

916 Dietz, W. Physical activity and childhood obesity.. *Nutrition (Burbank, Los Angeles County, Calif.)* 1991;7:295-296	Combination of Movement Behaviors Not Analyzed
917 Fan, H, Lee, Y, Yang, S, et al. Comprehensive determinants of growth trajectories and body composition in school children: A longitudinal cohort study.. *Obesity research & clinical practice* ;12:270-276	Combination of Movement Behaviors Not Analyzed
918 Motl, R, Sandroff, B, Pilutti, L, et al. Physical activity, sedentary behavior, and aerobic capacity in persons with multiple sclerosis.. *Journal of the neurological sciences* 2017;372:342-346	Combination of Movement Behaviors Not Analyzed
919 Epstein, L, Paluch, R, Gordy, C, et al. Decreasing sedentary behaviors in treating pediatric obesity.. *Archives of pediatrics & adolescent medicine* 2000;154:220-226	Combination of Movement Behaviors Not Analyzed
920 Faigenbaum, A, Rebullido, T, MacDonald, J. Pediatric Inactivity Triad: A Risky PIT.. *Current sports medicine reports* 2018;17:45-47	Combination of Movement Behaviors Not Analyzed
921 Leech, R, McNaughton, S, Timperio, A. Clustering of children's obesity-related behaviours: associations with sociodemographic indicators.. *European journal of clinical nutrition* 2014;68:623-628	No Outcome Assessed
922 Stearns, J, Carson, V, Spence, J, et al. The role of peer victimization in the physical activity and screen time of adolescents: a cross-sectional study.. *BMC pediatrics* 2017;17:170	Combination of Movement Behaviors Not Analyzed
923 DuRant RH.Thompson WO.Johnson M,, et al. The relationship among television watching, physical activity, and body composition of 5- or 6-year-old children.. *Pediatric Exercise Science* 1996;8:15-26	Combination of Movement Behaviors Not Analyzed
924 Morita, N, Nakajima, T, Okita, K, et al. Relationships among fitness, obesity, screen time and academic achievement in Japanese adolescents.. *Physiology & behavior* 2016;163:161-166	Combination of Movement Behaviors Not Analyzed
925 Castellano Barrera D.H, Mejia Mendoza L, Finozzi Silva M.R.et al. Factors of risks associated to the overweight and obese in children and adolescents. *Hormone Research in Paediatrics* 2012;78:53	Combination of Movement Behaviors Not Analyzed
926 Mozzillo E, Zito E, De Nitto E.et al. Lifestyle and health related quality of life in adolescents with diabetes mellitus type 1. *Hormone Research in Paediatrics* 2014;82:211	Combination of Movement Behaviors Not Analyzed
927 Must, A, Bandini, L, Tybor, D, et al. Activity, inactivity, and screen time in relation to weight and fatness over adolescence in girls. *Obesity* 2007;15:1774-1781	Combination of Movement Behaviors Not Analyzed
928 Morrissey B, Strugnell C, Malakellis M.et al. Sleep duration and risk of overweight and obesity among Victorian Primary School children. *Obesity Research and Clinical Practice* 2014;8:71	Combination of Movement Behaviors Not Analyzed

929 Morley, B, Scully, M, Niven, P, et al. What factors are associated with excess body weight in Australian secondary school students?. *The Medical journal of Australia* 2012;196:189-192	Combination of Movement Behaviors Not Analyzed
930 Moreno L.A, Hense S, Santaliestra-Pasias A.M.et al. Sedentary behaviour, physical activity and obesity in European children. *International Journal of Obesity* 2011;35:S150	Combination of Movement Behaviors Not Analyzed
931 Moreno C, Ozturk G, Lowden A. Daylight exposure, depression and sleep in adolescents. *Journal of Sleep Research* 2018;27:322	Combination of Movement Behaviors Not Analyzed
932 Makubuya, T. Health-risk behaviors and body mass index (BMI) percentiles. *Dissertation Abstracts International Section A: Humanities and Social Sciences* 2017;78:	Combination of Movement Behaviors Not Analyzed
933 Lubans, D, Morgan, P . Evaluation of an extra-curricular school sport programme promoting lifestyle and lifetime activity for adolescents. *Journal of Sports Sciences* 2008;26:519-529	No Outcome Assessed
934 Lubans D, Morgan P, Aguiar E.et al. Randomised controlled trial of the Physical Activity Leaders (PALs) program for low-active adolescent boys from disadvantaged secondary schools. *Journal of Science and Medicine in Sport* 2010;13:e12	Combination of Movement Behaviors Not Analyzed
935 Krietsch, K, Armstrong, B, McCrae, C, et al. Temporal Associations Between Sleep and Physical Activity Among Overweight/Obese Youth.. *Journal of pediatric psychology* 2016;41:680-691	Combination of Movement Behaviors Not Analyzed
936 Kriemler, S, Manser-Wenger, S, Zahner, L, et al. Reduced cardiorespiratory fitness, low physical activity and an urban environment are independently associated with increased cardiovascular risk in children.. *Diabetologia* 2008;51:1408-1415	Combination of Movement Behaviors Not Analyzed
937 Katzmarzyk, P, Malina, R, Song, T, et al. Television viewing, physical activity, and health-related fitness of youth in the QuÃ©bec Family Study. *Journal of Adolescent Health* 1998;23:318-325	Combination of Movement Behaviors Not Analyzed
938 Katzmarzyk, P, Barreira, T, Broyles, S, et al. Relationship between lifestyle behaviors and obesity in children ages 9â€“11: Results from a 12-country study. *Obesity* 2015;23:1696-1702	Combination of Movement Behaviors Not Analyzed
939 Jalo, E, Konttinen, H, Vepsäläinen, H, et al. Emotional Eating, Health Behaviours, and Obesity in Children: A 12-Country Cross-Sectional Study.. *Nutrients* 2019;11:	Combination of Movement Behaviors Not Analyzed
940 Jalali-Farahani, S, Amiri, P, Chin, Y. Are physical activity, sedentary behaviors and sleep duration associated with body mass index-for-age and health-related quality of life among high school boys and girls?. *Health and quality of life outcomes* 2016;14:30	Combination of Movement Behaviors Not Analyzed
941 Jago, R, Fox, K, Page, A, et al. Physical activity and sedentary behaviour typologies of 10-11 year olds. *The International Journal of Behavioral Nutrition and Physical Activity* 2010;7:	No Outcome Assessed

942 Khan, A, Uddin, R, Kolbe-Alexander, T. Promoting physical activity and reducing sedentary behaviour can minimise the risk of suicidal behaviours among adolescents. *Acta Paediatr* 2019;108:1163-1164	Combination of Movement Behaviors Not Analyzed
943 Kleppang, A, Thurston, M, Hartz, I, et al. Psychological distress among Norwegian adolescents: Changes between 2001 and 2009 and associations with leisure time physical activity and screen-based sedentary behaviour.. *Scandinavian journal of public health* 2019;47:166-173	Combination of Movement Behaviors Not Analyzed
944 Kleszczewska, D, Szkutnik, A, Siedlecka, J, et al. Physical Activity, Sedentary Behaviours and Duration of Sleep as Factors Affecting the Well-Being of Young People against the Background of Environmental Moderators.. *International journal of environmental research and public health* 2019;16:	Combination of Movement Behaviors Not Analyzed
945 Leppänen, M, Ray, C, Wennman, H, et al. Compliance with the 24-h movement guidelines and the relationship with anthropometry in Finnish preschoolers: the DAGIS study.. *BMC public health* 2019;19:1618	Wrong population
946 Lim, M, Lee, C, Sim, S, et al. Physical Activity, Sedentary Habits, Sleep, and Obesity are Associated with Asthma, Allergic Rhinitis, and Atopic Dermatitis in Korean Adolescents.. *Yonsei medical journal* 2017;58:1040-1046	Combination of Movement Behaviors Not Analyzed
947 Croezen, S, Visscher, T, Ter Bogt, N, et al. Skipping breakfast, alcohol consumption and physical inactivity as risk factors for overweight and obesity in adolescents: results of the E-MOVO project.. *European journal of clinical nutrition* 2009;63:405-412	Combination of Movement Behaviors Not Analyzed
948 Countryman, A, Saab, P, Llabre, M, et al. Cardiometabolic risk in adolescents: Associations with physical activity, fitness, and sleep. *Annals of Behavioral Medicine* 2013;45:121-131	Duplicate
949 Correa-Burrows P, Burrows R. ,. Physical inactivity in Chilean youth: Suboptimal strategies for making health related choices. *European Journal of Epidemiology* 2013;28:S181	Combination of Movement Behaviors Not Analyzed
950 Corder, K, Atkin, A, Bamber, D, et al. Revising on the run or studying on the sofa: Prospective associations between physical activity, sedentary behaviour, and exam results in British adolescents. *The International Journal of Behavioral Nutrition and Physical Activity* 2015;12:	Combination of Movement Behaviors Not Analyzed
951 Colucci G, Colucci E, Robusto F.et al. Cross-sectional study for obesity, high blood pressure and urinary abnormalities in adolescents. Correct lifestyles or cure the disease. *Obesity Facts* 2016;9:108-109	Combination of Movement Behaviors Not Analyzed
952 Collings, P, Wijndaele, K, Corder, K, et al. Prospective associations between sedentary time, sleep duration and adiposity in adolescents.. *Sleep medicine* 2015;16:717-722	Combination of Movement Behaviors Not Analyzed
953 Colley, R, Wong, S, Garriguet, D, et al. Physical activity, sedentary behaviour and sleep in Canadian children: parent-report versus direct measures and relative associations with health risk.. *Health reports* 2012;23:45-52	Combination of Movement Behaviors Not Analyzed
954 Collese, T, De Moraes, A, Fernández-Alvira, J, et al. How do energy balance-related behaviors cluster in adolescents?. *International Journal of Public Health* 2019;64:195-208	No Outcome Assessed
955 Collese T.S, De Moraes A.C.F, Fernandez-Alvira J.M.et al. Clustering of lifestyle-related behaviours in adolescents: Differences between Europe and Brazil. *European Journal of Epidemiology* 2015;30:787	No Outcome Assessed

956 Cliff, D, Okely, T, Burrows, T, et al. Levels and bouts of sedentary behaviour and physical activity: Associations with cardio-metabolic health in overweight and obese children. *Journal of Science & Medicine in Sport* 2012;15:S42-S42	Combination of Movement Behaviors Not Analyzed
957 Christofaro, D, De Andrade, S, Mesas, A, et al. Higher screen time is associated with overweight, poor dietary habits and physical inactivity in Brazilian adolescents, mainly among girls.. *European journal of sport science* 2016;16:498-506	Combination of Movement Behaviors Not Analyzed
958 Chien, L, Liou, Y, Chang, P. Low defaecation frequency in Taiwanese adolescents: Association with dietary intake, physical activity and sedentary behaviour. *Journal of Paediatrics and Child Health* 2011;47:381-386	Combination of Movement Behaviors Not Analyzed
959 Cheuiche Pires, G, Camboim Rockett, F, Abrahão Salum Júnior, G, et al. Cardiovascular risk factors in children and adolescents with anxiety disorders and their association with disease severity.. *Nutricion hospitalaria* 2005;31:269-277	Combination of Movement Behaviors Not Analyzed
960 Chen, X, Sekine, M, Hamanishi, S, et al. Lifestyles and health-related quality of life in Japanese school children: A cross-sectional study. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2005;40:668-678	Combination of Movement Behaviors Not Analyzed
961 Chen, S, Yan, J . Prevalence and Selected Sociodemographic of Movement Behaviors in Schoolchildren from Low- and Middle-Income Families in Nanjing, China: A Cross-Sectional Questionnaire Survey. *Children (Basel)* 2020;7:	No Outcome Assessed
962 Chastin, S, Mandrichenko, O, Skelton, D. The frequency of osteogenic activities and the pattern of intermittence between periods of physical activity and sedentary behaviour affects bone mineral content: the cross-sectional NHANES study.. *BMC public health* 2014;14:4	Combination of Movement Behaviors Not Analyzed
963 Chaput, J, Leduc, G, Boyer, C, et al. Electronic screens in children's bedrooms and adiposity, physical activity and sleep: do the number and type of electronic devices matter?. *Canadian journal of public health = Revue canadienne de sante publique* 2014;105:e273-e279	Combination of Movement Behaviors Not Analyzed
964 Chaput, J, Lambert, M, Gray-Donald, K, et al. Short sleep duration is independently associated with overweight and obesity in Quebec children.. *Canadian journal of public health = Revue canadienne de sante publique* 2011;102:369-374	Combination of Movement Behaviors Not Analyzed
965 Chaput, J, Lambert, M, Mathieu, M, et al. Physical activity vs sedentary time: Independent associations with adiposity in children. *Pediatric Obesity* 2012;7:251-258	Combination of Movement Behaviors Not Analyzed
966 Chaput, J, Barnes, J, Tremblay, M, et al. Inequality in physical activity, sedentary behaviour, sleep duration and risk of obesity in children: a 12-country study. *Obes Sci Pract* 2018;4:229-237	Combination of Movement Behaviors Not Analyzed
967 Castro, J, Nunes, H, Silva, D. Prevalence of abdominal obesity in adolescents: association between sociodemographic factors and lifestyle.. *Revista paulista de pediatria : orgao oficial da Sociedade de Pediatria de Sao Paulo* 2016;34:343-351	Combination of Movement Behaviors Not Analyzed
968 Cao, M, Zhu, Y, Li, X, et al. Gender-dependent association between sleep duration and overweight incidence in CHINESE school children: a national follow-up study.. *BMC public health* 2018;18:615	Combination of Movement Behaviors Not Analyzed

969 Cao, M, Zhu, Y, He, B, et al. Association between sleep duration and obesity is age- and gender-dependent in Chinese urban children aged 6-18 years: a cross-sectional study.. *BMC public health* 2015;15:1029	Combination of Movement Behaviors Not Analyzed
970 Camhi, S, Waring, M, Sisson, S, et al. Physical activity and screen time in metabolically healthy obese phenotypes in adolescents and adults.. *Journal of obesity* 2013;:984613	Combination of Movement Behaviors Not Analyzed
971 Cameron, A, van Stralen, M, Brug, J, et al. Television in the bedroom and increased body weight: Potential explanations for their relationship among European schoolchildren. *Pediatric Obesity* 2013;8:130-141	Combination of Movement Behaviors Not Analyzed
972 Calamaro, C, Park, S, Mason, T, et al. Shortened sleep duration does not predict obesity in adolescents. *Journal of Sleep Research* 2010;19:559-566	Combination of Movement Behaviors Not Analyzed
973 Byun, W, Dowda, M, Pate, R. Associations between screen-based sedentary behavior and cardiovascular disease risk factors in Korean youth.. *Journal of Korean medical science* 2012;27:388-394	Combination of Movement Behaviors Not Analyzed
974 Busto-Zapico, R, Amigo-Vázquez, I, Peña-Suárez, E, et al. Relationships between sleeping habits, sedentary leisure activities and childhood overweight and obesity. *Psychology, Health & Medicine* 2014;19:667-672	Combination of Movement Behaviors Not Analyzed
975 Burns, R, Bai, Y, Fu, Y, et al. Associations of adolescent lifestyle behaviors with body mass index within a nationally representative sample of US adolescents: a quantile regression analysis.. *Public health* 2020;179:51-58	Combination of Movement Behaviors Not Analyzed
976 Bucko A, Dowda M, Pate R. Sleep and weight status in adolescents. *Sleep Medicine* 2019;64:S51	Combination of Movement Behaviors Not Analyzed
977 Brug, J, Stralen, M, ChinAPaw, M, et al. Differences in weight status and energyâ€ balance related behaviours according to ethnic background among adolescents in seven countries in Europe: The ENERGYâ€ project. *Pediatric Obesity* 2012;7:399-411	Combination of Movement Behaviors Not Analyzed
978 Brodersen, N, Steptoe, A, Boniface, D, et al. Trends in physical activity and sedentary behaviour in adolescence: ethnic and socioeconomic differences.. *British journal of sports medicine* 2007;41:140-144	No Outcome Assessed
979 Bringolf-Isler, B, Mäder, U, Dössegger, A, et al. Regional differences of physical activity and sedentary behaviour in Swiss children are not explained by socio-demographics or the built environment. *International Journal of Public Health* 2015;60:291-300	No Outcome Assessed
980 Brazendale, K, Brazendale, A, Garcia, J, et al. Breaking tradition: Increasing physical activity and reducing sedentary time of children with developmental disabilities. *Disabil Health J* 2020;13:100869	No Outcome Assessed
981 Borras, P, Vidal, J, Ponseti, X, et al. Predictors of quality of life in children.. *Journal of Human Sport & Exercise* 2011;6:649-656	Combination of Movement Behaviors Not Analyzed

982 Borradaile, K, Foster, G, May, H, et al. Associations between the Youth/Adolescent Questionnaire, the Youth/Adolescent Activity Questionnaire, and body mass index z score in low-income inner-city fourth through sixth grade children.. *The American journal of clinical nutrition* 2008;87:1650-1655	Combination of Movement Behaviors Not Analyzed
983 Boddy, L, Murphy, M, Cunningham, C, et al. Physical activity, cardiorespiratory fitness, and clustered cardiometabolic risk in 10- to 12-year-old school children: the REACH Y6 study.. *American journal of human biology : the official journal of the Human Biology Council* 2014;26:446-451	Combination of Movement Behaviors Not Analyzed
984 Biddle, S, Marshall, S, Gorely, T, et al. Temporal and environmental patterns of sedentary and active behaviors during adolescents' leisure time. *International Journal of Behavioral Medicine* 2009;16:278-286	No Outcome Assessed
985 Biddle, S, Gorely, T, Marshall, S, et al. The prevalence of sedentary behavior and physical activity in leisure time: A study of Scottish adolescents using ecological momentary assessment. *Preventive Medicine: An International Journal Devoted to Practice and Theory* 2009;48:151-155	No Outcome Assessed
986 Bibiloni, M, Martinez, E, Llull, R, et al. Prevalence and risk factors for obesity in Balearic Islands adolescents.. *The British journal of nutrition* 2010;103:99-106	Combination of Movement Behaviors Not Analyzed
987 Berglind, D, Ljung, R, Tynelius, P, et al. Cross-sectional and prospective associations of meeting 24-h movement guidelines with overweight and obesity in preschool children.. *Pediatric obesity* 2018;13:442-449	Wrong population
988 Berentzen N.E, Smit H, Van Rossem L.et al. Is the association between child's screen time and cardiometabolic risk mediated by snacking and physical activity?. *European Journal of Epidemiology* 2013;28:S201-S202	No Outcome Assessed
989 Belanger, K, Barnes, J, Longmuir, P, et al. The relationship between physical literacy scores and adherence to Canadian physical activity and sedentary behaviour guidelines.. *BMC public health* 2018;18:1042	No Outcome Assessed
990 Bektaş, Ö, Uğur, C, Gençtürk, Z, et al. Relationship of childhood headaches with preferences in leisure time activities, depression, anxiety and eating habits: A population-based, cross-sectional study. *Cephalalgia* 2015;35:527-537	Combination of Movement Behaviors Not Analyzed
991 Basterfield, L, Pearce, M, Adamson, A, et al. Physical activity, sedentary behavior, and adiposity in English children. *American Journal of Preventive Medicine* 2012;42:445-451	Combination of Movement Behaviors Not Analyzed
992 Barreira, T, Broyles, S, Tudor-Locke, C, et al. Epidemiological Transition in Physical Activity and Sedentary Time in Children.. *Journal of physical activity & health* 2019;16:518-524	No Outcome Assessed
993 Bai, Y, Chen, S, Vazou, S, et al. Mediated Effects of Perceived Competence on Youth Physical Activity and Sedentary Behavior. *Research Quarterly for Exercise and Sport* 2015;86:406-413	No Outcome Assessed
994 Aznar, S, Naylor, P, Silva, P, et al. Patterns of physical activity in Spanish children: A descriptive pilot study. *Child: Care, Health and Development* 2011;37:322-328	No Outcome Assessed
995 Augste, C, Lämmle, L, Künzell, S. Does current behaviour predict the course of children's physical fitness?. *European Journal of Sport Science* 2015;15:429-435	Combination of Movement Behaviors Not Analyzed
996 Barbosa Filho, V, da Silva Lopes, A, Bozza, R, et al. Correlates of cardiorespiratory and muscular fitness among Brazilian adolescents. *American Journal of Health Behavior* 2014;38:42-52	Combination of Movement Behaviors Not Analyzed

997 Banks L, Manlhiot C, Davies J.et al. Cardiovascular risk in overweight and obese adolescents: Is there an influence of physical activity. *Canadian Journal of Diabetes* 2011;35:167	Combination of Movement Behaviors Not Analyzed
998 Baldursdottir, B, Taehtinen, R, Sigfusdottir, I, et al. Impact of a physical activity intervention on adolescents' subjective sleep quality: a pilot study.. *Global health promotion* 2017;24:14-22	No Outcome Assessed
999 Andrade Neto, F, Eto, F, Pereira, T, et al. Active and sedentary behaviours in children aged 7 to 10 years old: the urban and rural contexts, Brazil.. *BMC public health* 2014;14:1174	No Outcome Assessed
1000 Anderson, G, Snodgrass, J, Elliott, B. Determining physical activity patterns of suburban British Columbia residents.. *Canadian journal of public health = Revue canadienne de sante publique* 2007;98:70-73	No Outcome Assessed
1001 Aires, L, Andersen, L, Mendonça, D, et al. A 3-year longitudinal analysis of changes in fitness, physical activity, fatness and screen time. *Acta Paediatrica* 2010;99:140-144	Combination of Movement Behaviors Not Analyzed
1002 Guerrero, M, Barnes, J, Walsh, J, et al. 24-Hour Movement Behaviors and Impulsivity.. *Journal of Clinical Chiropractic Pediatrics* 2019;18:1608-1608	Duplicate
1003 Allen, M, Elliott, M, Morales, L, et al. Adolescent participation in preventive health behaviors, physical activity, and nutrition: Differences across immigrant generations for Asians and Latinos compared with Whites. *American Journal of Public Health* 2007;97:337-343	No Outcome Assessed
1004 Basterfield, L, Adamson, A, Frary, J, et al. Longitudinal study of physical activity and sedentary behavior in children. *Pediatrics* 2011;127:e24-e30	No Outcome Assessed
1005 Augustin, N, Mattocks, C, Cooper, A, et al. Modelling fat mass as a function of weekly physical activity profiles measured by actigraph accelerometers.. *Physiological measurement* 2012;33:1831-1839	Combination of Movement Behaviors Not Analyzed
1006 Akbulut, G, Yildirim, M, Sanlier, N, et al. Comparison of energy balance-related behaviours and measures of body composition between Turkish adolescents in Turkey and Turkish immigrant adolescents in the Netherlands.. *Public health nutrition* 2014;17:2692-2699	Combination of Movement Behaviors Not Analyzed
1007 Ajman, H, Novak, D, Mišigoj-Durakovic, M. Lifestyle Factors Associated with Overweight/Obesity Status in Croatian Adolescents: A Population-Based Study. *Physical Educator* 2019;76:926-944	Combination of Movement Behaviors Not Analyzed
1008 Ajejas Bazán, M, Sellán Soto, M, Sellán, A, et al. Factors associated with overweight and childhood obesity in Spain according to the latest national health survey (2011).. *Anna Nery School Journal of Nursing / Escola Anna Nery Revista de Enfermagem* 2018;22:1-6	Combination of Movement Behaviors Not Analyzed
1009 Aishworiya, R, Kiing, J, Chan, Y, et al. Screen time exposure and sleep among children with developmental disabilities.. *Journal of paediatrics and child health* 2018;54:889-894	Combination of Movement Behaviors Not Analyzed
1010 Aires L, Mendonca D, Silva G.et al. Longitudinal changes in physical fitness: Associations with changes in body mass index, active and sedentary behaviours in Portuguese adolescents. *Obesity Reviews* 2010;11:831	Combination of Movement Behaviors Not Analyzed

1011 Ahn, J, Sera, F, Cummins, S, et al. Associations between objectively measured physical activity and later mental health outcomes in children: findings from the UK Millennium Cohort Study. *Journal of Epidemiology and Community Health* 2018;72:94-100	Combination of Movement Behaviors Not Analyzed
1012 Aguilar-Cordero, M, Rodríguez-Blanque, R, Leon-Ríos, X, et al. Influence of Physical Activity on Blood Pressure in Children With Overweight/Obesity: A Randomized Clinical Trial. *Am J Hypertens* 2020;33:131-136	Combination of Movement Behaviors Not Analyzed
1013 Aggio, D, Smith, L, Fisher, A, et al. Context-Specific Associations of Physical Activity and Sedentary Behavior With Cognition in Children.. *American journal of epidemiology* 2016;183:1075-1082	Combination of Movement Behaviors Not Analyzed
1014 Aggio, D, Ogunleye, A, Voss, C, et al. Temporal relationships between screen-time and physical activity with cardiorespiratory fitness in English schoolchildren: a 2-year longitudinal study.. *Preventive medicine* 2012;55:37-39	Combination of Movement Behaviors Not Analyzed
1015 Afifi M. . Positive health practices and depressive symptoms among high school adolescents in Oman. *Singapore Medical Journal* 2006;47:960-966	Effects of Movement Behaviours Could Not be Determined
1016 Adrian, M, Charlesworth-Attie, S, Vander Stoep, A, et al. Health promotion behaviors in adolescents: Prevalence and association with mental health status in a statewide sample. *The Journal of Behavioral Health Services & Research* 2014;41:140-152	Effects of Movement Behaviours Could Not be Determined
1017 Adkins, M. An examination of changes in sedentary time with the integration of technology for children participating in a morning fitness program. *Dissertation Abstracts International Section A: Humanities and Social Sciences* 2012;72:3228-3228	Combination of Movement Behaviors Not Analyzed
1018 Adams, A, Prince, R . Correlates of physical activity in young American Indian children: lessons learned from the Wisconsin Nutrition and Growth Study.. *Journal of public health management and practice : JPHMP* 2010;16:394-400	No Outcome Assessed
1019 Adamo, K, Colley, R, Hadjiyannakis, S, et al. Physical activity and sedentary behavior in obese youth. *The Journal of Pediatrics* 2015;166:1270-1275	Combination of Movement Behaviors Not Analyzed
1020 Adam, E, Snell, E, Pendry, P. Sleep timing and quantity in ecological and family context: A nationally representative time-diary study. *Journal of Family Psychology* 2007;21:4-19	No Outcome Assessed
1021 Aceves-Martins, M, Whitehead, R, Inchley, J, et al. Self-reported weight and predictors of missing responses in youth.. *Nutrition (Burbank, Los Angeles County, Calif.)* 2018;53:54-58	Combination of Movement Behaviors Not Analyzed
1022 Abiri, B, Sarbakhsh, P, Vafa, M. Prevalence of overweight, obesity, and associated risk factors in healthy female adolescents in Tehran, Iran. *Cent Asian J Glob Health* 2019;8:413	Combination of Movement Behaviors Not Analyzed
1023 Akkerman M, Mouton L.J, Disseldorp L.M.et al. Physical activity and sedentary behavior following pediatric burns - a preliminary investigation using objective activity monitoring. *Experimental Hematology and Oncology* 2018;7:4	No Outcome Assessed

1024 Ahrens W. . Lifestyle factors, overweight/obesity and related disorders over the life-course of children-observations of the IDEFICS/ I. Family cohort. *Obesity Facts* 2018;11:15-16	Combination of Movement Behaviors Not Analyzed
1025 Aggio, D, Gardner, B, Roberts, J, et al. Correlates of children's independent outdoor play: Cross-sectional analyses from the Millennium Cohort Study. *Prev Med Rep* 2017;8:10-14	No Outcome Assessed
1026 Adamidou L, Pezarou M, Karabouta Z.et al. Mediterranean diet, physical activity, screen time and sleep duration in greek obese children/adolescents and their parents' perceptions. *Acta Paediatrica, International Journal of Paediatrics* 2016;106:29	No Outcome Assessed
1027 Cliff, D, Jones, R, Burrows, T, et al. Volumes and bouts of sedentary behavior and physical activity: Associations with cardiometabolic health in obese children. *Obesity* 2014;22:E112-E118	Combination of Movement Behaviors Not Analyzed
1028 Bermejo-Cantarero, A, Álvarez-Bueno, C, Martinez-Vizcaino, V, et al. Association between physical activity, sedentary behavior, and fitness with health related quality of life in healthy children and adolescents: A protocol for a systematic review and meta-analysis.. *Medicine* 2017;96:e6407	No Outcome Assessed
1029 Butte, N, Puyau, M, Wilson, T, et al. Role of physical activity and sleep duration in growth and body composition of preschoolâ€ aged children. *Obesity* 2016;24:1328-1335	Combination of Movement Behaviors Not Analyzed
1030 Auvinen, J, Tammelin, T, Taimela, S, et al. Neck and shoulder pains in relation to physical activity and sedentary activities in adolescence.. *Spine* 2007;32:1038-1044	Combination of Movement Behaviors Not Analyzed
1031 Aires, L, Pratt, M, Lobelo, F, et al. Associations of Cardiorespiratory Fitness in Children and Adolescents With Physical Activity, Active Commuting to School, and Screen Time.. *Journal of Physical Activity & Health* 2011;:S198-S205	Combination of Movement Behaviors Not Analyzed
1032 Adesina, A, Peterside, O, Anochie, I, et al. Weight status of adolescents in secondary schools in port Harcourt using Body Mass Index (BMI).. *Italian journal of pediatrics* 2012;38:31	Combination of Movement Behaviors Not Analyzed
1033 . Active Kids Score Higher: More Activity Time Adds Up to Better Learning.. *Physical & Health Education Journal* 2009;75:38-39	Not Quantitatively Analysed
1034 Kahlin, Y, Werner, S, Alricsson, M. A physical activity program for Swedish physically inactive female high school students: A controlled intervention study. *Journal of Physical Activity & Health* 2014;11:1162-1169	Combination of Movement Behaviors Not Analyzed
1035 De Bock, F, Genser, B, Raat, H, et al. A participatory physical activity intervention in preschools: A cluster randomized controlled trial. *American Journal of Preventive Medicine* 2013;45:64-74	Combination of Movement Behaviors Not Analyzed
1036 Aires, L, Mendonça, D, Silva, G, et al. A 3-year longitudinal analysis of changes in Body Mass Index.. *International journal of sports medicine* 2010;31:133-137	Combination of Movement Behaviors Not Analyzed

1037 Vale, S, Mota, J . Adherence to 24-hour movement guidelines among Portuguese preschool children: the prestyle study. *J Sports Sci* 2020;:1-6	Wrong population
1038 Vale S, Rego C, Mota J. Adherence 24hr movement guidelines and adiposity among portuguese preschoolers. *Annals of Nutrition and Metabolism* 2018;73:320	Wrong population
1039 Vassiloudis, I, Yiannakouris, N, Panagiotakos, D, et al. Academic performance in relation to adherence to the Mediterranean diet and energy balance behaviors in Greek primary schoolchildren. *Journal of Nutrition Education and Behavior* 2014;46:164-170	Combination of Movement Behaviors Not Analyzed
1040 Aceves-Martins, M, Llauradó, E, Tarro, L, et al. A school-based, peer-led, social marketing intervention to engage Spanish adolescents in a healthy lifestyle ('We Are Cool'â€"Som la Pera study): A parallel-cluster randomized controlled study. *Childhood Obesity* 2017;13:300-313	No Outcome Assessed
1041 Taylor, A, Winefield, H, Kettler, L, et al. A population study of 5 to 15 year olds: Full time maternal employment not associated with high BMI The importance of screen-based activity, reading for pleasure and sleep duration in childrenâ€™s BMI. *Maternal and Child Health Journal* 2012;16:587-599	Combination of Movement Behaviors Not Analyzed
1042 Wang, C, Chen, P, Zhuang, J. A National Survey of Physical Activity and Sedentary Behavior of Chinese City Children and Youth Using Accelerometers. *Research Quarterly for Exercise and Sport* 2013;84:	Combination of Movement Behaviors Not Analyzed
1043 Trilk, J, Pate, R, Pfeiffer, K, et al. A cluster analysis of physical activity and sedentary behavior patterns in middle school girls. *Journal of Adolescent Health* 2012;51:292-298	No Outcome Assessed
1044 Rogers, V, Motyka, E . 5-2-1-0 goes to school: a pilot project testing the feasibility of schools adopting and delivering healthy messages during the school day.. *Pediatrics* 2009;123 Suppl 5:S272-S276	No Outcome Assessed
1045 Taylor, R, Haszard, J, Meredith-Jones, K, et al. 24-h movement behaviors from infancy to preschool: Cross-sectional and longitudinal relationships with body composition and bone health. *The International Journal of Behavioral Nutrition and Physical Activity* 2018;15:	Wrong population
1046 Martoni, M, Carissimi, A, Fabbri, M, et al. 24-h actigraphic monitoring of motor activity, sleeping and eating behaviors in underweight, normal weight, overweight and obese children.. *Eating and weight disorders : EWD* 2016;21:669-677	Combination of Movement Behaviors Not Analyzed
1047 Abu-Mweis S.S, Tayyem R.F, Bawadi H.A.et al. Eating habits, physical activity, and sedentary behaviors of Jordanian adolescents' residents of Amman. *Mediterranean Journal of Nutrition and Metabolism* 2014;7:67-74	Combination of Movement Behaviors Not Analyzed
1048 Adelmann PK. Social environment factors and preteen health-related behaviors.. *Journal of Adolescent Health* 2005;36:36-47	No Outcome Assessed
1049 Agostini, A, Pignata, S, Camporeale, R, et al. Changes in growth and sleep across school nights, weekends and a winter holiday period in two Australian schools. *Chronobiology International* 2018;35:691-704	Combination of Movement Behaviors Not Analyzed
1050 Agaronov, A, Ash, T, Sepulveda, M, et al. Inclusion of Sleep Promotion in Family-Based Interventions To Prevent Childhood Obesity.. *Childhood obesity (Print)* 2018;14:485-500	Not Quantitatively Analysed
1051 Aerenhouts, D, Zinzen, E, Clarys, P. Energy expenditure and habitual physical activities in adolescent sprint athletes.. *Journal of Sports Science & Medicine* 2011;10:362-368	Combination of Movement Behaviors Not Analyzed

1052 Adwere-Boamah, J. Multiple Logistic Regression Analysis of Cigarette Use among High School Students. *Journal of Case Studies in Education* 2011;1:	Combination of Movement Behaviors Not Analyzed
1053 Abela, S, Bagnasco, A, Arpesella, M, et al. Childhood obesity: An observational study. *Journal of Clinical Nursing* 2014;23:2990-2992	Combination of Movement Behaviors Not Analyzed
1054 Abdelkarim O, Ammar A, Soliman A.M.A.et al. Prevalence of overweight and obesity associated with the levels of physical fitness among primary school age children in Assiut city. *Egyptian Pediatric Association Gazette* 2017;65:43-48	Combination of Movement Behaviors Not Analyzed
1055 Abdulsalam S, Olugbenga-Bello A, Olarewaju O.et al. Sociodemographic correlates of modifiable risk factors for hypertension in a rural local government area of Oyo state south west nigeria. *International Journal of Hypertension* 2014;2014:842028	Wrong population
1056 Aadland, K, Moe, V, Aadland, E, et al. Relationships between physical activity, sedentary time, aerobic fitness, motor skills and executive function and academic performance in children. *Mental Health and Physical Activity* 2017;12:10-18	Combination of Movement Behaviors Not Analyzed

Near miss 1: analysis in study considered amount of movement behaviour recommendations met, not specific combinations of behaviours

Near miss 2: too many health behaviours (e.g., tobacco use, alcohol consumption, diet) considered in study to accurately answer the research question

Appendix B.4 Quality Assessment

First Author (Year)	1: Setting	2: Eligibility Criteria	3: Define Outcomes	4: Measurement	5: Potential Bias	6: Quantitative Variables	7: Statistical Methods	8: Subgroups & Interactions	9: Reporting	Quality
Aggio (2015)	1	0	1	1	0	1	1	1	1	high
Agostinis-Sobrinho (2018)	1	1	1	1	0	1	1	1	0	high
Bai (2016)	1	0	1	1	0	1	1	0	1	low
Bergmann (2018)	1	1	1	1	0	1	1	1	1	high
Boone (2007)	1	1	1	1	0	1	1	1	1	high
Burns (2019)	1	1	1	1	0	1	1	0	1	high
Cao (2011)	1	1	1	1	0	1	1	1	1	high
Cao (2020)	1	1	1	1	0	1	1	0	1	high
Carson (2014)	1	1	1	1	0	1	1	1	1	high
Carson (2015)	1	1	1	1	0	1	1	1	1	high
Carson (2016)	1	1	1	1	0	1	1	0	1	high
Carson (2017)	1	1	1	1	0	1	1	1	1	high
Carson (2019)	1	1	1	1	0	1	1	0	1	high
Chaput (2013)	1	1	1	1	0	1	1	1	1	high
Chaput (2014)	1	1	1	1	0	1	1	0	1	high
Chen (2020)	1	1	1	1	0	1	1	1	1	high
Collings (2017)	1	1	1	1	1	1	1	1	1	high
Cristi-Montero (2019)	1	1	1	1	0	1	1	0	1	high
Crowe (2020)	1	1	1	1	1	1	1	1	1	high
Cureau (2017)	1	1	1	1	0	1	1	0	1	high
da Silva (2019)	1	1	1	1	1	1	1	1	1	high
Dalene (2017)	1	1	1	1	1	1	1	1	1	high
De Bourdeaudhuij (2013)	1	1	1	1	1	1	1	0	1	high
de Moraes (2013)	1	1	1	1	0	1	1	0	1	high
del Pozo-Cruz (2017)	1	1	1	1	0	1	1	1	1	high
del Pozo-Cruz (2019)	1	1	1	1	0	1	1	1	1	high
Djalalinia (2017)	1	0	1	1	0	1	1	0	1	low
Dollman (2004)	0	0	1	0	0	0	0	0	0	low
Dollman (2006)	1	0	1	1	1	1	1	0	1	high
Dowd (2016)	1	1	1	1	1	1	1	0	1	high
Drenowatz (2014)	1	0	1	1	0	1	1	0	1	low
Dumuid (2017)	1	1	1	1	1	1	1	1	1	high
Dumuid (2018)	1	1	1	1	1	1	1	1	1	high
Dumuid (2019)	1	1	1	1	1	1	1	1	1	high
Eisenmann (2008)	1	1	1	1	0	1	1	0	1	high
Ekelund (2012)	1	1	1	1	0	1	1	0	1	high
Fairclough (2017)	1	0	1	1	1	1	1	0	1	high
Fairclough (2018)	1	1	1	1	0	1	1	0	1	high
Faria (2020)	1	1	1	1	0	1	1	0	1	high
Gaba (2020)	1	1	1	1	1	1	1	1	1	high

Garcia-Hermoso (2017)	0	1	1	1	0	1	1	0	1	low
Garcia-Hermoso (2020)	1	1	1	1	0	1	1	0	1	high
Gillis (2019)	1	1	1	1	1	1	1	1	1	high
Gordon-Larsen (2002)	1	1	1	1	0	1	1	0	1	high
Guan (2020)	1	1	1	1	0	1	1	0	0	low
Guerrero (2019)	1	0	1	1	1	1	1	0	1	high
Haapala (2017)	1	1	1	1	1	1	1	1	1	high
Hamer (2009)	1	0	1	1	0	1	1	0	1	low
Hansen (2018)	1	1	1	1	1	1	1	0	1	high
Herman (2012)	1	1	1	1	0	0	0	0	0	low
Herman (2014)	1	1	1	1	1	1	1	0	1	high
Herman (2015)	1	1	1	1	0	1	1	0	1	high
Heshmat (2016)	1	1	1	1	0	1	1	0	1	high
Hjorth (2014a)	1	1	1	1	0	1	1	1	1	high
Hjorth (2014b)	1	1	1	1	0	1	1	1	1	high
Hormazabal-Aguayo (2019)	1	0	0	0	0	0	0	0	0	low
Hrafnkelsdottir (2018)	1	1	1	1	0	1	1	0	1	high
Huang (2016)	1	0	1	1	1	1	1	0	1	high
Ishii (2020)	1	0	1	1	0	1	1	0	1	low
Jakubec (2020)	1	1	1	1	0	1	1	1	1	high
Janssen (2017)	1	1	1	1	0	1	1	0	1	high
Jones (2019)	1	1	1	1	1	1	1	1	1	high
Jones (2020)	1	1	1	1	1	1	1	1	1	high
Kantoma (2016)	1	1	1	1	0	1	1	1	1	high
Katzmarzyk (2015)	1	1	1	1	0	1	1	1	1	high
Keane (2017)	1	1	1	1	0	1	1	0	1	high
Khan (2018)	1	0	1	0	0	1	1	0	1	low
Kidokoro (2019)	1	1	1	1	1	1	1	1	1	high
Kim (2016)	1	1	1	1	1	1	1	1	1	high
Lacy (2012)	1	1	1	1	0	1	1	1	1	high
Lane (2014)	1	1	1	1	0	1	1	0	1	high
Laurson (2008)	1	1	1	1	1	1	1	1	1	high
Laurson (2015)	1	1	1	1	0	1	1	1	1	high
Lee (2014)	1	1	1	1	0	1	1	1	1	high
Lee (2018)	1	0	1	1	0	1	1	1	1	high
Lien (2020)	1	0	1	1	0	1	1	0	1	low
Liu (2019)	1	0	1	1	1	1	1	0	1	high
Loprinzi (2015)	1	1	1	1	1	1	1	1	1	high
Maher (2012)	1	0	1	1	0	1	1	0	1	low
Maher (2016)	1	1	1	1	0	1	1	1	1	high
Marques (2015)	1	1	1	1	1	1	1	0	1	high
Martinez-Gomez (2011)	1	1	1	1	0	1	1	0	1	high
Matin (2017)	1	1	1	1	0	1	1	0	1	high
Melkevik (2010)	1	1	1	1	1	1	1	0	1	high
Melkevik (2015)	1	1	1	1	0	1	0	1	1	high
Mielke (2019)	1	1	1	1	1	1	1	1	1	high
Monda (2005)	1	1	1	0	0	1	1	1	1	high

Moore (2013)	1	1	1	1	0	1	1	0	1	high
Mota (2014)	1	1	1	1	0	1	1	0	1	high
Motamed-Gorji (2019)	1	1	1	1	0	1	1	0	1	high
Moura (2019)	1	1	1	1	1	1	1	1	1	high
Ogawa (2019)	1	1	1	1	1	1	1	0	1	high
Omorou (2016)	1	0	1	1	0	1	1	0	1	low
Parker (2019)	1	1	1	1	0	1	1	1	1	high
Patnode (2011)	1	1	1	1	0	1	1	1	1	high
Perez (2011)	1	1	1	1	0	1	1	0	1	high
Pérez-Rodrigo (2016)	1	1	1	0	1	1	1	1	1	high
Pitanga (2019)	1	1	1	1	0	1	1	0	1	high
Porter (2017)	1	1	1	1	0	1	1	0	1	high
Rendo-Urteaga (2015)	1	1	1	1	1	1	1	1	1	high
Roman-Viñas (2016)	1	1	1	1	0	1	1	1	1	high
Sampasa-Kanyinga (2017)	1	1	1	1	0	1	1	0	1	high
Sampasa-Kanyinga (2020)	1	1	1	1	0	1	1	1	1	high
Sánchez-Oliva (2018)	1	1	1	1	0	1	1	0	1	high
Sánchez-Oliva (2020)	1	1	1	1	1	1	1	0	1	high
Santos (2014)	1	1	1	1	0	1	1	1	1	high
Santos (2018)	1	1	1	1	0	1	1	0	1	high
Sardinha (2017)	1	1	1	1	1	1	1	0	1	high
Shi (2020)	1	0	1	1	0	1	1	0	1	low
Sisson (2010)	1	0	1	1	0	1	1	0	0	low
Spengler (2012)	1	1	1	1	0	1	1	0	1	high
Steele (2009)	1	1	1	1	1	1	1	0	1	high
Sun (2020)	1	1	1	1	1	1	1	1	1	high
Taheri (2019)	1	0	1	1	0	1	1	0	1	low
Tahir (2019)	1	1	1	1	0	1	1	1	1	high
Talarico (2018)	1	1	1	1	1	1	1	0	1	high
Tanaka (2020a)	1	1	1	1	0	1	1	0	1	high
Tanaka (2020b)	1	0	1	1	0	1	1	1	1	high
Tassitano (2020)	1	1	1	1	0	1	1	1	1	high
Taylor (2020)	1	1	1	1	1	1	1	1	1	high
teVelde (2007)	1	1	1	1	0	1	1	0	1	high
Trinh (2015)	1	1	1	1	0	1	1	1	1	high
Uddin (2020)	1	0	1	1	0	1	1	0	0	low
Vaisto (2014)	1	0	1	1	0	1	1	0	1	low
Van den Bulck (2009)	1	1	1	1	0	0	0	1	1	low
Verswijveren (2020)	1	1	1	1	1	1	1	1	1	high
Vicente-Rodríguez (2009)	1	1	1	1	1	1	1	0	1	high
Walsh (2018)	1	1	1	1	0	1	1	1	1	high
Wang (2016)	1	1	1	1	0	1	1	0	1	high
Weisser (2015)	0	0	0	0	0	0	0	0	0	low
Werneck (2019)	1	1	1	1	0	1	1	1	1	high
Wilkie (2016)	1	1	1	1	1	1	1	0	1	high
Wilson (2020)	1	1	1	1	0	1	1	1	1	high
Wong (2009)	1	1	1	1	0	1	1	1	1	high

Wong (2017)	1	1	1	1	1	1	1	0	1	high
Wu (2020)	1	1	1	1	1	1	1	1	1	high
Xi (2011)	1	1	1	1	1	1	1	0	1	high
Zeng (2020)	1	1	1	1	1	1	1	1	1	high
Zhu (2019)	1	0	1	1	1	1	1	0	1	high
Zhu (2020)	1	1	1	1	0	1	1	0	1	high

Note: 0, does not meet criteria; 1, meets criteria; high quality, >=7 criteria met; low quality, < 7 criteria met

Item 1: Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection

Item 2: Give the eligibility criteria, and the sources and methods of selection of participants

Item 3: Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable

Item 4: For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group

Item 5: Describe any efforts to address potential sources of bias

Item 6: Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why

Item 7: Describe all statistical methods, including those used to control for confounding

Item 8: Describe any methods used to examine subgroups and interactions

Item 9: Report numbers of outcome events or summary measures

Appendix B.5 Study Characteristics

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Aggio	2015	Cross-sectional	United Kingdom	Children	353	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß ↓ SB/↑ PA -4.187 [adiposity] .0511 - 16.098 [muscular physical fitness]
Agostinis-Sobrinho	2018	Cross-sectional	Sweden, Greece, Italy, Spain, Hungary, Belgium, France, Germany, Austria	Adolescents	3528	Accelerometer/ study-specific	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	Means Males “Healthy cluster” 10.5 µg/dL [cortisol] 10.1 ng/mL [leptin] “Medium healthy cluster” 12.7 µg/dL [cortisol] 8.3 ng/mL [leptin] “Unealthy cluster” 11.7 µg/dL [cortisol] 11.1 ng/mL [leptin] Females “Healthy cluster” 11.3 µg/dL [cortisol] 26.1 ng/mL [leptin] “Medium healthy cluster” 13.2 µg/dL [cortisol] 28.1 ng/mL [leptin] “Unealthy cluster” 13.4 µg/dL [cortisol] 32.5 ng/mL [leptin]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Bai	2016	Cross-sectional	United States	Adolescents, Children	1113	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios Children [high adiposity] high PA/low ST 1.49 low PA/low ST 1.6 low PA/high ST 3.0 Adolescents high PA/low ST 2.38 [high adiposity] 2.45 [low cardiorespiratory fitness] low PA/low ST 2.43 [high adiposity] 3.12 [low cardiorespiratory fitness] low PA/high ST 3.38 [high adiposity] 3.84 [low cardiorespiratory fitness]
Bergmann	2018	Cross-sectional	Brazil	Adolescents, Children	1045	Pedometer/ step recommendation 15000 (boys) 12000 (girls)	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios [high adiposity] low PA/high ST .54 [children] .81 [adolescent males] 1.93 [adolescent females] low PA/low ST .53 [children] 1.07 [adolescent males] 3.21 [adolescent females] high PA/high ST .49 [children] .74 [adolescent males] 1.75 [adolescent females]
Boone	2007	Longitudinal	United States	Adolescents	9155	Questionnaire/ bouts/week low = 2 high = 5	Questionnaire/ hours screen time/week low = 7 high = 25	N/A	mod PA/high ST [males] mod PA/mod ST [females]	Odds ratios [adiposity] low PA/low ST .77 - .79 [males] .61 - .66 [females] high PA/low ST .75 - .82 [males] .58 - .87 [females] low PA/high ST .87-.88 [males] .58 - 1.05 [females] high PA/high ST .97 - .99 [males] .55 - .61 [females]

First Author	Year	Study Design	Country	Population¹	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Burns	2019	Cross-sectional	United States	Children	409	Accelerometer/ % school day	Accelerometer/ % school day	N/A	N/A	ß [gross motor skills] ↓ SB/↑ MVPA .48
Cao	2011	Cross-sectional	China	Children	5003	Questionnaire/ dichotomized >=3 x 20 m VPA/week	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	"active cluster"	Odds ratios [mental health symptoms] "High SLP cluster" .88 "High ST cluster" 1.37 "Low PA/low SLP cluster" 1.46
Cao	2011	Cross-sectional	China	Children	5003	Questionnaire/ dichotomized >=3 x 20 m VPA/week	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	low PA/high ST	Odds ratios [mental health symptoms] high PA/high ST .78 - .87 low PA/low ST .5 - .66 high PA/low ST .34 - .67
Cao	2020	Cross-sectional	China	Adolescents, Children	4178	Questionnaire/ study-specific	Questionnaire/ study-specific (screen time)	Questionnaire/ study-specific	"active cluster"	Odds ratios [mental health symptoms] "High SLP cluster" .88 "High ST cluster" 1.37 "Low PA/low SLP cluster" 1.46
Cao	2020	Cross-sectional	China	Adolescents, Children	4178	Questionnaire/ study-specific	Questionnaire/ study-specific (screen time)	Questionnaire/ study-specific	low PA/high ST	Odds ratios [mental health symptoms] high PA/high ST .78 - .87 low PA/low ST .5 - .66 high PA/low ST .34 - .67
Carson	2014	Cross-sectional	Canada	Children	787	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	"healthiest movers"	Odds ratios [adiposity] Males "active screenies" 1.09 [males] 1.37 [females] "unhealthiest movers" 1.12 [males] 1.49 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Carson	2014	Cross-sectional	Canada	Children	787	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	N/A	ß [adiposity] low PA/high SB .01 high PA/high SB .03
Carson	2014	Cross-sectional	Canada	Children	787	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	N/A	ß ↓SB/↑ MVPA -.035 - -.001 [adiposity] 0 [diastolic blood pressure] .001 [HDL-cholesterol] .006 [C-reactive protein] 0 [systolic blood pressure] .013 [triglycerides] -.001 [insulin] .001 [cardiorespiratory fitness] -.005 [well-being - difficulties] ↓SB/↑ SLP -.053 - -.001 [adiposity] 0 [diastolic blood pressure] .001 [HDL-cholesterol] -.018 [C-reactive protein] 0 [systolic blood pressure] -.001 [triglycerides] -.002 [insulin] .001 [cardiorespiratory fitness] -.008 [negative wellbeing]
Carson	2014	Cross-sectional	Canada	Children	787	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	high PA/low ST/high SLP [compared to those not meeting guidelines]	ß .04 - .36 [adiposity] .01 [systolic blood pressure] 0 [diastolic blood pressure] .09 [fasting triglycerides] -.07 [fasting HDL cholesterol] .31 [C-reactive protein] .19 [fasting insulin] -14.05 [cardiorespiratory fitness] .18 [socio-emotional problems]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Carson	2014	Cross-sectional	Canada	Children	787	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	specific movement behavior relative to all other movement behaviors	ß SB .029 - .111 [adiposity] .952 [systolic blood pressure] 2.7 [diastolic blood pressure] -.038 [HDL-cholesterol] .097 [C-reactive protein] -.018 [LDL-cholesterol] .015 [triglycerides] -.017 [plasma glucose] -.008 [insulin] MPA .01 - .054 [adiposity] -.454 [systolic blood pressure] -1.051 [diastolic blood pressure] -.035 [HDL-cholesterol] .055 [C-reactive protein] -.008 [LDL-cholesterol] .003 [triglycerides] -.012 [plasma glucose] -.048 [insulin] VPA -.206 - -.033 [adiposity] .689 [systolic blood pressure] 1.246 [diastolic blood pressure] .058 [HDL-cholesterol] -.153 [C-reactive protein] .015 [LDL-cholesterol] -.041 [triglycerides] .005 [plasma glucose] -.062 [insulin]
Carson	2015	Cross-sectional	Canada	Adolescents	19831	Questionnaire/ quartiles	Questionnaire/ quartiles	Questionnaire/ quartiles	“healthiest movers”	Odds ratios [adiposity] Males “active screenies” 1.09 [males] 1.37 [females] “unhealthiest movers” 1.12 [males] 1.49 [females]
Carson	2015	Cross-sectional	Canada	Adolescents	19831	Questionnaire/ quartiles	Questionnaire/ quartiles	Questionnaire/ quartiles	N/A	ß [adiposity] low PA/high SB .01 high PA/high SB .03

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Carson	2015	Cross-sectional	Canada	Adolescents	19831	Questionnaire/ quartiles	Questionnaire/ quartiles	Questionnaire/ quartiles	N/A	ß ↓SB/↑ MVPA -.035 - -.001 [adiposity] 0 [diastolic blood pressure] .001 [HDL-cholesterol] .006 [C-reactive protein] 0 [systolic blood pressure] .013 [triglycerides] -.001 [insulin] .001 [cardiorespiratory fitness] -.005 [well-being - difficulties] ↓SB/↑ SLP -.053 - -.001 [adiposity] 0 [diastolic blood pressure] .001 [HDL-cholesterol] -.018 [C-reactive protein] 0 [systolic blood pressure] -.001 [triglycerides] -.002 [insulin] .001 [cardiorespiratory fitness] -.008 [negative wellbeing]
Carson	2015	Cross-sectional	Canada	Adolescents	19831	Questionnaire/ quartiles	Questionnaire/ quartiles	Questionnaire/ quartiles	high PA/low ST/high SLP [compared to those not meeting guidelines]	ß .04 - .36 [adiposity] .01 [systolic blood pressure] 0 [diastolic blood pressure] .09 [fasting triglycerides] -.07 [fasting HDL cholesterol] .31 [C-reactive protein] .19 [fasting insulin] -14.05 [cardiorespiratory fitness] .18 [socio-emotional problems]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Carson	2015	Cross-sectional	Canada	Adolescents	19831	Questionnaire/ quartiles	Questionnaire/ quartiles	Questionnaire/ quartiles	specific movement behavior relative to all other movement behaviors	ß SB .029 - .111 [adiposity] .952 [systolic blood pressure] 2.7 [diastolic blood pressure] -.038 [HDL-cholesterol] .097 [C-reactive protein] -.018 [LDL-cholesterol] .015 [triglycerides] -.017 [plasma glucose] -.008 [insulin] MPA .01 - .054 [adiposity] -.454 [systolic blood pressure] -1.051 [diastolic blood pressure] -.035 [HDL-cholesterol] .055 [C-reactive protein] -.008 [LDL-cholesterol] .003 [triglycerides] -.012 [plasma glucose] -.048 [insulin] VPA -.206 - -.033 [adiposity] .689 [systolic blood pressure] 1.246 [diastolic blood pressure] .058 [HDL-cholesterol] -.153 [C-reactive protein] .015 [LDL-cholesterol] -.041 [triglycerides] .005 [plasma glucose] -.062 [insulin]
Carson	2016	Cross-sectional	Canada	Children	4169	Accelerometer/ N/A	Accelerometer/ N/A	Interview/ N/A	“healthiest movers”	Odds ratios [adiposity] Males “active screenies” 1.09 [males] 1.37 [females] “unhealthiest movers” 1.12 [males] 1.49 [females]
Carson	2016	Cross-sectional	Canada	Children	4169	Accelerometer/ N/A	Accelerometer/ N/A	Interview/ N/A	N/A	ß [adiposity] low PA/high SB .01 high PA/high SB .03

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Carson	2016	Cross-sectional	Canada	Children	4169	Accelerometer/ N/A	Accelerometer/ N/A	Interview/ N/A	N/A	ß ↓SB/↑ MVPA -.035 - -.001 [adiposity] 0 [diastolic blood pressure] .001 [HDL-cholesterol] .006 [C-reactive protein] 0 [systolic blood pressure] .013 [triglycerides] -.001 [insulin] .001 [cardiorespiratory fitness] -.005 [well-being - difficulties] ↓SB/↑ SLP -.053 - -.001 [adiposity] 0 [diastolic blood pressure] .001 [HDL-cholesterol] -.018 [C-reactive protein] 0 [systolic blood pressure] -.001 [triglycerides] -.002 [insulin] .001 [cardiorespiratory fitness] -.008 [negative wellbeing]
Carson	2016	Cross-sectional	Canada	Children	4169	Accelerometer/ N/A	Accelerometer/ N/A	Interview/ N/A	high PA/low ST/high SLP [compared to those not meeting guidelines]	ß .04 - .36 [adiposity] .01 [systolic blood pressure] 0 [diastolic blood pressure] .09 [fasting triglycerides] -.07 [fasting HDL cholesterol] .31 [C-reactive protein] .19 [fasting insulin] -14.05 [cardiorespiratory fitness] .18 [socio-emotional problems]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Carson	2016	Cross-sectional	Canada	Children	4169	Accelerometer/ N/A	Accelerometer/ N/A	Interview/ N/A	specific movement behavior relative to all other movement behaviors	ß SB .029 - .111 [adiposity] .952 [systolic blood pressure] 2.7 [diastolic blood pressure] -.038 [HDL-cholesterol] .097 [C-reactive protein] -.018 [LDL-cholesterol] .015 [triglycerides] -.017 [plasma glucose] -.008 [insulin] MPA .01 - .054 [adiposity] -.454 [systolic blood pressure] -1.051 [diastolic blood pressure] -.035 [HDL-cholesterol] .055 [C-reactive protein] -.008 [LDL-cholesterol] .003 [triglycerides] -.012 [plasma glucose] -.048 [insulin] VPA -.206 - -.033 [adiposity] .689 [systolic blood pressure] 1.246 [diastolic blood pressure] .058 [HDL-cholesterol] -.153 [C-reactive protein] .015 [LDL-cholesterol] -.041 [triglycerides] .005 [plasma glucose] -.062 [insulin]
Carson	2017	Cross-sectional	Canada	Children	4157	Accelerometer/ dichotomized >=60 min/day	Interview/ dichotomized <=2 hours screen time/day	Interview dichotomized 9-11 hour/day (6-13 year olds) 8-10 hour/day (14-17 year olds)	“healthiest movers”	Odds ratios [adiposity] Males “active screenies” 1.09 [males] 1.37 [females] “unhealthiest movers” 1.12 [males] 1.49 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Carson	2017	Cross-sectional	Canada	Children	4157	Accelerometer/ dichotomized >=60 min/day	Interview/ dichotomized <=2 hours screen time/day	Interview dichotomized 9-11 hour/day (6-13 year olds) 8-10 hour/day (14-17 year olds)	N/A	ß [adiposity] low PA/high SB .01 high PA/high SB .03
Carson	2017	Cross-sectional	Canada	Children	4157	Accelerometer/ dichotomized >=60 min/day	Interview/ dichotomized <=2 hours screen time/day	Interview dichotomized 9-11 hour/day (6-13 year olds) 8-10 hour/day (14-17 year olds)	N/A	ß ↓SB/↑ MVPA -.035 - -.001 [adiposity] 0 [diastolic blood pressure] .001 [HDL-cholesterol] .006 [C-reactive protein] 0 [systolic blood pressure] .013 [triglycerides] -.001 [insulin] .001 [cardiorespiratory fitness] -.005 [well-being - difficulties] ↓SB/↑ SLP -.053 - -.001 [adiposity] 0 [diastolic blood pressure] .001 [HDL-cholesterol] -.018 [C-reactive protein] 0 [systolic blood pressure] -.001 [triglycerides] -.002 [insulin] .001 [cardiorespiratory fitness] -.008 [negative wellbeing]
Carson	2017	Cross-sectional	Canada	Children	4157	Accelerometer/ dichotomized >=60 min/day	Interview/ dichotomized <=2 hours screen time/day	Interview dichotomized 9-11 hour/day (6-13 year olds) 8-10 hour/day (14-17 year olds)	high PA/low ST/high SLP [compared to those not meeting guidelines]	ß .04 - .36 [adiposity] .01 [systolic blood pressure] 0 [diastolic blood pressure] .09 [fasting triglycerides] -.07 [fasting HDL cholesterol] .31 [C-reactive protein] .19 [fasting insulin] -14.05 [cardiorespiratory fitness] .18 [socio-emotional problems]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Carson	2017	Cross-sectional	Canada	Children	4157	Accelerometer/ dichotomized >=60 min/day	Interview/ dichotomized <=2 hours screen time/day	Interview dichotomized 9-11 hour/day (6-13 year olds) 8-10 hour/day (14-17 year olds)	specific movement behavior relative to all other movement behaviors	ß SB .029 - .111 [adiposity] .952 [systolic blood pressure] 2.7 [diastolic blood pressure] -.038 [HDL-cholesterol] .097 [C-reactive protein] -.018 [LDL-cholesterol] .015 [triglycerides] -.017 [plasma glucose] -.008 [insulin] MPA .01 - .054 [adiposity] -.454 [systolic blood pressure] -1.051 [diastolic blood pressure] -.035 [HDL-cholesterol] .055 [C-reactive protein] -.008 [LDL-cholesterol] .003 [triglycerides] -.012 [plasma glucose] -.048 [insulin] VPA -.206 - -.033 [adiposity] .689 [systolic blood pressure] 1.246 [diastolic blood pressure] .058 [HDL-cholesterol] -.153 [C-reactive protein] .015 [LDL-cholesterol] -.041 [triglycerides] .005 [plasma glucose] -.062 [insulin]
Carson	2019	Cross-sectional	United States	Children	2544	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	“healthiest movers”	Odds ratios [adiposity] Males “active screenies” 1.09 [males] 1.37 [females] “unhealthiest movers” 1.12 [males] 1.49 [females]
Carson	2019	Cross-sectional	United States	Children	2544	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	N/A	ß [adiposity] low PA/high SB .01 high PA/high SB .03

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Carson	2019	Cross-sectional	United States	Children	2544	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	N/A	ß ↓SB/↑ MVPA -.035 - -.001 [adiposity] 0 [diastolic blood pressure] .001 [HDL-cholesterol] .006 [C-reactive protein] 0 [systolic blood pressure] .013 [triglycerides] -.001 [insulin] .001 [cardiorespiratory fitness] -.005 [well-being - difficulties] ↓SB/↑ SLP -.053 - -.001 [adiposity] 0 [diastolic blood pressure] .001 [HDL-cholesterol] -.018 [C-reactive protein] 0 [systolic blood pressure] -.001 [triglycerides] -.002 [insulin] .001 [cardiorespiratory fitness] -.008 [negative wellbeing]
Carson	2019	Cross-sectional	United States	Children	2544	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	high PA/low ST/high SLP [compared to those not meeting guidelines]	ß .04 - .36 [adiposity] .01 [systolic blood pressure] 0 [diastolic blood pressure] .09 [fasting triglycerides] -.07 [fasting HDL cholesterol] .31 [C-reactive protein] .19 [fasting insulin] -14.05 [cardiorespiratory fitness] .18 [socio-emotional problems]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Carson	2019	Cross-sectional	United States	Children	2544	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	specific movement behavior relative to all other movement behaviors	ß SB .029 - .111 [adiposity] .952 [systolic blood pressure] 2.7 [diastolic blood pressure] -.038 [HDL-cholesterol] .097 [C-reactive protein] -.018 [LDL-cholesterol] .015 [triglycerides] -.017 [plasma glucose] -.008 [insulin] MPA .01 - .054 [adiposity] -.454 [systolic blood pressure] -1.051 [diastolic blood pressure] -.035 [HDL-cholesterol] .055 [C-reactive protein] -.008 [LDL-cholesterol] .003 [triglycerides] -.012 [plasma glucose] -.048 [insulin] VPA -.206 - -.033 [adiposity] .689 [systolic blood pressure] 1.246 [diastolic blood pressure] .058 [HDL-cholesterol] -.153 [C-reactive protein] .015 [LDL-cholesterol] -.041 [triglycerides] .005 [plasma glucose] -.062 [insulin]
Chaput	2013	Cross-sectional	Canada	Children	536	Accelerometer/ tertiles	Accelerometer/ tertiles	N/A	high PA/low SB/high SLP	Means [weight:height] high PA/low SB/high SLP .43 high PA/low SB/low SLP .44 low PA/high SB/high SLP .44 high PA/high SB/low SLP .46 low PA/low SB/high SLP .46 low PA/high SB/low SLP .47

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Chaput	2013	Cross-sectional	Canada	Children	536	Accelerometer/ tertiles	Accelerometer/ tertiles	N/A	N/A	Means low MVPA/high SB 71.3 cm [waist circumference] .89 mmol/L [fasting trigylcerides] 95 mm Hg [systolic blood pressure] 4.94 mmol/L [fasting glucose] 1.15 mmlol/L [HDL cholesterol] 50 mm Hg [diastolic blood pressure] low MVPA/low SB 69.6 cm [waist circumference] .94 mmol/L[fasting trigylcerides] 93 mm Hg [systolic blood pressure] 4.86 mmol/L [fasting glucose] 1.18 mmol/L[HDL cholesterol] 48 mm Hg[diastolic blood pressure] high MVPA/high SB 65.4 cm [waist circumference] .74 mmol/L [fasting trigylcerides] 92 mm Hg [systolic blood pressure] 4.97 mmol/L [fasting glucose] 1.23 mmol/L [HDL cholesterol] 47 mm Hg [diastolic blood pressure] high MVPA/low SB 62.7 cm [waist circumference] .74 mmol/L [fasting trigylcerides] 102 mm Hg [systolic blood pressure] 5.01 mmol/L [fasting glucose] 1.28 mmlol/L [HDL cholesterol] 47 mm Hg [diastolic blood pressure]
Chaput	2014	Cross-sectional	Canada	Children	507	Accelerometer/ tertiles	Accelerometer/ tertiles	Accelerometer/ tertiles	high PA/low SB/high SLP	Means [weight:height] high PA/low SB/high SLP .43 high PA/low SB/low SLP .44 low PA/high SB/high SLP .44 high PA/high SB/low SLP .46 low PA/low SB/high SLP .46 low PA/high SB/low SLP .47

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Chaput	2014	Cross-sectional	Canada	Children	507	Accelerometer/ tertiles	Accelerometer/ tertiles	Accelerometer/ tertiles	N/A	Means low MVPA/high SB 71.3 cm [waist circumference] .89 mmol/L [fasting trigylcerides] 95 mm Hg [systolic blood pressure] 4.94 mmol/L [fasting glucose] 1.15 mmlol/L [HDL cholesterol] 50 mm Hg [diastolic blood pressure] low MVPA/low SB 69.6 cm [waist circumference] .94 mmol/L[fasting trigylcerides] 93 mm Hg [systolic blood pressure] 4.86 mmol/L [fasting glucose] 1.18 mmol/L[HDL cholesterol] 48 mm Hg[diastolic blood pressure] high MVPA/high SB 65.4 cm [waist circumference] .74 mmol/L [fasting trigylcerides] 92 mm Hg [systolic blood pressure] 4.97 mmol/L [fasting glucose] 1.23 mmol/L [HDL cholesterol] 47 mm Hg [diastolic blood pressure] high MVPA/low SB 62.7 cm [waist circumference] .74 mmol/L [fasting trigylcerides] 102 mm Hg [systolic blood pressure] 5.01 mmol/L [fasting glucose] 1.28 mmlol/L [HDL cholesterol] 47 mm Hg [diastolic blood pressure]
Chen	2020	Cross-sectional	China	Adolescents, Children	114072	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day (6-13 year olds) 8-10 hour/day (14-17 year olds)	high PA/low ST/high SLP	Odds ratios high PA/low ST/low SLP .87 - .97 [male children] 1 - 1.02 [female children] 1.06 [male adolescents] 2.04 [female adolescents] high PA/high ST/high SLP .84 - 1. 14 [male children] 1.24 - 1.32 [female children] .59 [male adolescents] 1.98 [female adolescents] low PA/low ST/high SLP .96 - 1.06 [male children] 1.01 - 1.14 [female children] 98 [male adolescents] 1.78 [female adolescents]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Collings	2017	Cross-sectional	Finland	Children	410	Heart rate and movement sensor/ N/A	Heart rate and movement sensor/ N/A	N/A	N/A	ß ↓ SB/↑ MPA -2 - .016 [adiposity] .014 [cardiorespiratory fitness] ↓ SB/↑ VPA -13.1 - -.042 [adiposity] .098 [cardiorespiratory fitness]
Cristi-Montero	2019	Cross-sectional	Europe	Adolescents	548	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ median	N/A	N/A	Means low PA/high SB 53.0 mm [sum of 4 skinfolds] 3.11 [total cholesterol:HDL cholesterol] 73.9 mg/dL [triglycerides] 121 mmHg [systolic blood pressure] 2.48 [homeostasis model assessment] .822 [cardiometabolic risk score] 40.6 ml/kg/min [cardiorespiratory fitness] low PA/low SB 49.1 mm [sum of 4 skinfolds] 2.89 [total cholesterol:HDL cholesterol] 65.8 mg/dL [triglycerides] 121 mmHg [systolic blood pressure] 2.54 [homeostasis model assessment] .062 [cardiometabolic risk score] 40.6 ml/kg/min [cardiorespiratory fitness] high PA/low SB 50.1 mm [sum of 4 skinfolds] 2.9 [total cholesterol:HDL cholesterol] 61.6 mg/dL [triglycerides] 118 mmHg [systolic blood pressure] 2.13 [homeostasis model assessment] -.778 [cardiometabolic risk score] 42.6 ml/kg/min [cardiorespiratory fitness] high PA/high SB 49.8 mm [sum of 4 skinfolds] 2.85 [total cholesterol:HDL cholesterol] 66.0 mg/dL [triglycerides] 122 mmHg [systolic blood pressure] 2.11 [homeostasis model assessment] -.484 [cardiometabolic risk score] 43.8 ml/kg/min [cardiorespiratory fitness]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Crowe	2020	Cross-sectional	Canada	Adolescents	9913	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios [adiposity] low PA/high ST 1.71 low PA/low ST 1.54 high PA/high ST 1.27
Cureau	2017	Cross-sectional	Brazil	Adolescents	36956	Questionnaire/ min/week 0 1-299 300-599 >=600	Questionnaire/ hour screen time/day <=2 3–5 >=6	N/A	no PA/high ST	Odds ratios [cardiometabolic disease risk score] no PA/low ST .98 - .97 no PA/mod ST .61 - .86 low PA/high ST .7 - .85 low PA/mod ST .69 - .87 low PA/low ST .73 - .86 high PA/high ST .81 - .92 high PA/mod ST .61 - .79 high PA/low ST .45 - .74
da Silva	2019	Cross-sectional	Brazil	Adolescents	1152	Questionnaire/ dichotomized >=300 min/week	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	low PA/high ST	Odds ratios [high Vitamin D concentrations] Males low PA/low ST 1.23 [males] .96 [females] high PA/high ST 2.08 [males] .76 [females] high PA/low ST 2.11 [males] 1.47 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Dalene	2017	Cross-sectional, Longitudinal	Norway	Adolescents, Children	5897	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß [adiposity] ↓ SB/↑ MPA .03 - .06 [male children] -.47 - -.18 [female children] .02 - .06 [adolescents] ↓ SB/↑ VPA -.79 - -.32 [male children] -.21 - -.15 [female children] -1.08 - -.56 [adolescents]
De Bourdeaudhuij	2013	Cross-sectional	Belgium, Greece, Hungary, the Netherlands, and Switzerland	Children	766	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	N/A	Means [BMI] low PA/high SB 20.5 kg/m2 [males] 19.1 kg/m2 [females] high PA/low SB 17.6 kg/m2 [males] 17.7 kg/m2 [females] low PA/low SB 19.7 kg/m2 [males] 18.8 kg/m2 [females] mod-high PA/mod-high SB 18.5 kg/m2 [males] 19.1 kgm/m2 [females]
de Moraes[2]	2013	Cross-sectional	Brazil, Sweden, Greece, Italy, Spain, Hungary, Belgium, France, Germany, Austria	Adolescents	3308, 991	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ tertiles, hour/day 0–2 >2–4 >=4	N/A	low PA/high SB	ß [systolic blood presure] high PA/high SB -2.47 - .58 [males] -2.79 - 3.61 [females] high PA/mod SB -2.19 - .8 [males] -5.95 - -.45 [females] high PA/low SB -6.77 - .05 [males] -1.37 - .72 [females] low PA/mod SB -2.16 - 5.62 [males] -3.09 - .22 [females] low PA/high SB -3.49 - 2.17 [males] -4.95 - -.35 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
del Pozo-Cruz	2017	Cross-sectional	New Zealand	Children	1812	Accelerometer/ N/A	Accelerometer/ N/A	Questionnaire/ N/A	increase PA/ maintain low ST	ß maintain low PA/ maintain low ST -1.95 - -.84 [health-related quality of life] -.03 - .46 [socio-emotional problems] maintain PA/ increase ST -3.19 - -.58 [health-related quality of life] .14 - .74 [socio-emotional problems]
del Pozo-Cruz	2017	Cross-sectional	New Zealand	Children	1812	Accelerometer/ N/A	Accelerometer/ N/A	Questionnaire/ N/A	N/A	ß [adiposity] ↓ SB/↑ MVPA -1.429 - -1.255 ↓ SB/↑ SLP -.575 - -.129
del Pozo-Cruz	2019	Longitudinal	Australia	Children	3979	Time-use diary/ study-specific	Time-use diary/ study-specific	N/A	increase PA/ maintain low ST	ß maintain low PA/ maintain low ST -1.95 - -.84 [health-related quality of life] -.03 - .46 [socio-emotional problems] maintain PA/ increase ST -3.19 - -.58 [health-related quality of life] .14 - .74 [socio-emotional problems]
del Pozo-Cruz	2019	Longitudinal	Australia	Children	3979	Time-use diary/ study-specific	Time-use diary/ study-specific	N/A	N/A	ß [adiposity] ↓ SB/↑ MVPA -1.429 - -1.255 ↓ SB/↑ SLP -.575 - -.129
Djalalinia	2017	Cross-sectional	Iran	Children	23183	Questionnaire/ paq-a score 1-1.9 2-3.9 4-5	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios [adiposity] high PA/high ST .98 - 1.18 low PA/low ST .99 - 1.25 low PA/high ST 1.1 - 1.17
Dollman	2004	Cross-sectional	Australia	Children	823	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	"sporties"	p-value Males "technoactivies" [higher adiposity] .01 Females "screenies" [lower cardiorespiratory fitness] .02

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Dollman	2004	Cross-sectional	Australia	Children	823	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	N/A	Means [BMI] "sporties" 10.71 km/h [males] 10.51 km/h [females] "technoactives" 11.0 km/h [males] 10.57 km/h [females] "screenies" 10.59 km/h [males] 10.1 km/h [females]
Dollman	2006	Cross-sectional	Australia	Children	843	Time-use diary/ dichotomized >=60 min/day	Time-use diary/ dichotomized <=2 hours screen time/day	N/A	"sporties"	p-value Males "technoactivies" [higher adiposity] .01 Females "screenies" [lower cardiorespiratory fitness] .02
Dollman	2006	Cross-sectional	Australia	Children	843	Time-use diary/ dichotomized >=60 min/day	Time-use diary/ dichotomized <=2 hours screen time/day	N/A	N/A	Means [BMI] "sporties" 10.71 km/h [males] 10.51 km/h [females] "technoactives" 11.0 km/h [males] 10.57 km/h [females] "screenies" 10.59 km/h [males] 10.1 km/h [females]
Dowd	2016	Cross-sectional	Ireland	Adolescents	195	Accelerometer/ % total day	Accelerometer/ % total day	N/A	N/A	Median [BMI percentile] "Low activity profile" 75 "Moderate activity profie" 69 "High activity profiles" 63.5

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Drenowatz	2014	Cross-sectional	Germany	Children	1594	Questionnaire/ tertiles	Questionnaire/ dichotomized <=1 hours screen time/day	N/A	N/A	Means [BMI percentile] low PA/high ST 54.6% low PA/low ST 46.4% mod PA/high ST 51.9% mod PA/low ST 45.9% high PA/high ST 49.4% high PA/low ST 43.4%
Dumuid	2017	Cross-sectional	Australia	Children	284	Accelerometer/ study-specific	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	Means [standarized test scores] “junk food screenies” 470 - 491 “all-rounders” 487 - 516 “actives” 476 - 502
Dumuid	2017	Cross-sectional	Australia	Children	284	Accelerometer/ study-specific	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	ß [adiposity] ↓SB/↑ MVPA -2.15 - -1.54 ↓SB/↑ SLP -.55 - -.2
Dumuid	2017	Cross-sectional	Australia	Children	284	Accelerometer/ study-specific	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	ß ↓ SB/↑ remaining behaviors -.1 [% fat mass] .2 [% fat free mass] ↓ SB/↑ MVPA -.8 - -.4 [% fat mass] 1.2 [% fat free mass] ↓ SB/↑ SLP -.1 [% fat mass] .2 [% fat free mass]
Dumuid	2018	Cross-sectional	Australia, Canada, United Kingdom, Finland	Children	1728	Accelerometer/ N/A	Accelerometer/ N/A	Accelerometer/ N/A	N/A	Means [standarized test scores] “junk food screenies” 470 - 491 “all-rounders” 487 - 516 “actives” 476 - 502

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Dumuid	2018	Cross-sectional	Australia, Canada, United Kingdom, Finland	Children	1728	Accelerometer/ N/A	Accelerometer/ N/A	Accelerometer/ N/A	N/A	ß [adiposity] ↓SB/↑ MVPA -2.15 - -1.54 ↓SB/↑ SLP -.55 - -.2
Dumuid	2018	Cross-sectional	Australia, Canada, United Kingdom, Finland	Children	1728	Accelerometer/ N/A	Accelerometer/ N/A	Accelerometer/ N/A	N/A	ß ↓ SB/↑ remaining behaviors -.1 [% fat mass] .2 [% fat free mass] ↓ SB/↑ MVPA -.8 - -.4 [% fat mass] 1.2 [% fat free mass] ↓ SB/↑ SLP -.1 [% fat mass] .2 [% fat free mass]
Dumuid	2019	Cross-sectional	Australia	Children	938	Accelerometer/ N/A	Accelerometer/ N/A	Accelerometer/ N/A	N/A	Means [standarized test scores] “junk food screenies” 470 - 491 “all-rounders” 487 - 516 “actives” 476 - 502
Dumuid	2019	Cross-sectional	Australia	Children	938	Accelerometer/ N/A	Accelerometer/ N/A	Accelerometer/ N/A	N/A	ß [adiposity] ↓SB/↑ MVPA -2.15 - -1.54 ↓SB/↑ SLP -.55 - -.2
Dumuid	2019	Cross-sectional	Australia	Children	938	Accelerometer/ N/A	Accelerometer/ N/A	Accelerometer/ N/A	N/A	ß ↓ SB/↑ remaining behaviors -.1 [% fat mass] .2 [% fat free mass] ↓ SB/↑ MVPA -.8 - -.4 [% fat mass] 1.2 [% fat free mass] ↓ SB/↑ SLP -.1 [% fat mass] .2 [% fat free mass]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Eisenmann	2008	Cross-sectional	United States	Adolescents	12464	Questionnaire/ bouts/week (>=30 min) <2 3-5 6-7	Questionnaire/ hours screen time/day <1 2-3 >4	N/A	high PA/low ST	Odds ratios [adiposity] mod PA/low ST .94 - 1.04 [males] .6 - .9 [females] low PA/low ST .87 - 1.08 [males] 1.02 - 1.48 [females] high PA/mod ST 1.02 - 1.33 [males] 1.24 - 1.28 [females] mod PA/mod ST 1.09 - 1.2 [males] 1.48 - 1.67 [females] low PA/mod ST .95 - 1.19 [males] 1.25 - 2.09 [females] high PA/high ST 1.22 - 1.24 [males] 1.27 - 1.39 [females] mod PA/high ST 1.32 - 1.34 [males] 1.7 - 2.28 [females] low PA/high ST 1.22 - 1.49 [males] 2.03 - 3.11 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Ekelund	2012	Meta-analysis	Australia, Brazil, Europe, United States	Both	6413	Accelerometer/ tertiles	Accelerometer/ tertiles	N/A	N/A	Means low PA/low SB 70.4 cm [waist circumference] 106.2 mmHg [systolic blood pressure] 8.0 μIU/mL [fasting insulin] 74.1 mg/dL [fasting triglycerides] 53.5 mg/dL [HDL cholesterol] high PA/low SB 64.8 cm [waist circumference] 103.7 mmHg [systolic blood pressure] 5.1 μIU/mL [fasting insulin] 58.3 mg/dL [fasting triglycerides] 57.8 mg/dL [HDL cholesterol] low PA/high SB 69.1 cm [waist circumference] 57.8 mg/dL [systolic blood pressure] 5.7 μIU/mL [fasting insulin] 68.3 mg/dL [fasting triglycerides] 55.9 mg/dL [HDL cholesterol] high PA/high SB 65 cm [waist circumference] 104.6 mmHg [systolic blood pressure] 3.4 μIU/mL [fasting insulin] 58.9 mg/dL [fasting triglycerides] 58.5 mg/dL [HDL cholesterol]
Fairclough	2017	Cross-sectional	England	Children	169	Accelerometer/ N/A	Accelerometer/ N/A	Accelerometer/ N/A	N/A	isometric log-ratio ↓SB/↑ MVPA -.11 - -.08 [adiposity] .57 - 1.95 [cardiorespiratory fitness] -1.11 - -.29 [health-related quality of life]
Fairclough	2017	Cross-sectional	England	Children	169	Accelerometer/ N/A	Accelerometer/ N/A	Accelerometer/ N/A	N/A	isometric log-ratio ↓ MVPA/↑ SB -3.6 - 10.7 [adiposity] ↓ SB/↑ MVPA 1.3 [cardiorespiratory fitness] ↓ SB/↑ SLP .05 - .1 [adiposity] 0 [cardiorespiratory fitness]
Fairclough	2018	Cross-sectional	United Kingdom	Children	243	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	isometric log-ratio ↓SB/↑ MVPA -.11 - -.08 [adiposity] .57 - 1.95 [cardiorespiratory fitness] -1.11 - -.29 [health-related quality of life]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Fairclough	2018	Cross-sectional	United Kingdom	Children	243	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	isometric log-ratio ↓ MVPA/↑ SB -3.6 - 10.7 [adiposity] ↓ SB/↑ MVPA 1.3 [cardiorespiratory fitness] ↓ SB/↑ SLP .05 - .1 [adiposity] 0 [cardiorespiratory fitness]
Faria	2020	Cross-sectional	Brazil	Adolescents	217	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	N/A	Median high PA/low SB 21.4 [BMI] 105.5 mmHg [systolic blood pressure] 56 mmHg [diastolic blood pressure] 4.0 [common mental disorders score] low PA/low SB 21.1 [BMI] 102.5 mmHg [systolic blood pressure] 57.2 mmHg [diastolic blood pressure] 6.0 [common mental disorders score] low PA/high SB 20.4 [BMI] 104.2 mmHg [systolic blood pressure] 59.5 mmHg [diastolic blood pressure] 6.0 [common mental disorders score]
Gaba	2020	Cross-sectional	Czech Republic	Children	425	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß [adiposity] ↓SB/↑ MVPA -11.9 - 17.7
Garcia-Hermoso	2017	Cross-sectional	Chile	Children	395	Questionnaire/ dichotomized >=2.17 (boys paq-a score) >=1.97 (girls (paq-a score)	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios [academic performance] low PA/high ST .26 - .5 [males] .23 - .49 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Garcia-Hermoso	2017	Cross-sectional	Chile	Children	395	Questionnaire/ dichotomized >=2.17 (boys paq-a score) >=1.97 (girls (paq-a score)	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	N/A	Means high PA/low ST 8.57 [life satisfcation] 4.49 [positive affect] 1.84 [negative affect] high PA/low ST 8.3 [life satisfcation] 4.44 [positive affect] 2.09 [negative affect] low PA/low ST 7.89 [life satisfcation] 4.21 [positive affect] 1.85 [negative affect] high PA/high ST 7.9 [life satisfcation] 4.14 [positive affect] 2.06 [negative affect]
Garcia-Hermoso	2020	Cross-sectional	Chile	Children	1540	Questionnaire/ study-specific	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios [academic performance] low PA/high ST .26 - .5 [males] .23 - .49 [females]
Garcia-Hermoso	2020	Cross-sectional	Chile	Children	1540	Questionnaire/ study-specific	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	N/A	Means high PA/low ST 8.57 [life satisfcation] 4.49 [positive affect] 1.84 [negative affect] high PA/low ST 8.3 [life satisfcation] 4.44 [positive affect] 2.09 [negative affect] low PA/low ST 7.89 [life satisfcation] 4.21 [positive affect] 1.85 [negative affect] high PA/high ST 7.9 [life satisfcation] 4.14 [positive affect] 2.06 [negative affect]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Gillis	2019	Cross-sectional	United States	Adolescents	235	Questionnaire/ study-specific	N/A	Octagonal basic motionloggers/ study-specific	N/A	Means [internalizing symptoms] low PA/low SLP 56.52 low PA/high SLP 50.58 high PA/low SLP 48.0 high PA/high SLP 47.87
Gordon-Larsen	2002	Longitudinal	United States	Adolescents	12759	Questionnaire/ bouts/week low =1 high=7	Questionnaire/ hours screen time/week low <7 high >35	N/A	N/A	Predicted probability [overweight] low PA/high ST 8 - 27.8 [males] 5.2 - 21.5 [females] high PA/low ST 9.1 - 12.3 [males] 3.4 - 12.3 [females]
Guan	2020	Cross-sectional	China	Children	254	Accelerometer/ dichotomized >=3 h/day total pa & >= 1 h/day mVPA	Questionnaire/ dichotomized <=1 hour screen time/day	Accelerometer/ dichotomized 10-13 hour/day	low PA/high ST/low SLP	Odds ratios [adiposity] high PA/low ST/low SLP 1.19 high PA/high ST/high SLP .56 low PA/low ST/high SLP .96 high PA/low ST/high SLP .61
Guerrero	2019	Cross-sectional	United States	Children	4524	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day	N/A	ß high PA/low ST/low SLP -.06 - .01 [impulsivity] .0 - 09 [perseverance and drive] high PA/high ST/high SLP -.04 - .74 [impulsivity] .04 - .07 [perseverance and drive] low PA/low ST/high SLP -.15 - .81 [impulsivity] -.1 - .1 [perseverance and drive] high PA/low ST/high SLP -.11 - .74 [impulsivity] -.02 - .12 [perseverance and drive]
Haapala	2017	Cross-sectional	Finland	Children	153	Heart rate and movement sensor/ median	Heart rate and movement sensor/ median	N/A	low PA/high SB [compared to all other combinations]	Mean difference [academic performance] -10.6 - -1.3

First Author	Year	Study Design	Country	Population¹	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Hamer	2009	Cross-sectional	Scotland	Children	1486	Questionnaire/ bouts/week (>15 min) < 6 7-9 >=10	Questionnaire/ study-specific	N/A	low PA/high ST	ß [socio-emotional problems] mod PA/high ST -1.45 high PA/high ST -2.74 low PA/mod ST -1.81 mod PA/mod ST -2.24 high PA/mod ST -2.72 low PA/low ST -2.63 mod PA/low ST -2.59 high PA/low ST -2.19
Hansen	2018	Cross-sectional	Australia, Europe, United States	Adolescents, Children	18200	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß ↓ SB/↑ MVPA Children -.587 - -.287 [adiposity] -.097 - -.084 [systolic blood pressure] .006 [HDL-cholesterol] -.022 - -.012 [LDL cholesterol] -.019 - -.006 [triglycerides] -.85 - -.77 [insulin] -.016 - -.006 [glucose] Adolescents -.0814 [adiposity] -.24 [systolic blood pressure] 0 [HDL-cholesterol] .003 [LDL cholesterol] -.007 [triglycerides] -.092 [insulin] -.015 [glucose]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Herman	2012	Cross-sectional	Canada	Children	537	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST high PA/low SB	Odds ratios [adiposity] high PA/high ST 3.24 - 7.14 high PA/high SB .65 - 2.39 low PA/low ST 2.17 - 7.57 low PA/low SB .93 - 5.36 low PA/high ST 1.73 - 12.62 low PA/high SB 1.14 - 7.57
Herman	2012	Cross-sectional	Canada	Children	537	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ dichotomized <=2 hours screen time/day	N/A	N/A	Prevalence [overweight] high PA/low ST 5.1% high PA/low SB 20.5% high PA/high ST 18.1% high PA/high SB 4.2% low PA/low ST 31.2% low PA/low SBA 38.1% low PA/high ST 45.6% low PA/high SB 37.2%
Herman	2012	Cross-sectional	Canada	Children	537	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios [adiposity] low PA/high ST 5.7 low PA/low ST 4.0 high PA/high ST 4.4

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Herman	2014	Cross-sectional	Canada	Children	534	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ tertiles, Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST high PA/low SB	Odds ratios [adiposity] high PA/high ST 3.24 - 7.14 high PA/high SB .65 - 2.39 low PA/low ST 2.17 - 7.57 low PA/low SB .93 - 5.36 low PA/high ST 1.73 - 12.62 low PA/high SB 1.14 - 7.57
Herman	2014	Cross-sectional	Canada	Children	534	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ tertiles, Questionnaire/ dichotomized <=2 hours screen time/day	N/A	N/A	Prevalence [overweight] high PA/low ST 5.1% high PA/low SB 20.5% high PA/high ST 18.1% high PA/high SB 4.2% low PA/low ST 31.2% low PA/low SBA 38.1% low PA/high ST 45.6% low PA/high SB 37.2%
Herman	2014	Cross-sectional	Canada	Children	534	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ tertiles, Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios [adiposity] low PA/high ST 5.7 low PA/low ST 4.0 high PA/high ST 4.4

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Herman	2015	Cross-sectional	Canada	Children	520	Accelerometer/ dichotomized >=60 min/day, tertiles	Accelerometer/ dichotomized <=2 hours screen time/day, tertiles	N/A	high PA/low ST high PA/low SB	Odds ratios [adiposity] high PA/high ST 3.24 - 7.14 high PA/high SB .65 - 2.39 low PA/low ST 2.17 - 7.57 low PA/low SB .93 - 5.36 low PA/high ST 1.73 - 12.62 low PA/high SB 1.14 - 7.57
Herman	2015	Cross-sectional	Canada	Children	520	Accelerometer/ dichotomized >=60 min/day, tertiles	Accelerometer/ dichotomized <=2 hours screen time/day, tertiles	N/A	N/A	Prevalence [overweight] high PA/low ST 5.1% high PA/low SB 20.5% high PA/high ST 18.1% high PA/high SB 4.2% low PA/low ST 31.2% low PA/low SBA 38.1% low PA/high ST 45.6% low PA/high SB 37.2%
Herman	2015	Cross-sectional	Canada	Children	520	Accelerometer/ dichotomized >=60 min/day, tertiles	Accelerometer/ dichotomized <=2 hours screen time/day, tertiles	N/A	high PA/low ST	Odds ratios [adiposity] low PA/high ST 5.7 low PA/low ST 4.0 high PA/high ST 4.4

First Author	Year	Study Design	Country	Population¹	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Heshmat	2016	Cross-sectional	Iran	Adolescents	5625	Questionnaire/ bouts/week (>30 min) 0-2 3-7	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios high PA/high ST 1.13 - 1.57 [adiposity] .896 - .956 [cholesterol] 1.063 - 1.127 [fasting glucose] .737 - .991 [metabolic syndrome] 1.243 - 1.583 [LDL-cholesterol] .709 - .766 [HDL-cholesterol] 1.048 - 1.208 [systolic blood pressure] .586 - .952 [triglycerides] low PA/low ST 1.07 - 1.29 [adiposity] .487 - .5 [cholesterol] .828 - .913 [fasting glucose] 1.41 - 1.599 [metabolic syndrome] 1.067 - 1.2 [LDL-cholesterol] 1.187 - 1.219 [HDL-cholesterol] .906 - 1.063 [systolic blood pressure] .811 - .867 [triglycerides] low PA/high ST 1.81 - 1.77 [adiposity] .598 - .647 [cholesterol] .912 - .971 [fasting glucose] 1.536 - 1.571 [metabolic syndrome] 1.645 - 1.991 [LDL-cholesterol] 1.297 - 1.4 [HDL-cholesterol] .897 - .991 [systolic blood pressure] .984 - 1.157 [triglycerides]
Hjorth	2014a	Cross-sectional	Denmark	Children	785	Accelerometer/ quartiles	Accelerometer/ quartiles	Accelerometer, questionnaire/ quartiles	increase PA/ decrease SB/ increase SLP	ß [MetS-score] decrease PA/ increase SB/ decrease SLP 3.31
Hjorth	2014a	Cross-sectional	Denmark	Children	785	Accelerometer/ quartiles	Accelerometer/ quartiles	Accelerometer, questionnaire/ quartiles	high PA/low ST/high SLP high PA/low SB/high SLP	ß [adiposity] low PA/high ST/low SLP 1.52 low PA/high SB/low SLP 2.39
Hjorth	2014b	Longitudinal	Denmark	Children	632	Accelerometer/ tertiles	Accelerometer, questionnaire/ tertiles	Accelerometer/ tertiles	increase PA/ decrease SB/ increase SLP	ß [MetS-score] decrease PA/ increase SB/ decrease SLP 3.31

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Hjorth	2014b	Longitudinal	Denmark	Children	632	Accelerometer/ tertiles	Accelerometer, questionnaire/ tertiles	Accelerometer/ tertiles	high PA/low ST/high SLP high PA/low SB/high SLP	ß [adiposity] low PA/high ST/low SLP 1.52 low PA/high SB/low SLP 2.39
Hormazabal-Aguayo	2019	Cross-sectional	Chile	Children	1540	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ 1-hour screen time increments	N/A	N/A	p-value high PA/high ST, high PA/low ST > low PA/high ST, low PA/low ST [positive affect] .001 low PA/high ST, low PA/low ST> high PA/high ST, high PA/low ST [negative affect] .017
Hrafnkelsdottir	2018	Cross-sectional	Iceland	Adolescents	244	Questionnaire/ dichotomzed >=4 x 15 m VPA/weekk	Questionnaire/ median (screen time)	N/A	low PA/high ST	Odds ratios [poor mental health] low PA/low ST .26 - 1.25 high PA/high ST .55 - 1.78 high PA/low ST .06 - .57
Huang	2016	Cross-sectional	Hong Kong	Children	1020	Accelerometer/ N/A	Questionnaire/ N/A	Questionnaire/ N/A	N/A	ß ↓ SB/↑ MVPA -.3 ↓ SB/↑ SLP .09
Ishii	2020	Longitudinal	Japan	Children	261	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	low PA/high ST	Odds ratios low PA/low ST 2.1 [males] 1.84 [females] high PA/high ST .61 [males] 1.59 [females] high PA/low ST 4.12 [males] 1.86 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Jakubec	2020	Cross-sectional	Czech Republic	Adolescents, Children	679	Accelerometer/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Accelerometer/ dichotomized 9-11 hour/day	low PA/high ST/low SLP	Odds ratios [adiposity] high PA/low ST/low SLP .42 - .84 [children] .22 - .59 [adolescents] high PA/high ST/high SLP .54 - 1.16 [children] 1.56 - 2.15 [adolescents] low PA/low ST/high SLP .32 - 1.13 [children] .11 - .42 [adolescents] high PA/low ST/high SLP .26 - .34 [children] .62 - 1.2 [adolescents]
Janssen	2017	Cross-sectional	Canada	Both	29206	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day (6-13 year olds) 8-10 hour/day (14-17 year olds)	N/A	Means [z-scores] high PA/high ST/high SLP -.19 [adiposity] .03 - .3 [socio-emotional problems] -.42 [well-being] low PA/low ST/high SLP .12 [adiposity] -.05 - .26 [socio-emotional problems] -.45 [well-being] high PA/low ST/low SLP .17 [adiposity] .08 - .31 [socio-emotional problems] -.53 [well-being] high PA/low ST/high SLP -.26 [adiposity] .08 - .1 [socio-emotional problems] -.29 [well-being]
Jones	2019	Cross-sectional	Norway	Children	880	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß ↓SB/↑ MVPA -1.04 - - .09 [adiposity] 1.87 - 3.57 [cardiorespiratory fitness]
Jones	2019	Cross-sectional	Norway	Children	880	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß ↓ SB/↑ MVPA -.213 - .194 [non-HDL cholesterol] -.099 - .174 [HDL-cholesterol]
Jones	2020	Cross-sectional	New Zealand	Children	443	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß ↓SB/↑ MVPA -1.04 - - .09 [adiposity] 1.87 - 3.57 [cardiorespiratory fitness]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Jones	2020	Cross-sectional	New Zealand	Children	443	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß ↓ SB/↑ MVPA -.213 - .194 [non-HDL cholesterol] -.099 - .174 [HDL-cholesterol]
Kantomaa	2016	Cross-sectional	Finland	Adolescents	8061	Questionnaire/ tertiles	Questionnaire/ hour/day <1 1-2 >2 hour/day	Questionnaire/ hour/day <8 8 >8 hour/day	"sedentary TV viewers"	Odds ratios [academic performance] "generally inactive" 1.02 "moderately active readers" 1.81 "active sports clubbers" 1.98 "generally active" 2.02
Katzmarzyk	2015	Cross-sectional	Australia, Brazil, Canada, China, Colombia, Finland, India, Kenya, Portugal, South Africa, United Kingdom, United States	Children	6539	Accelerometer/ tertiles	Accelerometer, questionnaire/ tertiles	N/A	N/A	Means [BMI z-score] low PA/low SB 1.15 [males] .91 [females] mod PA/low SB .75 [males] .52 [females] high PA/low SB .24 [males] .09 [females] low PA/mod SB .99 [males] .69 [females] mod PA/mod SB .52 [males] .46 [females] high PA/mod SB .19 [males] .21 [females] low PA/high SB .77 [males] .48 [females] mod PA/high SB .38 [males] .34 [females] high PA/high SB .2 [males] .2 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Keane	2017	Cross-sectional	Ireland	Both	10474	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios [poor well-being] low PA/low ST .92 - 1.28 high PA/high ST 1.29 - 1.78 low PA/high ST 1.16 - 1.61
Khan	2018	Cross-sectional	Bangladesh	Adolescents	671	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios [socio-emotional problems] high PA/high ST .83 low PA/low ST 1.56 low PA/high ST 1.61
Kidokoro	2019	Cross-sectional	Japan, Hong Kong, China, Taiwan, Thailand, Malaysia, South Korea, Singapore	Children	9553	Questionnaire/ min/day < 30 30-60 60-90 >=90	Questionnaire/ hours screen time/day <1 1-2 2-3 >=3	N/A	N/A	Means [PACER z-score] low PA/high ST -.32 - .02 [males] -.26 - -.04 [females] low PA/low ST -.27 - -.03 [males] -.14 - .1 [females] high PA/high ST .1 - .46 [males] .11 - .77 [females] high PA/low ST .12 - .6 [males] .19 - .69 [females]
Kim	2016	Cross-sectional	United States	Adolescents	12081	Questionnaire/ study-specific	Questionnaire/ study-specific	N/A	high PA/low ST	Odds ratios [adiposity] high PA/high ST 2.7 low PA/high ST 4.7 low PA/low ST 2.1

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Lacy	2012	Cross-sectional	Australia	Adolescents	2995	Questionnaire/ dichotomized active every school day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	low PA/high ST	ß [health-related quality of life] high PA/high ST 3.3 [males] 3.83 [females] low PA/low ST 3.19 [males] 3.68 [females] high PA/low ST 6.63 [males] 7.58 [females]
Lane	2014	Cross-sectional	Ireland	Children	7035	Questionnaire/ bouts/week 0-8 >=9	Questionnaire/ dichotomized <=3 hours screen time/day	N/A	high PA/low ST	Odds ratios [adiposity] low PA/low ST 1.38 high PA/high ST 1.63 low PA/high ST 2.07
Laurson	2008	Cross-sectional	United States	Children	709	Pedometer/ step recommendation 13000 (boys) 11000 (girls)	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios [adiposity] low PA/high ST 2.6 [males] 2.56 [females] high PA/high ST 1.59 [males] 1.32 [females] low PA/high ST 4.39 [males] 3.0 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Laurson	2008	Cross-sectional	United States	Children	709	Pedometer/ step recommendation 13000 (boys) 11000 (girls)	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST/high SLP	Odds ratios [adiposity] high PA/low ST/low SLP 1.5 [males] 1.1 [females] high PA/high ST/high SLP 1.8 [males] 1.5 [females] high PA/high ST/low SLP 1.6 [males] 2.2 [females] low PA/low ST/high SLP 2.3 [males] 2.2 [females] low PA/low ST/low SLP 1.9 [males] 2.5 [females] low PA/high ST/high SLP 3.3 [males] 2.6 [females] low PA/high ST/low SLP 4.0 [males] 3.8 [females]
Laurson	2015	Cross-sectional	United States	Adolescents	9589	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized >=8 hour/day	high PA/low ST	Odds ratios [adiposity] low PA/high ST 2.6 [males] 2.56 [females] high PA/high ST 1.59 [males] 1.32 [females] low PA/high ST 4.39 [males] 3.0 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Laurson	2015	Cross-sectional	United States	Adolescents	9589	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized >=8 hour/day	high PA/low ST/high SLP	Odds ratios [adiposity] high PA/low ST/low SLP 1.5 [males] 1.1 [females] high PA/high ST/high SLP 1.8 [males] 1.5 [females] high PA/high ST/low SLP 1.6 [males] 2.2 [females] low PA/low ST/high SLP 2.3 [males] 2.2 [females] low PA/low ST/low SLP 1.9 [males] 2.5 [females] low PA/high ST/high SLP 3.3 [males] 2.6 [females] low PA/high ST/low SLP 4.0 [males] 3.8 [females]
Lee	2014	Longitudinal	United States	Adolescents	3717	Questionnaire, interview/ study-specific	Questionnaire, interview/ study-specific (screen time)	N/A	low PA/low ST	Mean differences [adiposity] high PA/low ST -.56 - -.53 low PA/high ST .46 - .51 Odds ratios [diabetes diagnosis] high PA/low ST .87 low PA/high ST 1.69
Lee	2014	Longitudinal	United States	Adolescents	3717	Questionnaire, interview/ study-specific	Questionnaire, interview/ study-specific (screen time)	N/A	those who do no meet all guidelines	Odds ratios [well-being] high PA/low ST/high SLP 1.29 - 1.46

First Author	Year	Study Design	Country	Population¹	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Lee	2018	Cross-sectional	South Korea	Adolescents	50987	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day (6-13 year olds) 8-10 hour/day (14-17 year olds)	low PA/low ST	Mean differences [adiposity] high PA/low ST -.56 - -.53 low PA/high ST .46 - .51 Odds ratios [diabetes diagnosis] high PA/low ST .87 low PA/high ST 1.69
Lee	2018	Cross-sectional	South Korea	Adolescents	50987	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day (6-13 year olds) 8-10 hour/day (14-17 year olds)	those who do no meet all guidelines	Odds ratios [well-being] high PA/low ST/high SLP 1.29 - 1.46
Lien	2020	Cross-sectional	Canada	Adolescents, Children	10160	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day (6-13 year olds) 8-10 hour/day (14-17 year olds)	N/A	ß [academic performance] high PA/low ST/low SLP -.005 - .017 high PA/high ST/high SLP -.002 - .042 low PA/low ST/high SLP .022 - .028 high PA/low ST/high SLP .038 - .077
Liu	2019	Cross-sectional	China	Adolescents	13163	Questionnaire/ bouts/week 0 1-3 >3	Questionnaire/ hour screen time/day 0 <1 1-2 >=2	N/A	N/A	Means Males high PA/low ST 16.64 [depression] 32.98 [anxiety] 7.7 [physical symptoms] 9.25 [social anxiety] 10.15 [harm avoidance] 5.96 [separation anxiety] 6.08 [self-injurious behavior] low PA/low ST 16.4 [depression] 32.75 [anxiety] 7.6 [physical symptoms] 9.06 [social anxiety] 10.1 [harm avoidance] 6.04 [separation anxiety]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
										6.0 [self-injurious behavior] low PA/high ST 19.18 [depression] 36.61 [anxiety] 9.52 [physical symptoms] 9.72 [social anxiety] 10.03 [harm avoidance] 7.14 [separation anxiety] 6.62 [self-injurious behavior] low PA/mod ST 17.37 [depression] 35.27 [anxiety] 8.71 [physical symptoms] 9.58 [social anxiety] 10.16 [harm avoidance] 6.86 [separation anxiety] 6.45 [self-injurious behavior] Females high PA/low ST 17.43 [depression] 40.42 [anxiety] 9.34 [physical symptoms] 11.12 [social anxiety] 11.8 [harm avoidance] 8.23 [separation anxiety] 6.36 [self-injurious behavior] low PA/low ST 18.22 [depression] 41.21 [anxiety] 9.87 [physical symptoms] 11.3 [social anxiety] 11.8 [harm avoidance] 8.84 [separation anxiety] 6.52 [self-injurious behavior] low PA/high ST 20.69 [depression] 42.5 [anxiety] 10.74 [physical symptoms] 11.95 [social anxiety] 11.75 [harm avoidance] 8.58 [separation anxiety] 7.41 [self-injurious behavior] low PA/mod ST 18.66 [depression] 39.23 [anxiety] 9.56 [physical symptoms] 10.73 [social anxiety]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
										10.89 [harm avoidance] 8.15 [separation anxiety] 6.61 [self-injurious behavior]
Loprinzi	2015	Cross-sectional	United States	Adolescents, Children	2856	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ sedentary behavior >/< light physical activity	N/A	low PA/high SB	ß [adiposity] ↓ SB/↑ PA -7.33 - -1.2 Children high PA/low SB -9.3 - -2.2 [children] -3.7 - .2 [adolescents] high PA/high SB -7.2 - -1.8 [children] -.2 - 1.1 [adolescents] low PA/low SB -3.7 - -.7 [children] -.65 - .1 [adolescents]
Maher	2012	Cross-sectional	Australia	Children	2200	Time-use diary/ dichotomized >=60 min/day	Time-use diary/ dichotomized <=120 m screen time/day	N/A	N/A	Means [standarized test scores] high PA/low SB 485 low PA/low SB 471 low PA/high SB 502 high PA/high SB 504
Maher	2012	Cross-sectional	Australia	Children	2200	Time-use diary/ dichotomized >=60 min/day	Time-use diary/ dichotomized <=120 m screen time/day	N/A	high PA/low ST	Odds ratios [adiposity] low PA/ low ST .89 - 1.78 [females] high PA/high ST 1.37 - 2.51 [males] 1.68 - 1.89 [females] low PA/high ST 2.2 - 2.55 [males] 1.17 - 2.67 [females]
Maher	2016	Cross-sectional	Australia	Children	285	Accelerometer/ median	Accelerometer/ median	N/A	N/A	Means [standarized test scores] high PA/low SB 485 low PA/low SB 471 low PA/high SB 502 high PA/high SB 504

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Maher	2016	Cross-sectional	Australia	Children	285	Accelerometer/ median	Accelerometer/ median	N/A	high PA/low ST	Odds ratios [adiposity] low PA/ low ST .89 - 1.78 [females] high PA/high ST 1.37 - 2.51 [males] 1.68 - 1.89 [females] low PA/high ST 2.2 - 2.55 [males] 1.17 - 2.67 [females]
Marques	2015	Cross-sectional	Portugal	Children	2506	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ median	N/A	low PA/high SB	Odds ratios low PA/low SB .97 [adiposity] .76 - 1.46 [muscular physical fitness] high PA/high SB 1.44 [adiposity] .97 - 1.85 [muscular physical fitness] high PA/low SB 1.35 [adiposity] 1.18 - 2.55 [muscular physical fitness]
Martinez-Gomez	2011	Cross-sectional	Sweden, Greece, Italy, Spain, Hungary, Belgium, France, Germany, Austria	Adolescents	1808	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ study-specific	N/A	N/A	Means [cardiorespiratory fitness] low PA/low SB 38.55 ml/kg/min low PA/high SB 37.31 ml/kg/min high PA/low SB 39.72 ml/kg/min high PA/high SB 39.01 ml/kg/min
Matin	2017	Cross-sectional	Iran	Children	13486	Questionnaire/ hour/week <2 2-4 >4	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	low PA/low ST	Odds ratios [well-being] mod PA/low ST 1.13 - 1.3 high PA/low ST 1.37 - 1.5 low PA/high ST .91 - 1.06 mod PA/high ST 1.14 - 1.3 high PA/high ST 1.27 - 1.47

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Melkevik	2010	Cross-sectional	Norway	Adolescents	4848	Questionnaire/ study-specific	Questionnaire/ study-specific (screen time)	N/A	N/A	ß [adiposity] low PA/high ST .07 - .09 [males] .07 -.09 [females] high PA/high ST high PA/high ST .04 - .06 [males] .15 - .18 [females]
Melkevik	2010	Cross-sectional	Norway	Adolescents	4848	Questionnaire/ study-specific	Questionnaire/ study-specific (screen time)	N/A	very high PA/most ST	Odds ratios [adiposity] high PA/mod ST 1 [males] 1.26 [females] mod PA/mod ST 1.18 [males] 1.18 [females] low PA/low ST 1.35 [males] 1.36 [females] low PA/high ST 1.62 [males] 1.59 [females] low PA/very high ST 1.82 [males] 2.01 [females]
Melkevik	2010	Cross-sectional	Norway	Adolescents	4848	Questionnaire/ study-specific	Questionnaire/ study-specific (screen time)	N/A	very high PA/mod ST	Odds ratios [adiposity] high PA/mod ST 1.0 [males] 1.26 [females] mod PA/mod ST 1.18 [males] 1.18 [females] low PA/low ST 1.35 [males] 1.36 [females] low PA/high ST 1.62 [males] 1.59 [females] low PA/very high ST 1.82 [males] 2.01 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Melkevik	2015	Cross-sectional	United States, Greece, Slovenia, Croatia, Portugal, Spain, Italy, Poland, Czech Republic, Finland, Hungary, Israel, Iceland, Luxembourg, Romania, Macedonia, Germany, Estonia, Slovakia, Turkey, Belgium, Latvia, Norway, Switzerland, Sweden, United Kingdom, Ukraine, France, Denmark, Russia Federation, Netherlands	Adolescents	107184	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	N/A	ß [adiposity] low PA/high ST .07 - .09 [males] .07 -.09 [females] high PA/high ST high PA/high ST .04 - .06 [males] .15 - .18 [females]
Melkevik	2015	Cross-sectional	United States, Greece, Slovenia, Croatia, Portugal, Spain, Italy, Poland, Czech Republic, Finland, Hungary, Israel, Iceland, Luxembourg, Romania, Macedonia, Germany, Estonia, Slovakia, Turkey, Belgium, Latvia, Norway, Switzerland, Sweden, United Kingdom, Ukraine, France, Denmark, Russia Federation, Netherlands	Adolescents	107184	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	very high PA/most ST	Odds ratios [adiposity] high PA/mod ST 1 [males] 1.26 [females] mod PA/mod ST 1.18 [males] 1.18 [females] low PA/low ST 1.35 [males] 1.36 [females] low PA/high ST 1.62 [males] 1.59 [females] low PA/very high ST 1.82 [males] 2.01 [females]
Melkevik	2015	Cross-sectional	United States, Greece, Slovenia, Croatia, Portugal, Spain, Italy, Poland, Czech Republic, Finland, Hungary, Israel, Iceland, Luxembourg, Romania, Macedonia, Germany, Estonia, Slovakia, Turkey, Belgium, Latvia, Norway, Switzerland, Sweden, United Kingdom, Ukraine, France, Denmark, Russia Federation, Netherlands	Adolescents	107184	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	very high PA/mod ST	Odds ratios [adiposity] high PA/mod ST 1.0 [males] 1.26 [females] mod PA/mod ST 1.18 [males] 1.18 [females] low PA/low ST 1.35 [males] 1.36 [females] low PA/high ST 1.62 [males] 1.59 [females] low PA/very high ST 1.82 [males] 2.01 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Mielke	2019	Longitudinal	Brazil	Adolescents, Children	3613	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=5 hours screen time/day	N/A	high PA/low ST	ß high PA/high ST .01 - .635 [adiposity] -.51 - -.034 [triglycerides] -.049 - -.009 [glucose] -.02 - 0 [non-HDL] -.174 - .55 [diastolic blood pressure] low PA/low ST -.303 - .11 [adiposity] -.52 - -.001 [triglycerides] -.032 - .046[glucose] 0 - 0.1 [non-HDL] .25 - .56 [diastolic blood pressure] low PA/high ST -.343 - .07 [adiposity] -.52 - -.005 [triglycerides] -.082 - .058 [glucose] .02 - .031 [non-HDL] -.576 - .59 [diastolic blood pressure]
Monda	2005	Cross-sectional, Longitudinal	China	Children	2282	Questionnaire/ study-specific	Questionnaire/ study-specific	N/A	low PA/low SB	Odds ratios [adiposity] low PA/mod SB .2 - .75 low PA/high SB .39 - .68 mod PA/mod SB .18 - .29 mod PA/high SB .17 - .47 high PA/mod SB .22 - .36 high PA/high SB .08 - .16
Moore	2013	Cross-sectional	United States	Children	285	Accelerometer/ median	Accelerometer/ median	N/A	N/A	ß [cardiorespiratory fitness] high PA/low SB -8.6 high PA/high SB -10.2

First Author	Year	Study Design	Country	Population¹	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Mota	2014	Cross-sectional	Portugal	Children	627	N/A	Questionnaire/ dichotomized <=1 hours screen time/day	Questionnaire/ dichotomized >=10.5 hour/day	low ST/high SLP	Odds ratios [elevated blood pressure] high ST/low SLP 2.4 low ST/low SLP 2.4 high ST/high SLP 1.5
Motamed-Gorji	2019	Cross-sectional	Iran	Children	23043	Questionnaire/ dichotomized >=2 paq-a score	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	low PA/low ST	ß [health-related quality of life] low PA/high ST -1.8 - -.72 high PA/low ST 1.1 - 3.5 high PA/high ST 0 - 3.1
Moura	2019	Cross-sectional	Brazil	Adolescents	84	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß ↓SB/↑ MVPA -.95 - 1.02 [adiposity] 2.21 - 12.92 [total cholesterol] .96 - 1 [HDL-cholesterol] 1.19 - 14.05 [Non-HDL-cholesterol] 1.07 - 12.71 [LDL-cholesterol] 1.01 -1.08 [triglycerides] .21 - 1.09 [glucose] 1.03 - 1.45 [insulin] 1.03 - 1.45 [HOMA insulin resistance] .69 - .97 [HOMA insulin sensitivity] 1.02 - 1.24 [HOMA beta cell function] .33 - 4.0 [systolic blood pressure] .12 - 1.43 [diastolic blood pressure] .01 - .14 [cardiometabolic risk score]
Ogawa	2019	Cross-sectional	Japan	Adolescents	983	Questionnaire/ study-specific, dichotomized >=60 min/day	N/A	Questionnaire/ dichotomized 8-10 hour/day	N/A	ß low PA/high SLP -.66 - -.6 high PA/high /SLP -.48 - -.24
Omorou	2016	Longitudinal	France	Adolescents	1445	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=7 hour/day	N/A	high PA/low SB	ß [health-related quality of life] mod PA/mod SB -4.9 - -3.6 low PA/high SB -7 - - 3

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Parker	2019	Cross-sectional	Australia	Adolescents	473	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	Prevalence high PA/high SB 30% [overweight] 52.2% [mostly A/Bs] mod PA/high ST 27.2% [overweight] 46.8% [mostly A/Bs] high PA/low SB 10.9% [overweight] 58.5% [mostly A/Bs]
Patnode	2011	Cross-sectional	United States	Adolescents	720	Accelerometer, questionnaire/ dichotomized >= 30 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	N/A	Prevalence [overweight] "sedentary" 36% [males] 29.9% [females] "active" 22.7% [males] 15.3% [females] "low media/moderate activity" 26.6% [males] 20.0% [females]
Perez	2011	Cross-sectional	United States	Children	23190	Questionnaire/ dichotomized >=60 min/day, Questionnaire/ dichotomized >=60 min/day, participation in: organized pa resistance exercises, pe, sports	Questionnaire/ hours screen time/week low < =2 high >=3, Questionnaire/ study-specific (screen time)	N/A	high PA/low ST	Odds ratios [adiposity] low PA/low ST .52 - 1.11 [males] .72 - 1.8 [females] high PA/high ST .68 - 1.72 [males] .77 - 1.13 [females] low PA/high ST .84 - 1.92 [males] .7 - 1.45 [females]
Pérez-Rodrigo	2016	Cross-sectional	Spain	Adolescents, Children	424	Interview, accelerometer/ study-specific	Questionnaire/ study-specific	Questionnaire/ study-specific	"healthier lifestyle" [compared to those not in this cluster]	Odds ratios [adiposity] 1.07 [children] 2 [adolescents]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Pitanga	2019	Cross-sectional	Brazil	Adolescents	613	Questionnaire/ study-specific	Questionnaire/ dichotomized <=4 hours screen time/day	N/A	low PA/high ST	Odds ratios [adiposity] high PA/low ST .31 - .69 [males] .87 - 1.3 [females] low PA/low ST .68 - 1.15 [males] .93 - 1.02 [females] high PA/high ST .55 [males] 1.19 - 1.81 [females]
Porter	2017	Cross-sectional	United States	Children	451	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ median	N/A	low PA/high SB	Odds ratios [cardiorespiratory fitness] low PA/low SB 1.85 [males] .7 [females] high PA/high SB 5.01 [males] 1.76 [females] high PA/low SB 1.25 [males] 1.88 [females]
Rendo-Urteaga	2015	Cross-sectional	Greece, Germany, Belgium, France, Hungary, Italy, Sweden, Austria, Spain	Adolescents	769	Accelerometer, questionnaire/ dichotomized >=60 min/day or >=30 m VPA/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	low PA/high ST	ß low PA/low ST .03 [adiposity] .35 [HOMA Index] -1.2 [systolic blood pressure] -.27 [cholesterol] .04 [triglycerides] -.38 [cardiorespiratory fitness] high PA/high ST .15 [adiposity] -.07 [HOMA Index] -.21 [systolic blood pressure] .11 [cholesterol] -.03 [triglycerides] -.16 [cardiorespiratory fitness] high PA/low ST -.19 [adiposity] -.2 [HOMA Index] -.28 [systolic blood pressure] -.05 [cholesterol] -.13 [triglycerides] .15 [cardiorespiratory fitness]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Roman-Viñas	2016	Cross-sectional	Australia, Brazil, Canada, China, Colombia, Finland, India, Kenya, Portugal, South Africa, United Kingdom, United States	Children	6128	Accelerometer/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Accelerometer/ dichotomized 9-11 hour/day	low PA/high ST/low SLP	Odds ratios [adiposity] high PA/low ST/high SLP .38 [males] .11 [females]
Sampasa-Kanyinga	2017	Cross-sectional	Australia, Australia, Brazil, Canada, China, Colombia, Finland, India, Kenya, Portugal, South Africa, United Kingdom, United States, Brazil, Canada, China, Colombia, Finland, India, Kenya, Portugal, South Africa, United Kingdom, United States	Children	6106	Accelerometer/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Accelerometer/ dichotomized 9-11 hour/day	low PA/high ST/low SLP	Odds ratios [poor mental health] high PA/low ST/low SLP .47 - 1.13 [male children] .41 -.57 [female children] .4 - .58 [male adolescents] .62 - 1.63 [female adolescents] high PA/high ST/low SLP 1.43 - 1.54[male children] .42 - 1.49 [female children] 1.28 - 2.92 [male adolescents] .86 - 1.68 [female adolescents] low PA/low ST/high SLP 1.04 - 2.98 [male children] .44 - 1.26 [female children] .55 - 1.54 [male adolescents] .55 - .72 [female adolescents] high PA/low ST/high SLP .7 - 1.84 [male children] .86 - 1.03 [female children] .08 -.24 [male adolescents] .49 - .68 [female adolescents]
Sampasa-Kanyinga	2017	Cross-sectional	Australia, Australia, Brazil, Canada, China, Colombia, Finland, India, Kenya, Portugal, South Africa, United Kingdom, United States, Brazil, Canada, China, Colombia, Finland, India, Kenya, Portugal, South Africa, United Kingdom, United States	Children	6106	Accelerometer/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Accelerometer/ dichotomized 9-11 hour/day	N/A	Means [health-related quality of life] high PA/low ST/low SLP 50.9 [males] 50.1 [females] high PA/high ST/high SLP 50.6 [males] 50.2 [females] low PA/low ST/high SLP 51 [males] 51.3 [females] high PA/low ST/high SLP 50.7 [males] 51.7 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Sampasa-Kanyinga	2020	Cross-sectional	Canada	Adolescents, Children	10183	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day (6-13 year olds) 8-10 hour/day (14-17 year olds)	low PA/high ST/low SLP	Odds ratios [poor mental health] high PA/low ST/low SLP .47 - 1.13 [male children] .41 -.57 [female children] .4 - .58 [male adolescents] .62 - 1.63 [female adolescents] high PA/high ST/low SLP 1.43 - 1.54[male children] .42 - 1.49 [female children] 1.28 - 2.92 [male adolescents] .86 - 1.68 [female adolescents] low PA/low ST/high SLP 1.04 - 2.98 [male children] .44 - 1.26 [female children] .55 - 1.54 [male adolescents] .55 - .72 [female adolescents] high PA/low ST/high SLP .7 - 1.84 [male children] .86 - 1.03 [female children] .08 -.24 [male adolescents] .49 - .68 [female adolescents]
Sampasa-Kanyinga	2020	Cross-sectional	Canada	Adolescents, Children	10183	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day (6-13 year olds) 8-10 hour/day (14-17 year olds)	N/A	Means [health-related quality of life] high PA/low ST/low SLP 50.9 [males] 50.1 [females] high PA/high ST/high SLP 50.6 [males] 50.2 [females] low PA/low ST/high SLP 51 [males] 51.3 [females] high PA/low ST/high SLP 50.7 [males] 51.7 [females]
Sánchez-Oliva	2018	Cross-sectional, Longitudinal	Spain	Adolescents, Children	1263	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	N/A	Means [body fat percentage] “healthy lifestyle” 24.08% [children] 21.22% [adolescents] “high screen” 23.95% 21.03 % [adolescents]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Sánchez-Oliva	2018	Cross-sectional, Longitudinal	Spain	Adolescents, Children	1263	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	N/A	Means “highly sedentary” 44.91 [health-related quality of life] 2.3 [positive affect] 1.71 [negative affect] “sedentary” 45.78 [health-related quality of life] 2.31 [positive affect] 1.69 [negative affect] “active” 47.24 [health-related quality of life] 2.33 [positive affect] 1.68 [negative affect] “highly active” 49.48 [health-related quality of life] 2.42 [positive affect] 1.7 [negative affect]
Sánchez-Oliva	2020	Longitudinal	Spain	Children	1099	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	N/A	Means [body fat percentage] “healthy lifestyle” 24.08% [children] 21.22% [adolescents] “high screen” 23.95% 21.03 % [adolescents]
Sánchez-Oliva	2020	Longitudinal	Spain	Children	1099	Accelerometer/ study-specific	Accelerometer/ study-specific	N/A	N/A	Means “highly sedentary” 44.91 [health-related quality of life] 2.3 [positive affect] 1.71 [negative affect] “sedentary” 45.78 [health-related quality of life] 2.31 [positive affect] 1.69 [negative affect] “active” 47.24 [health-related quality of life] 2.33 [positive affect] 1.68 [negative affect] “highly active” 49.48 [health-related quality of life] 2.42 [positive affect] 1.7 [negative affect]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Santos	2014	Cross-sectional	Portugal	Both	2506	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ median	N/A	N/A	ß [cardiorespiratory fitness] ↓ SB/↑ MPA -0.12 - .03 ↓ SB/↑ VPA .307 - .78
Santos	2014	Cross-sectional	Portugal	Both	2506	Accelerometer/ dichotomized >=60 min/day	Accelerometer/ median	N/A	low PA/high SB	Odds ratios [cardiorespiratory fitness] low PA/low SB 1.27 high PA/high SB 1.25 high PA/low SB 1.81
Santos	2018	Cross-sectional, Longitudinal	Portugal	Children	315	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß [cardiorespiratory fitness] ↓ SB/↑ MPA -0.12 - .03 ↓ SB/↑ VPA .307 - .78
Santos	2018	Cross-sectional, Longitudinal	Portugal	Children	315	Accelerometer/ N/A	Accelerometer/ N/A	N/A	low PA/high SB	Odds ratios [cardiorespiratory fitness] low PA/low SB 1.27 high PA/high SB 1.25 high PA/low SB 1.81
Sardinha	2017	Cross-sectional, Longitudinal	Portugal	Children	386	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß [adiposity] ↓SB/↑ MVPA -1.62 - -.06
Shi	2020	Cross-sectional	Hong Kong	Adolescents	692	Accelerometer/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Accelerometer/ dichotomized >=9 hour/day (13 year olds) 8-10 hour/day (14-17 year olds)	high PA/low ST/high SLP [compared to those not meeting all guidelines]	ß [adiposity] 2.28 [males] -.59 [females]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Sisson	2010	Cross-sectional	United States	Both	53562	Questionnaire/ bouts/week (>20 min) 0-2 3-5 5-7	Questionnaire/ hour/day <=1 2-3 >4	N/A	high PA/low ST	Odds ratios [adiposity] low PA/high ST 1.95 [males] 1.68 [females] mod PA/high ST 1.35 [males] 1.52 [females] high PA/high ST 1.03 [males] 1.33 [females] low PA/mod ST 1.43 [males] 1.86 [females] mod PA/mod ST 1.21 [males] 1.82 [females] high PA/mod ST 1.07 [males] 1.23 [females] low PA/low ST 1.13 [males] 1.19 [females] mod PA/low ST 1.11 [males] 1.12 [females]
Spengler	2012	Cross-sectional	Germany	Children	1643	Questionnaire/ study-specific	Questionnaire/ study-specific	N/A	N/A	Prevalence [overweight] “high PA/average ST cluster” 12.5% “low PA/low ST cluster” 16.7% “low PA/high ST cluster” 12.6%
Steele	2009	Cross-sectional	England	Children	1862	Accelerometer/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	low PA/high ST	Odds ratios [adiposity] low PA/low ST 1.1 high PA/high ST .7 high PA/low ST .69

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Sun	2020	Cross-sectional	China	Adolescents, Children	536	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß [cardiorespiratory fitness] ↓ SB/↑ MVPA .57 [male children] .65 [female children] .61 [male adolescents] .48 [female adolescents]
Taheri	2019	Cross-sectional	Iran	Children	13486	Questionnaire/ bouts/week (>30 min) 0-2 3-5 6-7	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	low PA/high ST	Odds ratios mod PA/high ST .7 - .85 [mental health] .67 - .84 [socio-emotional problems] high PA/high ST .66 - .75 [mental health] .52 - .7 [socio-emotional problems] low PA/low ST .71 - .77 [mental health] .61 - .73 [socio-emotional problems] mod PA/low ST .56 - .74 [mental health] .48 - .52 [socio-emotional problems] high PA/low ST .45 - .69 [mental health] .43 - .56 [socio-emotional problems]
Tahir	2019	Longitudinal	United States	Children	30921	Questionnaire/ study-specific	Questionnaire/ hours screen time/day <2 >3	N/A	high PA/low ST	Odds ratios [adiposity] low PA/low ST 1.55 - 2.51 high PA/high ST 1.19 - 1.25 low PA/high ST 2.19 - 4.41
Talarico	2018	Cross-sectional	Canada	Children	458	Accelerometer/ N/A	Accelerometer/ N/A	Questionnaire/ N/A	specific movement behavior relative to all other movement behaviors	ß [adiposity] SB -.82 - .46 MVPA -2.79 - -.23 SLP -.6 - .66

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Tanaka	2020a	Cross-sectional	Japan	Children	243	Accelerometer/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day	N/A	Means high PA/low ST/low SLP 37.3 ml/kg/min [cardiorespiratory fitness] 12.6 kg [muscular strength] 14.6 situps/ 30 sec[muscular endurance] 31.3 cm [flexibility] high PA/high ST/high SLP 40.8 ml/kg/min [cardiorespiratory fitness] 13.3 kg [muscular strength] 16.5 situps/ 30 sec[muscular endurance] 31.2 cm [flexibility] low PA/low ST/high SLP 378.7 ml/kg/min [cardiorespiratory fitness] 12.9 kg [muscular strength] 14.8 situps/ 30 sec[muscular endurance] 30.7 cm [flexibility] high PA/low ST/high SLP 37.6 ml/kg/min [cardiorespiratory fitness] 12.7 kg [muscular strength] 14.9 situps/ 30 sec[muscular endurance] 37.6 cm [flexibility]
Tanaka	2020a	Cross-sectional	Japan	Children	243	Accelerometer/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day	those who do no meet all guidelines	Odds ratios [adiposity] high PA/low ST/high SLP .44 [boys] .49 [girls]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Tanaka	2020b	Cross-sectional	Japan	Children	902	Accelerometer/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day	N/A	Means high PA/low ST/low SLP 37.3 ml/kg/min [cardiorespiratory fitness] 12.6 kg [muscular strength] 14.6 situps/ 30 sec[muscular endurance] 31.3 cm [flexibility] high PA/high ST/high SLP 40.8 ml/kg/min [cardiorespiratory fitness] 13.3 kg [muscular strength] 16.5 situps/ 30 sec[muscular endurance] 31.2 cm [flexibility] low PA/low ST/high SLP 378.7 ml/kg/min [cardiorespiratory fitness] 12.9 kg [muscular strength] 14.8 situps/ 30 sec[muscular endurance] 30.7 cm [flexibility] high PA/low ST/high SLP 37.6 ml/kg/min [cardiorespiratory fitness] 12.7 kg [muscular strength] 14.9 situps/ 30 sec[muscular endurance] 37.6 cm [flexibility]
Tanaka	2020b	Cross-sectional	Japan	Children	902	Accelerometer/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day	those who do no meet all guidelines	Odds ratios [adiposity] high PA/low ST/high SLP .44 [boys] .49 [girls]
Tassitano	2020	Cross-sectional	Brazil	Adolescents	5520	Interview/ study-specific	Interview/ study-specific	Interview/ study-specific	N/A	Prevalence [overweight] “computer users” 34.5% “short sleepers” 29.7% “typical behviors class” 26.7% “techno-active gamers” 26.6% “lower screen engagement” 23.3%

First Author	Year	Study Design	Country	Population¹	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Taylor	2020	Cross-sectional	New Zealand	Children	690	Accelerometer/ N/A	Accelerometer/ N/A	Accelerometer/ N/A	specific movement behavior relative to all other movement behaviors	isometric log-ratio [adiposity] SB .23 MVPA -.7 SLP -.89
teVelde	2007	Cross-sectional	Austria, Belgium, Denmark, Iceland, the Netherlands, Norway, Portugal, Spain, Sweden	Children	7909	Questionnaire/ study-specific	Questionnaire/ study-specific (screen time)	N/A	"healthy behavior pattern"	Odds ratios [adiposity] "high TV viewers" 1.25 [males] 1.64 [females] "low PA/low SB" 1.5 [males] 1.03 [females] "high PC useres" 1.43 [males] 1.42 [females] "unhealthy behavior pattern" 1.6 [males] "high PA/high SB" 1.33 [females]
Trinh	2015	Cross-sectional	Canada	Adolescents	1263	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios [low self-esteem] low PA/low ST 1.14 low PA/high ST 1.34 high PA/high ST 1.84
Uddin	2020	Cross-sectional	52 low-middle income countries	Adolescents	206357	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <3 hour/day	N/A	high PA/low SB	Odds ratios [poor mental health] low PA/high SB 1.51 - 2.07 [males] 1.3 - 1.43 [females]
Vaisto	2014	Cross-sectional	Finland	Children	468	Questionnaire/ median	Questionnaire/ median (screen time)	N/A	N/A	ß [cardiometabolic risk score] high PA/low ST -.77 low PA/low ST -.41 high PA/high ST .08 low PA/high ST .86

First Author	Year	Study Design	Country	Population¹	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Van den Bulck	2009	Longitudinal	Belgium	Children	1276	Questionnaire/ study-specific	Questionnaire/ study-specific (screen time)	N/A	high PA/low ST	Relative Risk [overweight] mod PA/mod ST 2.7 - 5.4 low PA/high ST 5.2 - 8.9
Verswijveren	2020	Cross-sectional	Australia	Children	772	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß [waist circumference] SB 7.06 VPA -3.26
Vicente-Rodríguez	2009	Cross-sectional	Spain	Adolescents	277	Questionnaire/ median	Questionnaire/ median	N/A	N/A	Prevalence [low bone mineral content] high PA/high ST 5% low PA/high ST 29.4% high PA/low ST 6.1% low PA/low ST 16.1%
Walsh	2018	Cross-sectional	United States	Children	4524	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized 9-11 hour/day	N/A	ß [cognitive/executive function] high PA/low ST/low SLP -.72 - 1.17 high PA/high ST/high SLP -2.31 - -.55 low PA/low ST/high SLP -.72 - 1.17 high PA/low ST/high SLP 2.69 - 3.89
Wang	2016	Cross-sectional	China	Children	1027	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	N/A	Odds ratios [non-alcoholic fatty liver disease] high PA/low SB 3.17
Weisser	2015	Cross-sectional	NR	Adolescents	532	NR/ dichotomized >=60 min/day	NR/ dichotomized <=2 hours screen time/day	N/A	N/A	Means [systolic blood pressure] low PA/high ST 151.6 mm Hg low PA/low ST 146.8 mm Hg high PA/high ST 143.7 mm Hg high PA/low ST 140.1 mm Hg

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Werneck	2019	Cross-sectional	Brazil	Adolescents	100839	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <= 4 hour/day, dichotomized <=4 hours screen time/day	N/A	high PA/low SB high PA/low ST	Odds ratios [poor health-related quality of life] high PA/high SB 1.12 [males] 1.15 [females] high PA/high ST 1.12 [males] 1.48 [females] low PA/low SB 1.14 [males] .93 [females] low PA/low ST 1.08 [males] .98 [females] low PA/high SB 1.38 [males] 1.04 [females] low PA/high ST 1.44 [males] 1.32 [females]
Wilkie	2016	Cross-sectional	England	Children	374	Accelerometer/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Accelerometer/ dichotomized >=10 hour/day (9 years olds) >=9.75 hour/day (10 years olds) >=9.5 hour/day (11 years olds)	N/A	ß [adiposity] high PA/high ST/high SLP .44 low PA/low ST/high SLP .66
Wilson	2020	Cross-sectional	Australia	Children	343	Questionnaire/ study-specific	Questionnaire/ study-specific (screen time)	Questionnaire/ study-specific	N/A	Means [standarized test scores] “junk food screenies” 400 - 426 “high sport” 417 - 449 “low sport” 389 - 427

First Author	Year	Study Design	Country	Population[1]	Sample Size	Physical Activity Tool Category	Sedentary Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Wong	2009	Cross-sectional	Canada	Adolescents	25069	Questionnaire/ study-specific	Questionnaire/ hour screen time/day low <=1 high >3	N/A	“studious actives”	Mean differences “technoactives” -.02 [CHU9D] -1.1 [PedsQL Physical] -1.8 [PedsQL Psychosocial] “stay home screenies” -.02 [CHU9D] -2 [PedsQL Physical] -2.9 [PedsQL Psychosocial] “potterers” -.03 [CHU9D] -5.5 [PedsQL Physical] -5.8 [PedsQL Psychosocial]
Wong	2009	Cross-sectional	Canada	Adolescents	25069	Questionnaire/ study-specific	Questionnaire/ hour screen time/day low <=1 high >3	N/A	high PA/low SB	Odds ratios [adiposity] high PA/high SB 1.15 [males] 1.91 [girls] low PA/low SB 1.16 [males] 1.53 [females] low PA/high SB 1.6 [males] 2.24 [females]
Wong	2017	Cross-sectional	Australia	Children	1455	Time-use diary/ N/A	Time-use diary/ N/A	N/A	“studious actives”	Mean differences “technoactives” -.02 [CHU9D] -1.1 [PedsQL Physical] -1.8 [PedsQL Psychosocial] “stay home screenies” -.02 [CHU9D] -2 [PedsQL Physical] -2.9 [PedsQL Psychosocial] “potterers” -.03 [CHU9D] -5.5 [PedsQL Physical] -5.8 [PedsQL Psychosocial]

First Author	Year	Study Design	Country	Population[1]	Sample Size	Activity Tool Category	Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Wong	2017	Cross-sectional	Australia	Children	1455	Time-use diary/ N/A	Time-use diary/ N/A	N/A	high PA/low SB	Odds ratios [adiposity] high PA/high SB 1.15 [males] 1.91 [girls] low PA/low SB 1.16 [males] 1.53 [females] low PA/high SB 1.6 [males] 2.24 [females]
Wu	2020	Cross-sectional	Mexico	Adolescents	369	Accelerometer/ N/A	Accelerometer/ N/A	N/A	N/A	ß ↓ SB/↑ MPA .71 - 1.29 [hormone levels] -.52 - .75 [DNA Methylation] ↓ SB/↑ VPA .81 - 2.07 [hormone levels] -2.7 - 5.83 [DNA Methylation]
Xi	2011	Cross-sectional	China	Both, Children	2848	Questionnaire/ bouts/week (>=30 min) <3 3-4 >= 4	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	high PA/low ST	Odds ratios [adiposity] high PA/high ST .69 - 1.43 low PA/low ST 1.26 - 2.09 low PA/high ST 1.71 - 2.58
Zeng	2020	Cross-sectional	China	Children	4304	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	N/A	N/A	Means [cognitive/executive function] high PA/low ST 41.57 - 48.25 high PA/high ST 42.93 - 51.54 low PA/high ST 43.16 - 53.01 low PA/low ST 42.16 - 50.55
Zhu	2019	Cross-sectional	United States	Adolescents, Children	35718	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized >=9 hour/day (6-12 year olds) >=8 hour/day (13-17 year olds)	high PA/low ST/high SLP	Odds ratios low PA/low ST/high SLP .14 - 1.53 high PA/low ST/low SLP 2.8 - 4.36 high PA/high ST/high SLP .11 - .99

First Author	Year	Study Design	Country	Population[1]	Sample Size	Activity Tool Category	Behavior Tool Category	Sleep Tool Category	Reference Group	Key Results
Zhu	2019	Cross-sectional	United States	Adolescents, Children	35718	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized >=9 hour/day (6-12 year olds) >=8 hour/day (13-17 year olds)	high PA/low ST/high SLP	Odds ratios [adiposity] low PA/low ST/high SLP 1.46 - 1.76 [males] 1.22 - 2.11 [females] high PA/low ST/low SLP 1.17 - 1.27 [males] .64 - 1.56 [females] high PA/high ST/high SLP 1.56 - 1.78 [males] .63 - 1.11 [females]
Zhu	2020	Cross-sectional	United States	Children	30478	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized >=9 hour/day (13 year olds) 8-10 hour/day (14-17 year olds)	high PA/low ST/high SLP	Odds ratios low PA/low ST/high SLP .14 - 1.53 high PA/low ST/low SLP 2.8 - 4.36 high PA/high ST/high SLP .11 - .99
Zhu	2020	Cross-sectional	United States	Children	30478	Questionnaire/ dichotomized >=60 min/day	Questionnaire/ dichotomized <=2 hours screen time/day	Questionnaire/ dichotomized >=9 hour/day (13 year olds) 8-10 hour/day (14-17 year olds)	high PA/low ST/high SLP	Odds ratios [adiposity] low PA/low ST/high SLP 1.46 - 1.76 [males] 1.22 - 2.11 [females] high PA/low ST/low SLP 1.17 - 1.27 [males] .64 - 1.56 [females] high PA/high ST/high SLP 1.56 - 1.78 [males] .63 - 1.11 [females]

Note: N/A, not applicable; NR, not reported; PAQ-A, Physical activity questionnaire children and adolescents; PedsQL, Pediatric quality of life; CHU9D; Child helath utility instrument
Physical activity, sedentary behavior, and sleep categories to predetermined category cutoffs.
Study-specific categories include cutoffs from cluster analyses, are unique to a study, or use generic definitions of high vs. low./n Physical activity categories refer to moderate-vigorous physical activity unless otherwise noted.
Sedentary behavior refers to total time spent sedentary unless otherwise noted. [1] For the Population, 'both' refers to studies that didn't report a mean age and the range spanned between children and adolescents
[2] de Moraes has two sample sizes because separate analyses were conducted on different datasets

Appendix C.1 Movement Behaviour Code Sheet

Activity Code	Activity	LSAC category	General Movement Behaviour Category	Domain-Specific Category
454	Window shopping	Active Activities	Light-Physical Activity	Unstructured Leisure-time Physical Activity
463	Attendance at musuem/exhibition	Active Activities	Light-Physical Activity	Unstructured Leisure-time Physical Activity
464	Attendance at zoo/animal park/botanic garden	Active Activities	Light-Physical Activity	Unstructured Leisure-time Physical Activity
465	Attendance at other mass events	Active Activities	Light-Physical Activity	Unstructured Leisure-time Physical Activity
466	Going out nec	Active Activities	Light-Physical Activity	Unstructured Leisure-time Physical Activity
491	Active activities nec	Active Activities	Light-Physical Activity	Unstructured Leisure-time Physical Activity
450	Shopping	Active Activities	Light-Physical Activity	Unstructured Leisure-time Physical Activity
451	Shopping	Active Activities	Light-Physical Activity	Unstructured Leisure-time Physical Activity
1	Retailing	Work	Light-Physical Activity	Work/Household Physical Activity
11	Hospitality (including fast food)	Work	Light-Physical Activity	Work/Household Physical Activity
31	Labourers and related workers	Work	Light-Physical Activity	Work/Household Physical Activity
41	Gardening/lawn mowing	Work	Light-Physical Activity	Work/Household Physical Activity
51	Babysitting	Work	Light-Physical Activity	Work/Household Physical Activity
61	Apprenticeships/trades persons	Work	Light-Physical Activity	Work/Household Physical Activity
71	Working in a family business or farm	Work	Light-Physical Activity	Work/Household Physical Activity
82	Umpring (work)	Work	Light-Physical Activity	Work/Household Physical Activity
83	Car washing (work)	Work	Light-Physical Activity	Work/Household Physical Activity
84	Animal care (work)	Work	Light-Physical Activity	Work/Household Physical Activity
91	Volunteering (work)	Work	Light-Physical Activity	Work/Household Physical Activity
201	Cleaning teeth	Personal Care/Medical/Health Care	Light-Physical Activity	Work/Household Physical Activity
211	Showering/bathing	Personal Care/Medical/Health Care	Light-Physical Activity	Work/Household Physical Activity
221	Getting dressed/getting ready	Personal Care/Medical/Health Care	Light-Physical Activity	Work/Household Physical Activity
231	Personal care nec	Personal Care/Medical/Health Care	Light-Physical Activity	Work/Household Physical Activity
301	Cleaning/tidying	Chores	Light-Physical Activity	Work/Household Physical Activity
311	Laundry/clothes care	Chores	Light-Physical Activity	Work/Household Physical Activity
321	Food/drink preparation	Chores	Light-Physical Activity	Work/Household Physical Activity
331	Food/drink clean up	Chores	Light-Physical Activity	Work/Household Physical Activity
341	Gardenin (maintenance chores)	Chores	Light-Physical Activity	Work/Household Physical Activity
342	Cleaning grounds/garage/shed/outside of house (chores)	Chores	Light-Physical Activity	Work/Household Physical Activity
344	Pool care (chores	Chores	Light-Physical Activity	Work/Household Physical Activity
351	Animal Care (work)	Chores	Light-Physical Activity	Work/Household Physical Activity
361	Home maintenance	Chores	Light-Physical Activity	Work/Household Physical Activity
362	Design/Home Improvement	Chores	Light-Physical Activity	Work/Household Physical Activity
363	Heat/water/power upkeep	Chores	Light-Physical Activity	Work/Household Physical Activity
364	Car/boat/bike care	Chores	Light-Physical Activity	Work/Household Physical Activity
365	Selling/disposing of household assets	Chores	Light-Physical Activity	Work/Household Physical Activity
366	Rubbish/Recyling	Chores	Light-Physical Activity	Work/Household Physical Activity
367	Packing	Chores	Light-Physical Activity	Work/Household Physical Activity
368	Household management Other	Chores	Light-Physical Activity	Work/Household Physical Activity
371	Taking care of siblings (chores)	Chores	Light-Physical Activity	Work/Household Physical Activity
381	Chores nec	Chores	Light-Physical Activity	Work/Household Physical Activity
901	By foot	Travel	Light-Physical Activity	Active Transportation
911	By bike, scooter, skateboard, etc	Travel	Light-Physical Activity	Active Transportation

401 Archery/Shooting sports	Active Activities	Moderate-to-Vigorous Physical Activity	Structured Leisure-time Physical Activity
402 Athletics/Gymnastics	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
403 Fitness/Gym/Exercise	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
404 Ball Sports	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
405 Martial arts/Dancing	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
406 Motor Sports/Roller Sports/Cycling	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
407 Water/Ice/Snow Sports	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
408 Organised team sports and training other	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
411 Archery/shooting sports (individual)	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
412 Athletics/Gymnastics (individual)	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
413 Fitness/Gym/Exercise (individual)	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
414 Martial arts/Dancing (individual)	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
415 Motor Sports/Roller Sports/Cycling (individual)	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
416 Ball sports (individual)	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
417 Water/Ice/Snow Sports (individual)	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
418 Organised individual sports and training other	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
430 Walking pets/playing with pets	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
440 Active club activities	Active Activities	Moderate-vigorous Physical Activity	Structured Leisure-time Physical Activity
421 Archery/Shooting sports (unstructured)	Active Activities	Moderate-vigorous Physical Activity	Unstructured Leisure-time Physical Activity
422 Athletics/Gymnastics (unstructured)	Active Activities	Moderate-vigorous Physical Activity	Unstructured Leisure-time Physical Activity
423 Fitness/Gym/Exercise (unstructured)	Active Activities	Moderate-vigorous Physical Activity	Unstructured Leisure-time Physical Activity
424 Ball sports (unstructured)	Active Activities	Moderate-vigorous Physical Activity	Unstructured Leisure-time Physical Activity
425 Martial arts/Dancing (unstructured)	Active Activities	Moderate-vigorous Physical Activity	Unstructured Leisure-time Physical Activity
426 Motor Sports/Roller Sports/Cycling (unstructured)	Active Activities	Moderate-vigorous Physical Activity	Unstructured Leisure-time Physical Activity
427 Water/Ice/Snow Sports (unstructured)	Active Activities	Moderate-vigorous Physical Activity	Unstructured Leisure-time Physical Activity
428 Unstructured active play Other	Active Activities	Moderate-vigorous Physical Activity	Unstructured Leisure-time Physical Activity
21 Clerical/office	Work	Sedentary Behaviour	Education-Based Sedentary Behaviour
81 Work Other	Work	Sedentary Behaviour	Education-Based Sedentary Behaviour
501 Private music lessons/practice, academic tutoring	Non-Active Activities	Sedentary Behaviour	Education-Based Sedentary Behaviour
521 Playing musical instruments or singing for leisure	Non-Active Activities	Sedentary Behaviour	Education-Based Sedentary Behaviour
531 Reading or being red to for leisure	Non-Active Activities	Sedentary Behaviour	Education-Based Sedentary Behaviour
541 Chess, cards , paper, and board games	Non-Active Activities	Sedentary Behaviour	Education-Based Sedentary Behaviour
581 Doing homework (not via electronic device)	Non-Active Activities	Sedentary Behaviour	Education-Based Sedentary Behaviour
601 Doing homework (electronic device)	Electronic Device Use	Sedentary Behaviour	Education-Based Sedentary Behaviour
701 School lessons	School Lessons	Sedentary Behaviour	Education-Based Sedentary Behaviour
281 Person care/Medical/Health care nec	Personal Care/Medical/Health Care	Sedentary Behaviour	Leisure-time Sedentary Behaviour
312 Clothes making	Chores	Sedentary Behaviour	Leisure-time Sedentary Behaviour
981 Filling out the diary	Non-Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
481 Attending live sporting events	Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
462 Attendance at concert/theatre	Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
101 Eating/drinking	Eating/drinking	Sedentary Behaviour	Leisure-time Sedentary Behaviour
511 Listening to music	Non-Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
542 Games of chance/gambling	Non-Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
543 Hobbies, collections	Non-Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
544 Handwork crafts (excl. clothes making)	Non-Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour

545 Arts	Non-Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
548 Unstructure non-active play nec	Non-Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
551 Attend courses (exlcuding school/university)	Non-Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
552 Clubs	Non-Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
555 Religious groups	Non-Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
561 Doing nothing	Non-Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
591 Non-active activites nec	Non-Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
452 Purchasing consumer goods	Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
453 Purchasing durable goods	Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
455 Purchasing repair services	Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
456 Purchasing administrative services	Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
457 Purchasing personal care services	Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
458 Purchasing other services	Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
471 Religious practice	Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
472 Weddings, funeral, rites of passage	Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
473 Religious activites/ ritual ceremonies nec	Active Activities	Sedentary Behaviour	Leisure-time Sedentary Behaviour
921 By private motor vehicle/bike	Travel	Sedentary Behaviour	Passive Transportation
931 By public/chartered transport	Travel	Sedentary Behaviour	Passive Transportation
941 Travel nec	Travel	Sedentary Behaviour	Passive Transportation
461 Attendance at movies/cinema	Active Activities	Sedentary Behaviour	Recreational Screen Time
611 Playing games (electornic device)	Electronic Device Use	Sedentary Behaviour	Recreational Screen Time
612 Playing games (electornic device) nfd	Electronic Device Use	Sedentary Behaviour	Recreational Screen Time
621 Watching TV programs or movies	Electronic Device Use	Sedentary Behaviour	Recreational Screen Time
631 Spending time on social networking sites	Electronic Device Use	Sedentary Behaviour	Recreational Screen Time
641 Downloading/posting media	Electronic Device Use	Sedentary Behaviour	Recreational Screen Time
651 Internet shopping	Electronic Device Use	Sedentary Behaviour	Recreational Screen Time
661 General Internet browsing	Electronic Device Use	Sedentary Behaviour	Recreational Screen Time
671 Creating/maintaining websites	Electronic Device Use	Sedentary Behaviour	Recreational Screen Time
681 General application use	Electronic Device Use	Sedentary Behaviour	Recreational Screen Time
691 Electornic devisue use nec	Electronic Device Use	Sedentary Behaviour	Recreational Screen Time
841 Texting/emailing	Communication	Sedentary Behaviour	Recreational Screen Time
851 Online chatting/Instant messaging	Communication	Sedentary Behaviour	Recreational Screen Time
241 Doctor	Personal Care/Medical/Health Care	Sedentary Behaviour	Self Care
251 Dentist/Orthodontist	Personal Care/Medical/Health Care	Sedentary Behaviour	Self Care
261 Physiotherapist/Chiropractor	Personal Care/Medical/Health Care	Sedentary Behaviour	Self Care
271 Medical/Health care	Personal Care/Medical/Health Care	Sedentary Behaviour	Self Care
802 Talking face-to-face	Communication	Sedentary Behaviour	Social-Based Sedentary Behaviour
811 Talking on a landline phone	Communication	Sedentary Behaviour	Social-Based Sedentary Behaviour
821 Talking on a mobile phone	Communication	Sedentary Behaviour	Social-Based Sedentary Behaviour
831 Video chatting	Communication	Sedentary Behaviour	Social-Based Sedentary Behaviour
861 Non-verbal interaction	Communication	Sedentary Behaviour	Social-Based Sedentary Behaviour
871 Negative face-to-face commication	Communication	Sedentary Behaviour	Social-Based Sedentary Behaviour
881 Communication nec	Communication	Sedentary Behaviour	Social-Based Sedentary Behaviour
571 Sleeping/napping (not end of day bed-time)	Non-Active Activities	Sleep	Daytime Naps
971 Illegal activities	Other	Uncodeable	Uncodeable

991 Other	Other	Uncodeable	Uncodeable
998 Uncodeable activity	Uncodeable Activity	Uncodeable	Uncodeable

Appendix C.2 Outlier Decisions

Domain-specific movement behaviour	**Cut-off time for outliers**	**Rationale**	**Updated included participants**
Active Transportation (Age 10)	>= 300 min	Doesn't seem like a reasonable time for a 10-year old to be walking and timing doesn't make it look like the family went for a bushwalk (e.g., one participant walked from 19:30-1:00)	Original: 3,309 Excluded: 3 Updated: 3,306
Daytime Naps (Age 10)	OK	*Going to change "outlier naps' >240 min to nighttime sleep as these naps started before 5am with participants waking up for toilet/drink breaks and then "napping" again	
Education-Based Sedentary Behaviour (Age 10)	OK		
Leisure-Time Sedentary Behaviour (Age 10)	>550 min	Participants had abnormally long eating times (4-8+ hours) or many activities were a secondary activity to "not in coder"	Excluded: 11 Updated: 3,295
Passive Transportation (Age 10)	>= 302 min	Participants were on the road all day, mainly broken up my eating breaks. This suggests the family was going on a long trip which would not be a typical day	Excluded: 32 Updated: 3,263
Recreational Screen Time (Age 10)	OK	There are some very high numbers, but it's	

		reasonable to think that some 10-year olds spend their weekends watching TV and playing games all day	
Self-Care Sedentary Behaviour (Age 10)	>= 90 min	These participants either reported being sick, having a doctor's appointment, or visiting the hospital; exclude since this is not indicative of a typical day	Excluded: 80 Updated: 3,183
Social-Based SB (Age 10)	OK		
Structured MVPA (Age 10)	>=350	Participants appeared to be at competitions or camps (e.g., MVPA for 2 hours, eating for 30 minutes - pattern repeated throughout the whole day) Even if this is a typical weekend, it is reasonable to think that the participants were active the entire time (e.g. resting between event competitions, waiting for their turn to compete, sitting on the bench, etc.)	Excluded: 7 Updated: 3,176
Unstructured LPA (Age 10)	> 660 - however, this participant was already eliminated by one of the above criteria	Abnormal day; looks like diary wasn't filled out properly	Excluded: 0 Updated: 3,176
Unstructured MVPA (Age 10)	> = 350	The day looked like it could have been normal, but very long bouts were	Excluded: 3 Updated: 3,173

		sometimes paired with SB. It is reasonable to assume that these participants were not participating in MVPA the entire time. This cut-off number was chosen in line with structured MVPA	
Work/Household LPA (Age 10)	>= 800	One participant only recorded 1 activity for the entire day, this is extremely unlikely to be a true representation of the day. All other participants with high volumes of work/household LPA were doing chores all day, but their days were split up with appropriate breaks. Therefore, they were not excluded.	Excluded: 1 Updated: 3,172
Nighttime Sleep (Age 10)	>= 1000 & <200	1 participant met this criteria. They slept over 100 min longer than the closest cluster of high duration sleepers. A couple participants with very low sleep, appears that TUD was incorrectly filled	Excluded: 3 (1 long, 2 short) Updated: 3,169
Active Transportation (Age 12)	>= 300 min	Same as age 10	Original: 3,024 Excluded: 4 Updated: 3,020
Daytime Naps (Age 12)	OK	Same as age 10	
Education (Age 12)	OK	Same as age 10	
Leisure Time SB (Age 12)	OK	Nothing abnormal	

Passive Transportation (Age 12)	>330 min	Same as above	Excluded: 21 Updated: 2,991
Recreational Screen Time (Age 12)	>1000	Abnormal circumstance for not going to school reported	Excluded: 1 Updated: 2,990
Self care (Age 12)	>= 90 min	Same as above	Excluded: 20 Updated: 2,970
Social (Age 12)	>800 min	Same activity repeated in succession without other activities	Excluded: 1 Updated: 2,969
Structured MVPA (Age 12)	>=350	Same as above	Excluded: 6 Updated: 2,963
Unstructured LPA (Age 12)	OK	High volume of time, but reasonable activities done throughout the day	
Unstructured MVPA (Age 12)	>=350	Same as above	Excluded: 10 Updated: 2,953
Work and Household LPA (Age 12)	>=800	Diary entry appears incorrect	Excluded: 1 Updated: 2,952
Nighttime Sleep (Age 12)	<200	Very low sleep and days looked atypical	Excluded: 2 Updated: 2,950
Active Transportation (Age 14)	>=300 min	Abnormal walking periods not broken up by anything/sometimes paired with sedentary secondary activities or uncodeable main activities	Original: 2,736 Excluded: 2 Updated: 2,734
Daytime Naps (Age 14)	>700 min	Abnormal diaries and patterns	Excluded: 1 Updated:2,733
Education (Age 14)	OK		
Leisure SB (Age 14)	>700 min	Diary incomplete	Excluded: 1 Updated: 2,732

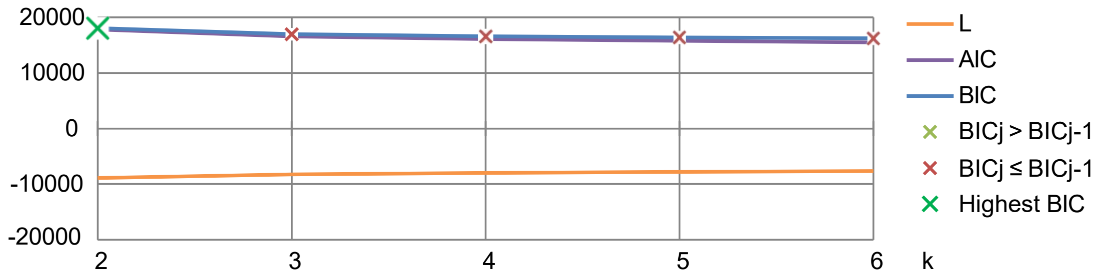
Passive Transportation (Age 14)	>340 min		Excluded:25 Updated: 2,707
Recreational Screen Time (Age 14)	>1000	All participants had school, but did not attend	Excluded: 3 Updated: 2,704
Self-Care (Age 14)	>=90 min	Same as above	Excluded: 36 Updated: 2,670
Social (Age 14)	>750 min	Same as above	Excluded: 3 Updated: 2,667
Structured MVPA (Age 14)	>=350 min	Same as above	Excluded: 9 Updated: 2,658
Unstr. LPA (Age 14)	OK		
Unstr. MVPA (Age 14)	>=350 min	Same as above	Excluded: 3 Updated: 2,655
Work/Household LPA (Age 14)	Looks good		
Nighttime Sleep (Age 14)	>1000 & <100	very long and participant did not go to school on a school day; 20 minute sleep time -TUD looked incorrect and it is reasonable to think this is not a typical day	Excluded: 2 (1 meeting each criteria) Updated: 2,653

Note: active transportation values at all ages were from total number of valid time-use diaries used at each timepoint

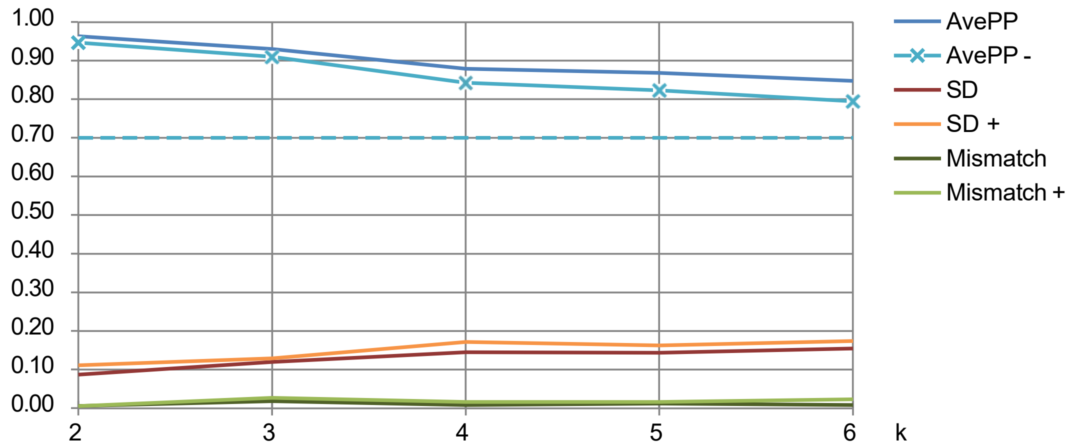
Appendix C.3 Fit-criteria Assessment Plots

Fit-Criteria Assessment Plots (General Male)

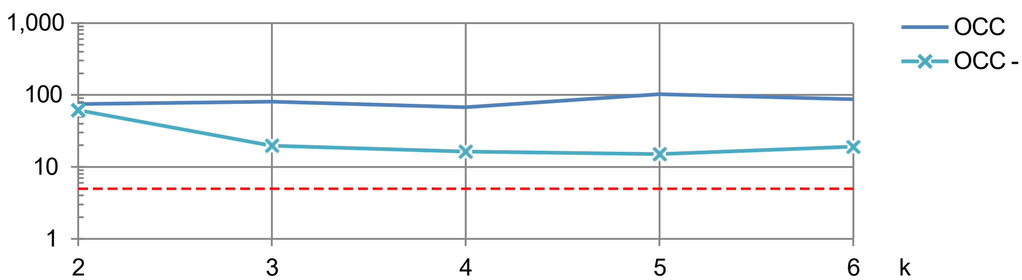
Linear Polynomial



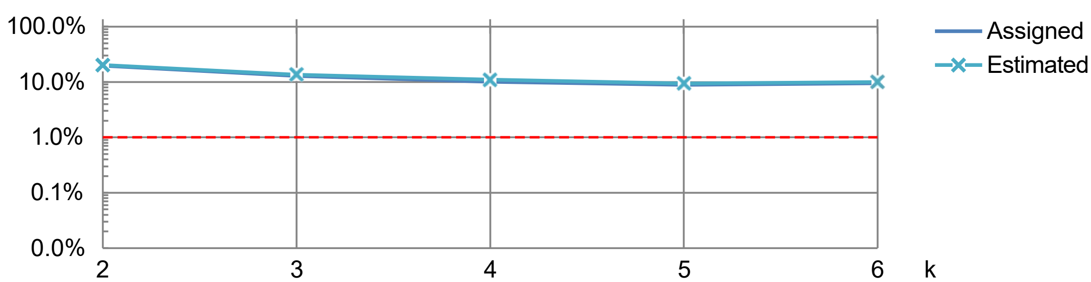
Akaike's information criterion, Bayesian information criterion and Likelihood



Posterior probability, mismatch and SD



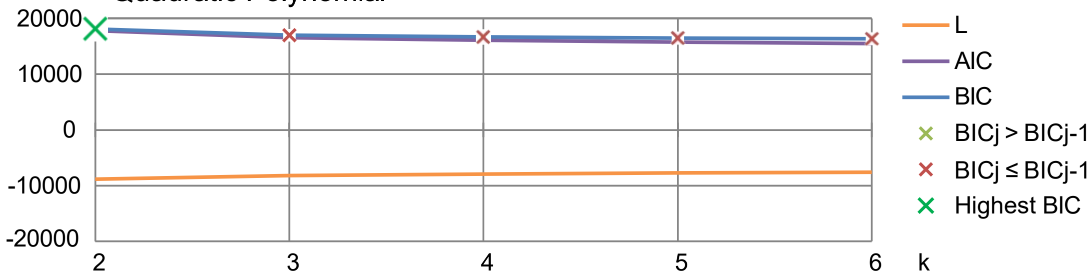
Odds of correct classification



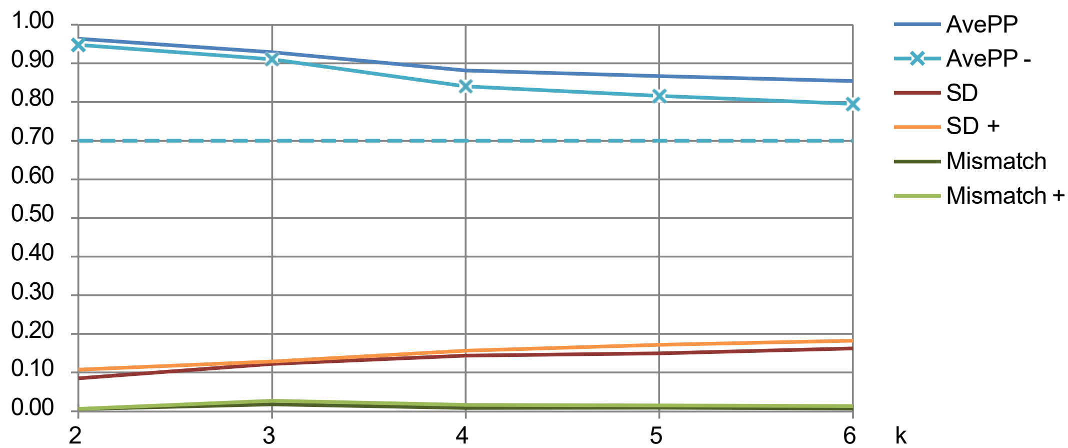
Percentage of individuals belonging to the smallest group

Fit-Criteria Assessment Plots (General Male)

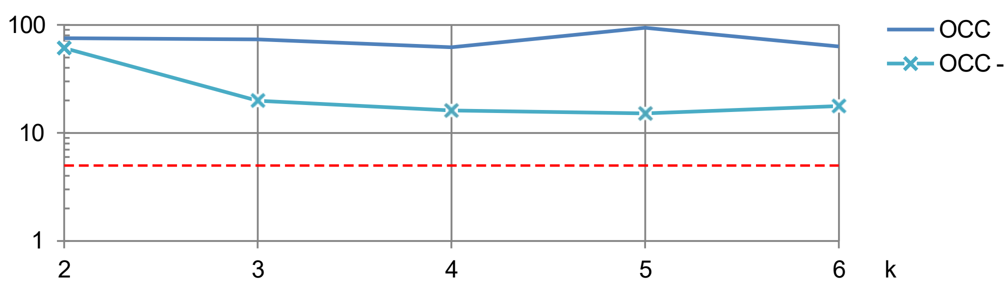
Quadratic Polynomial



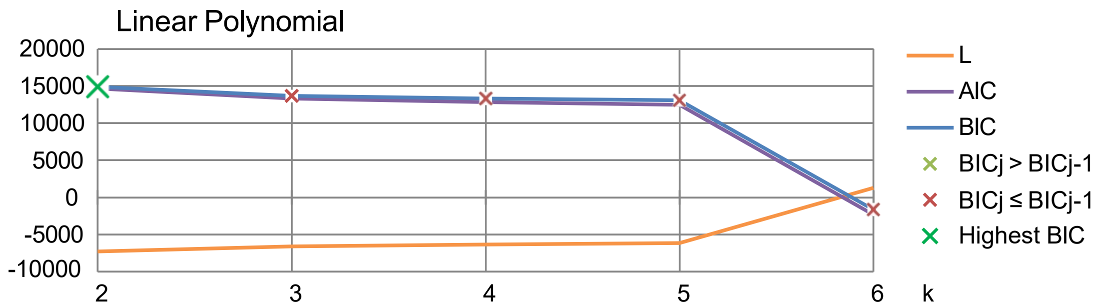
Akaike's information criterion, Bayesian information criterion and Likelihood



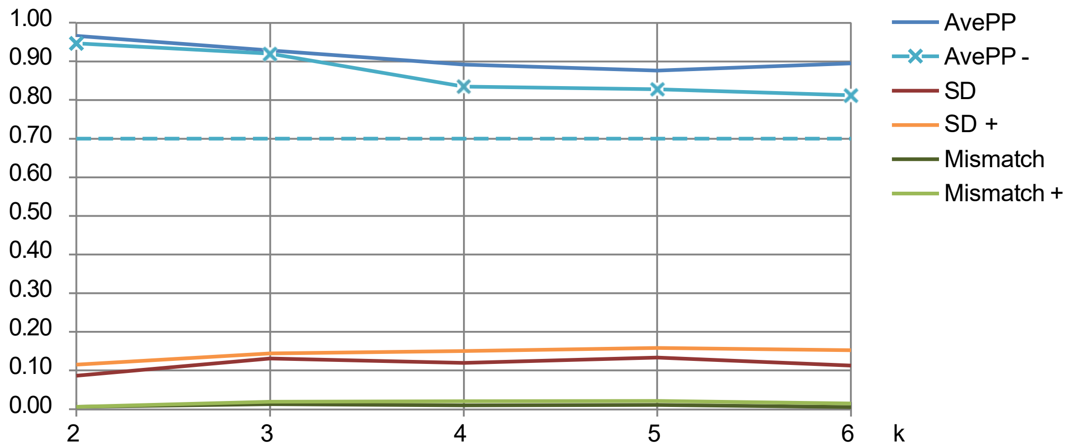
Posterior probability, mismatch and SD



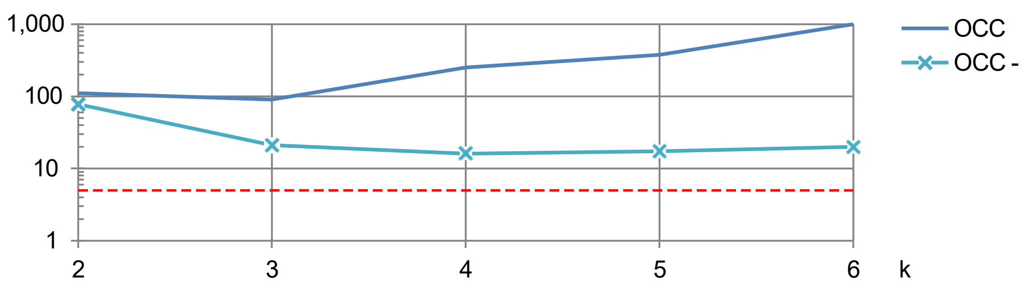
Odds of correct classification



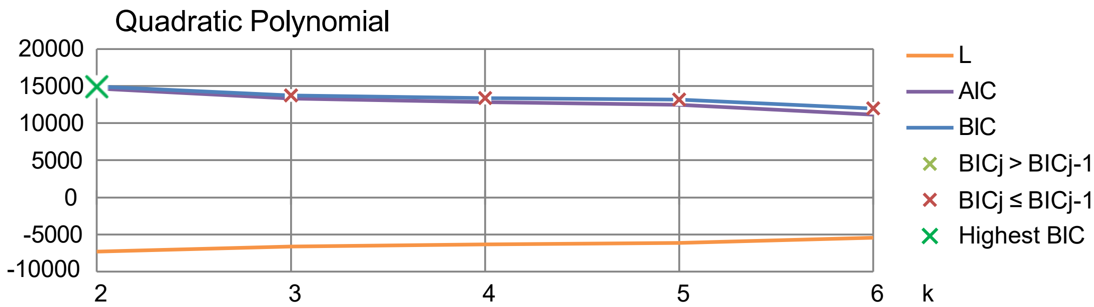
Akaike's information criterion, Bayesian information criterion and Likelihood



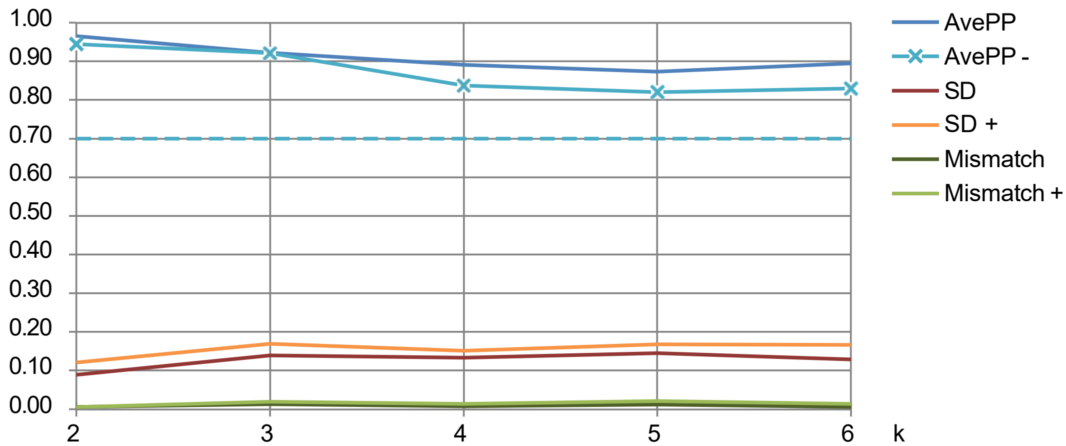
Posterior probability, mismatch and SD



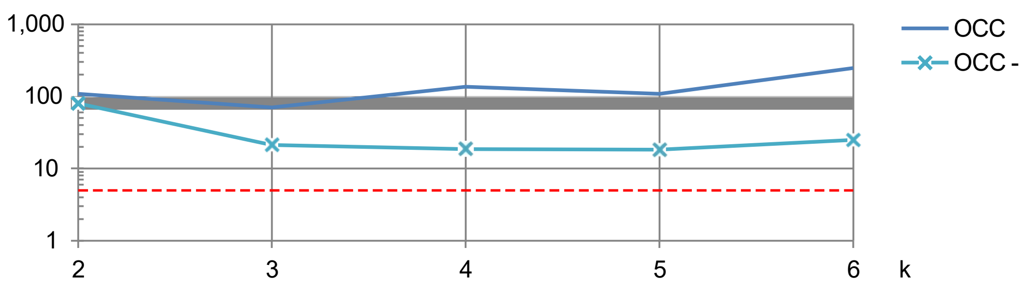
Odds of correct classification



Akaike's information criterion, Bayesian information criterion and Likelihood

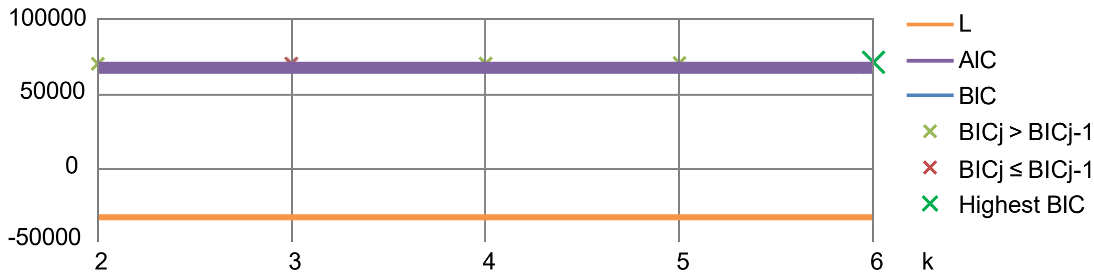


Posterior probability, mismatch and SD

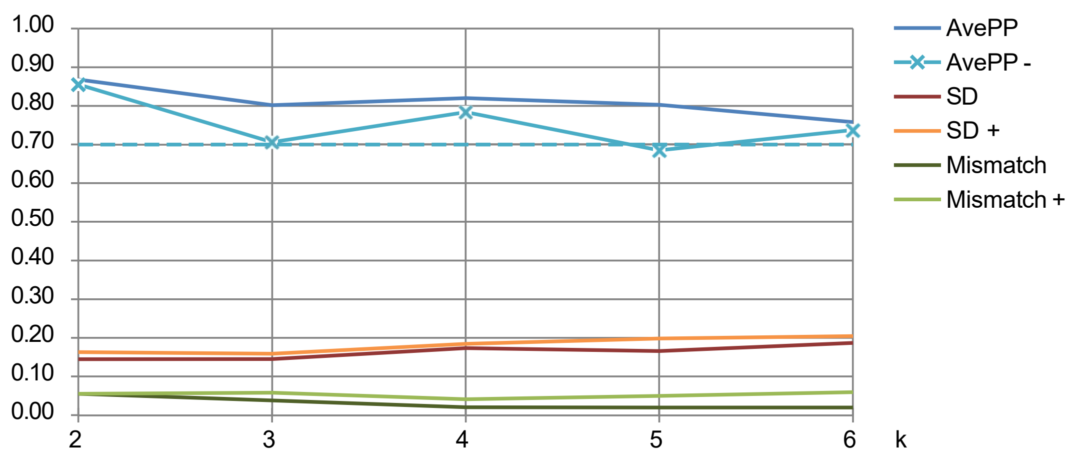


Odds of correct classification

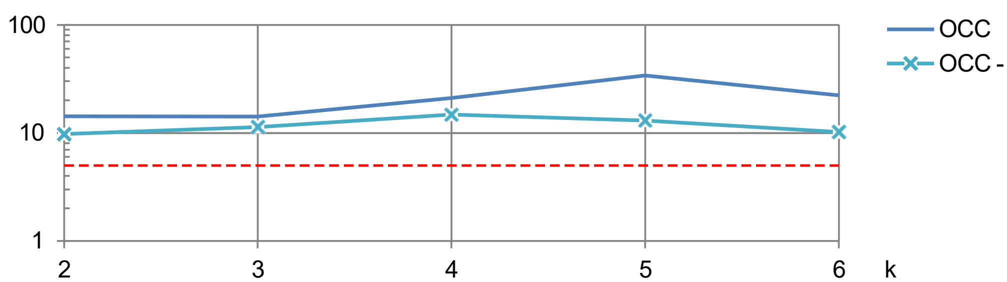
Linear Polynomial



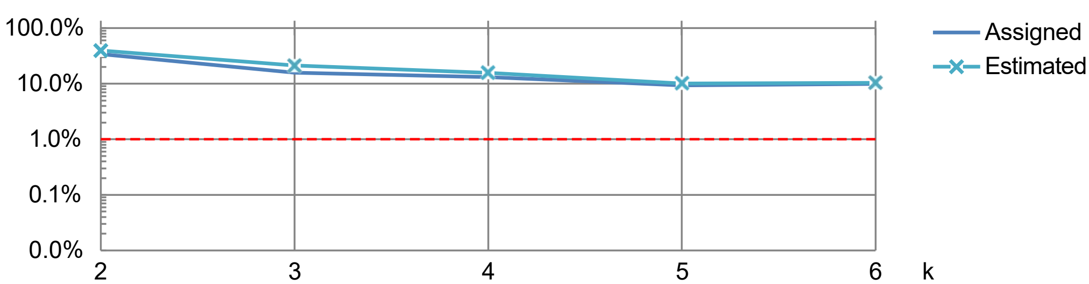
Akaike's information criterion, Bayesian information criterion and Likelihood



Posterior probability, mismatch and SD

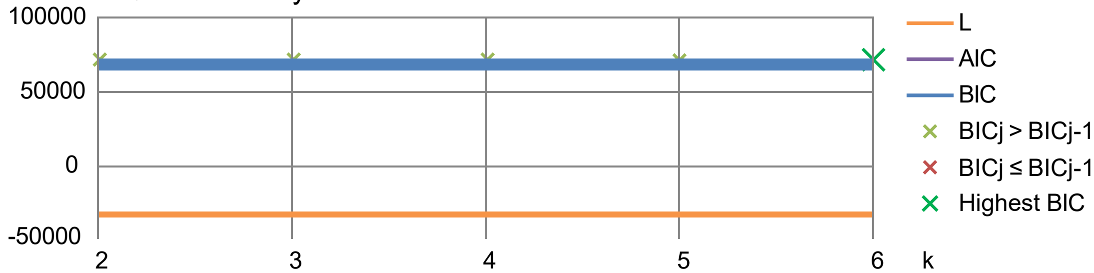


Odds of correct classification

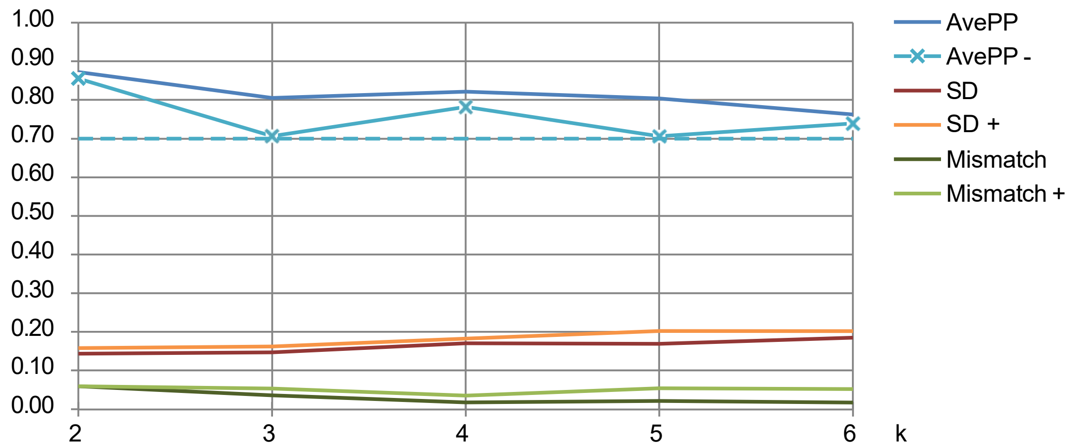


Percentage of individuals belonging to the smallest group

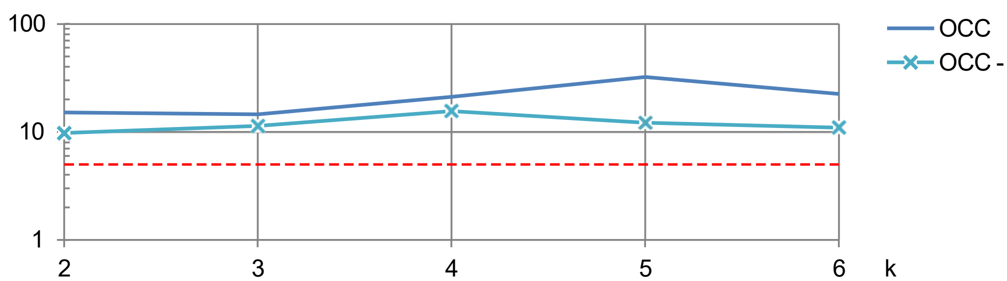
Quadratic Polynomial



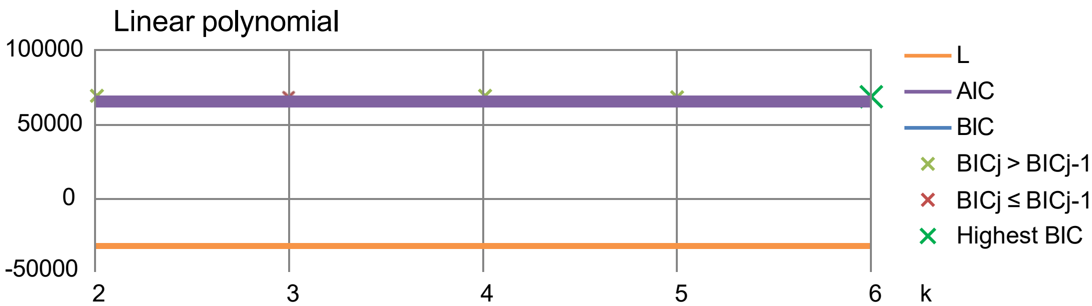
Akaike's information criterion, Bayesian information criterion and Likelihood



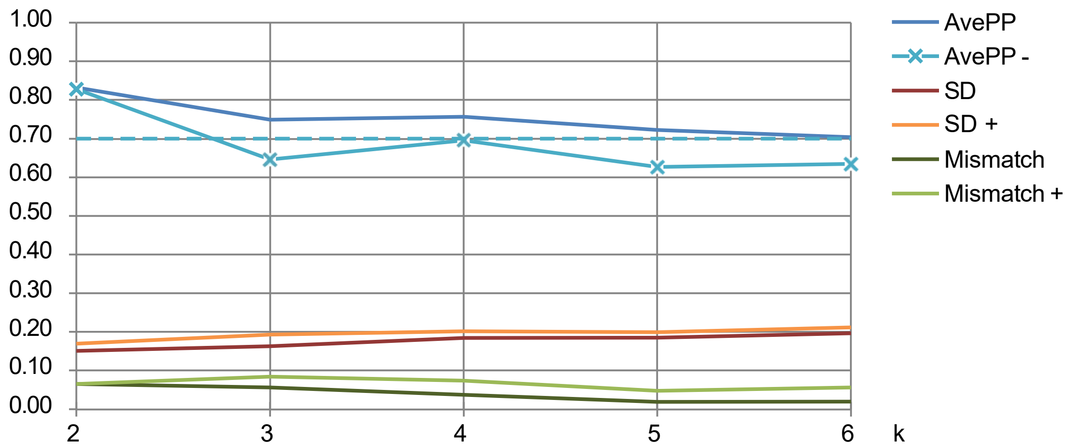
Posterior probability, mismatch and SD



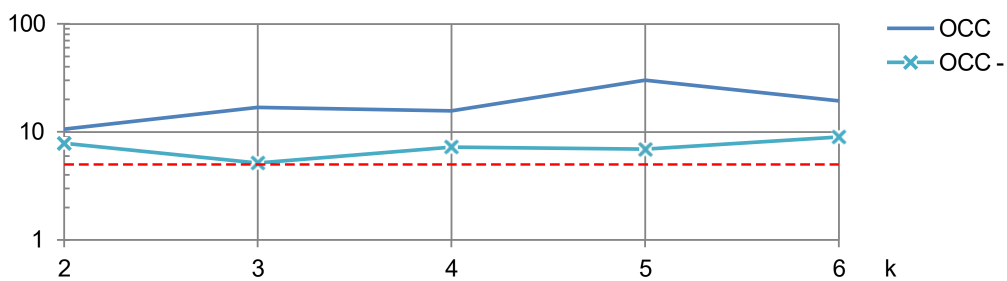
Odds of correct classification



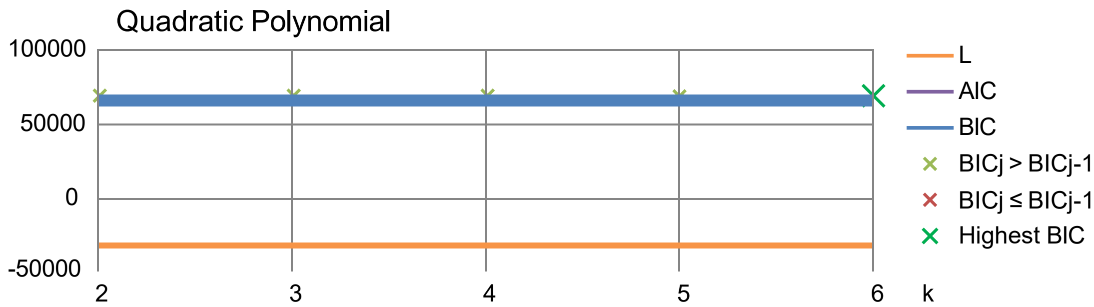
Akaike's information criterion, Bayesian information criterion and Likelihood



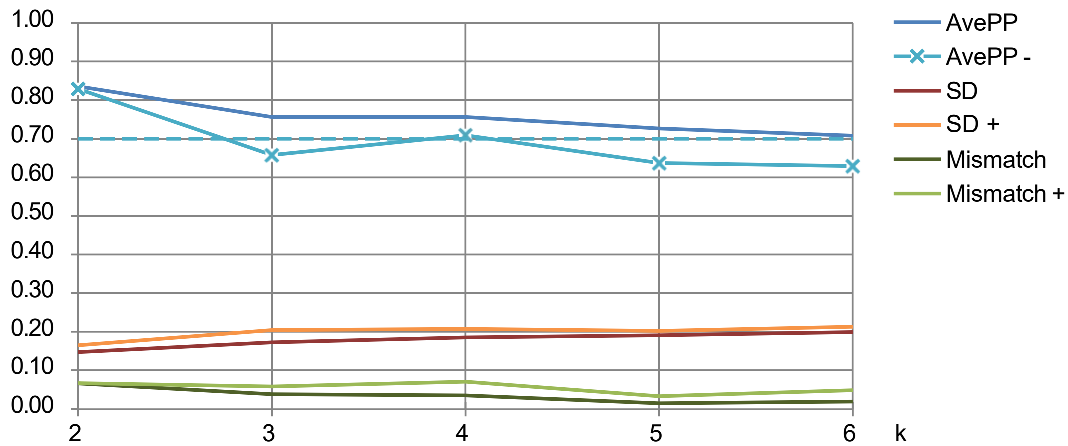
Posterior probability, mismatch and SD



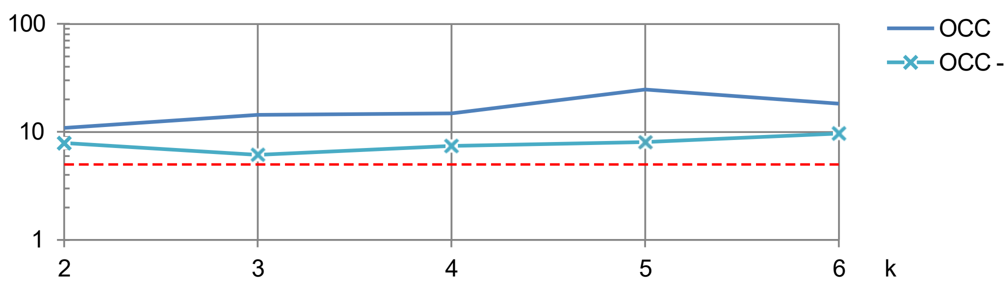
Odds of correct classification



Akaike's information criterion, Bayesian information criterion and Likelihood

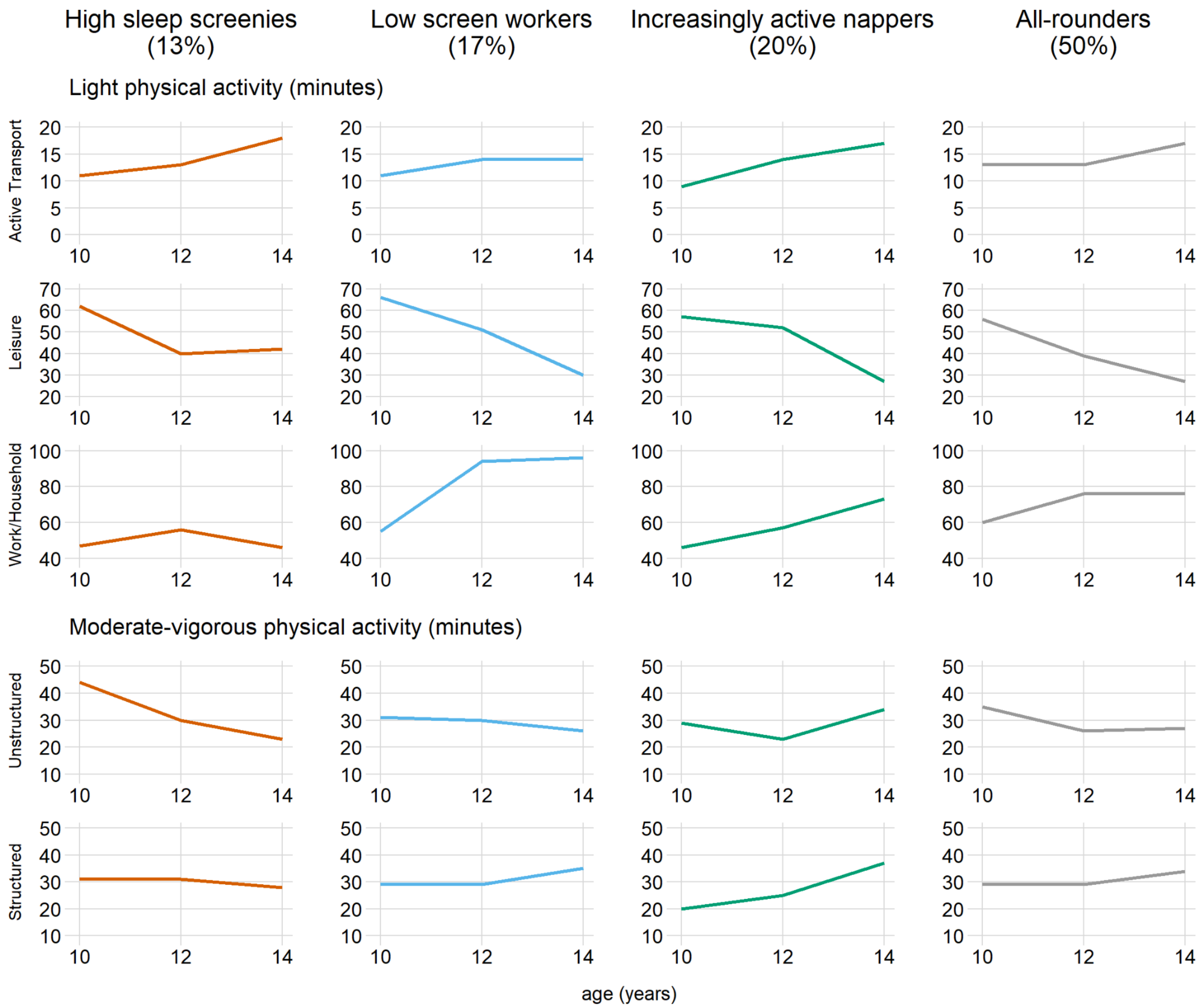


Posterior probability, mismatch and SD

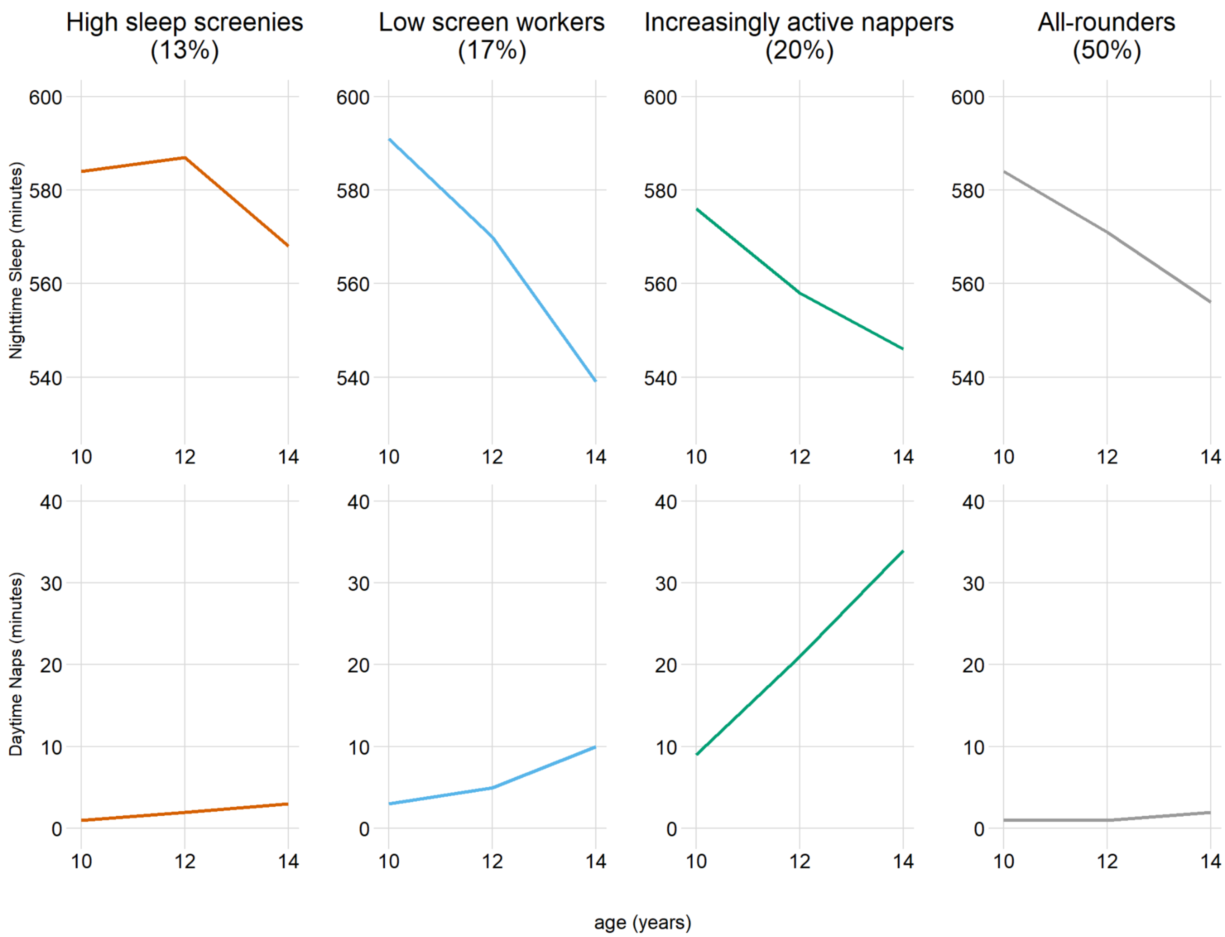


Odds of correct classification

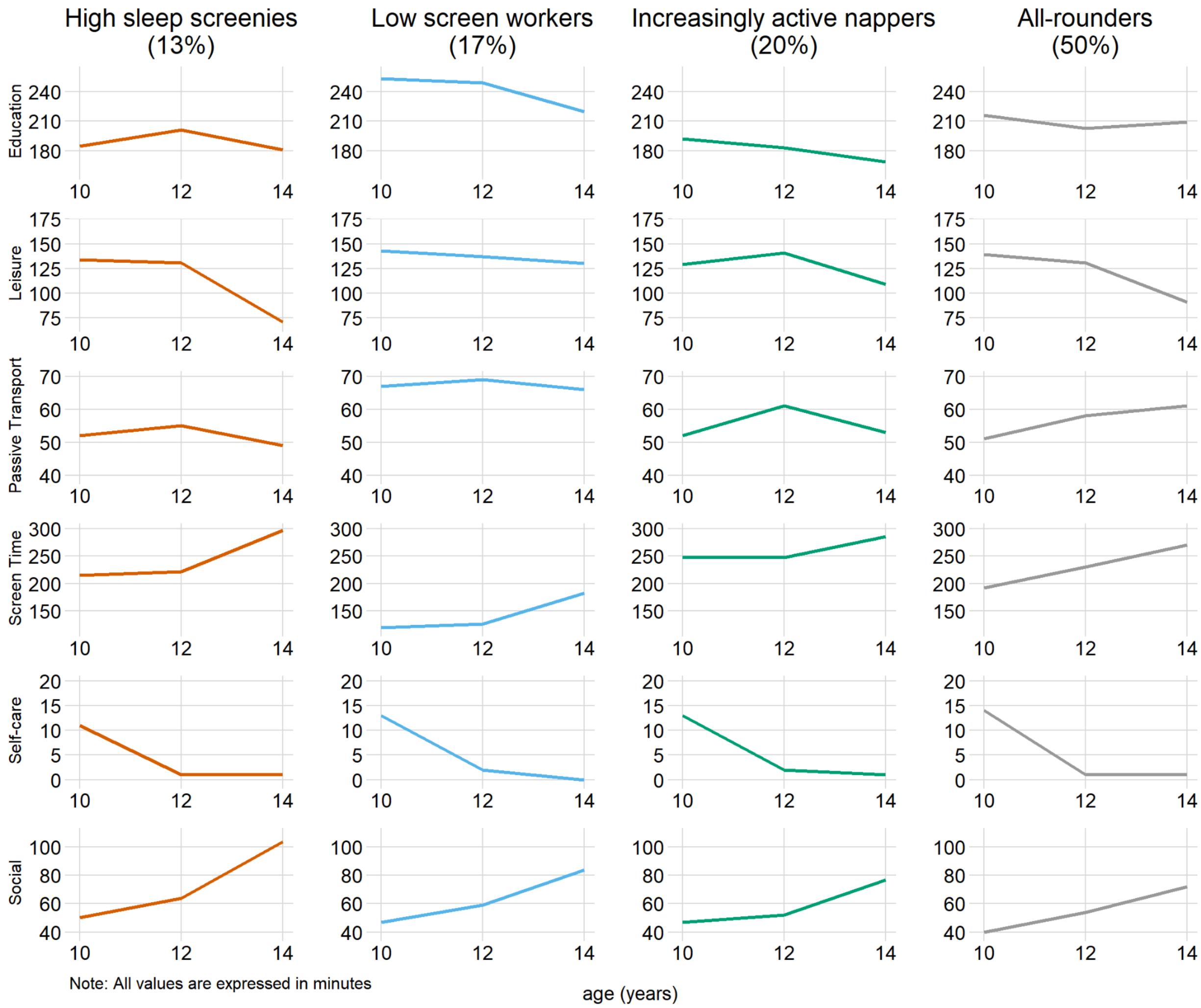
Appendix C.4 Domain-specific Movement Trajectory Profiles



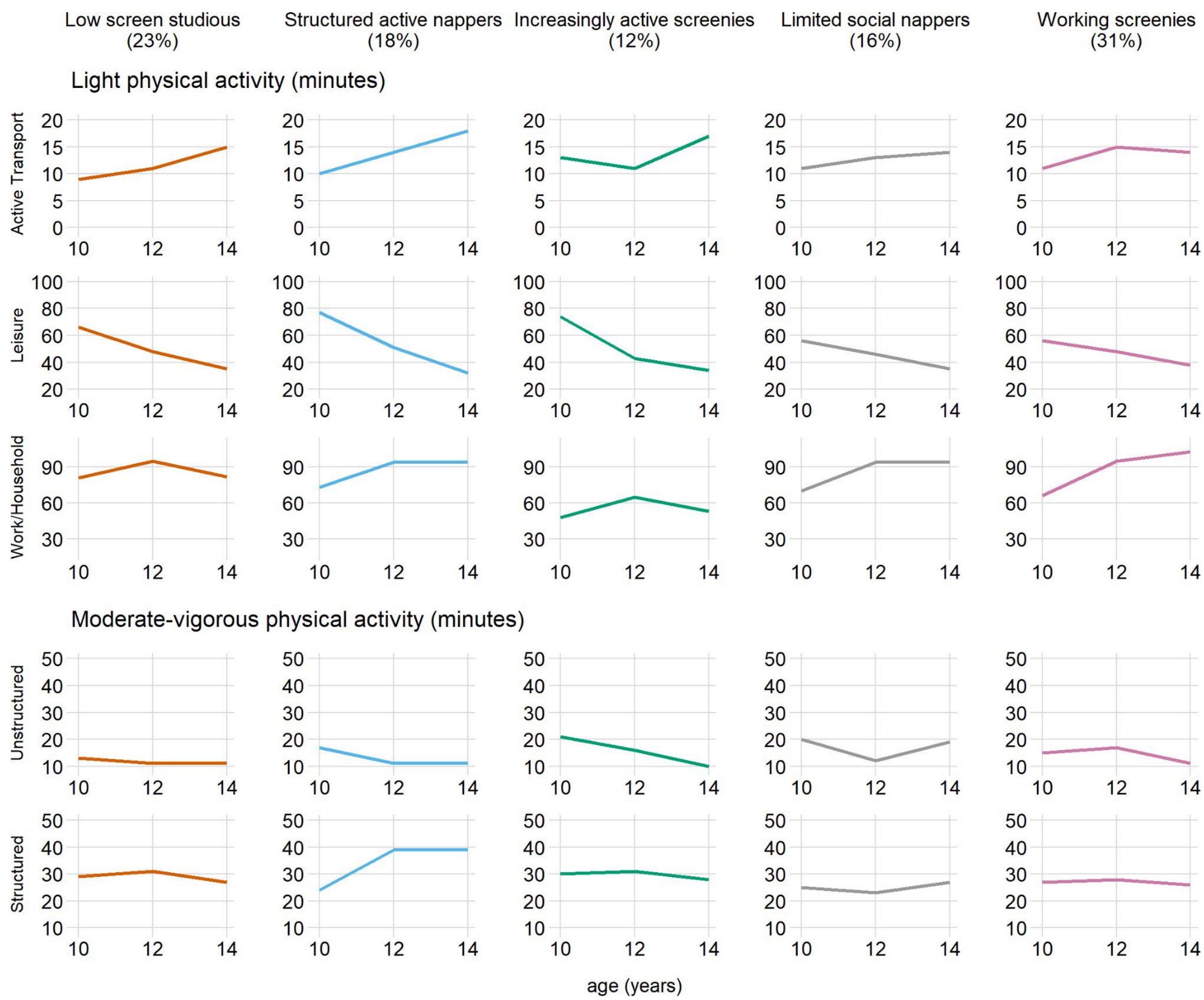
Male Domain-specific Physical Activity Trajectories



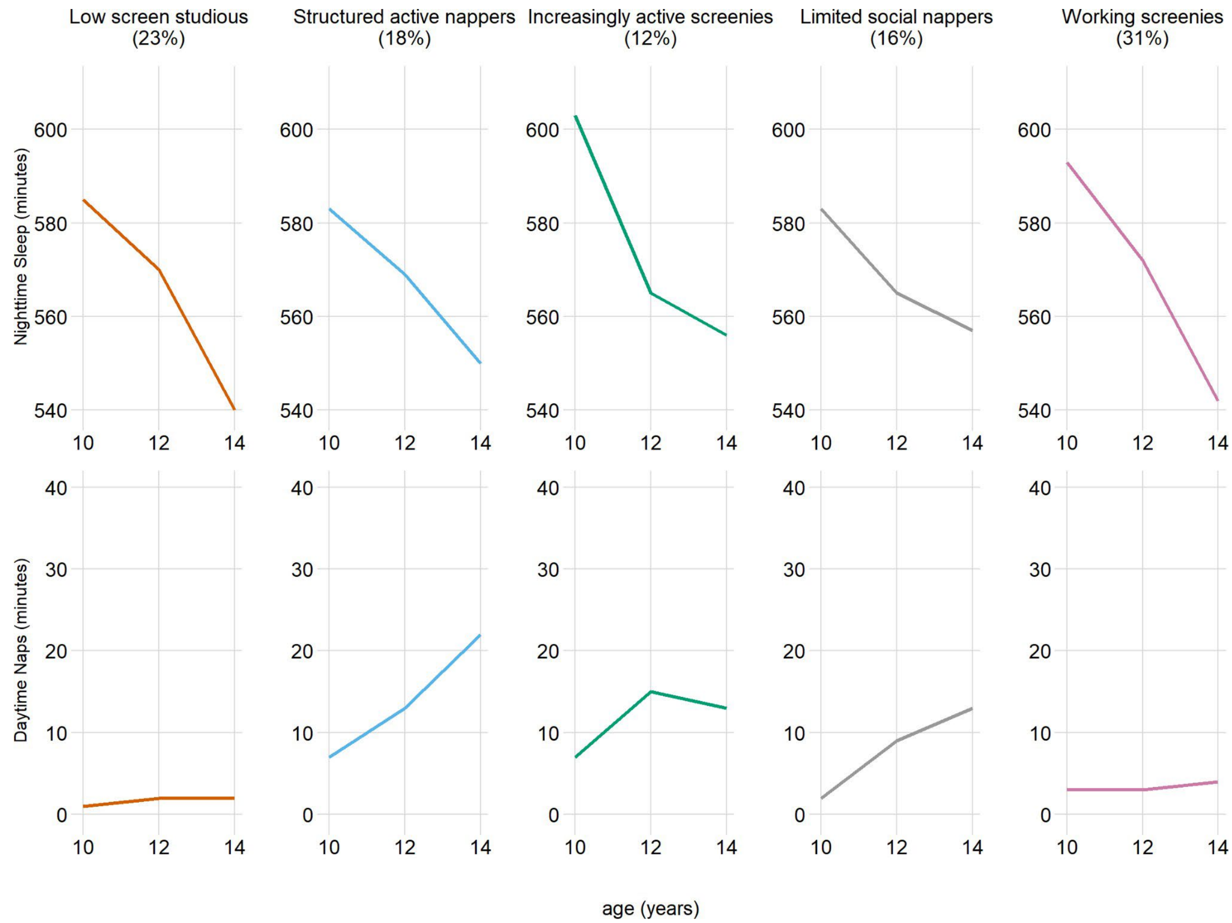
Male Domain-specific Sleep Trajectories



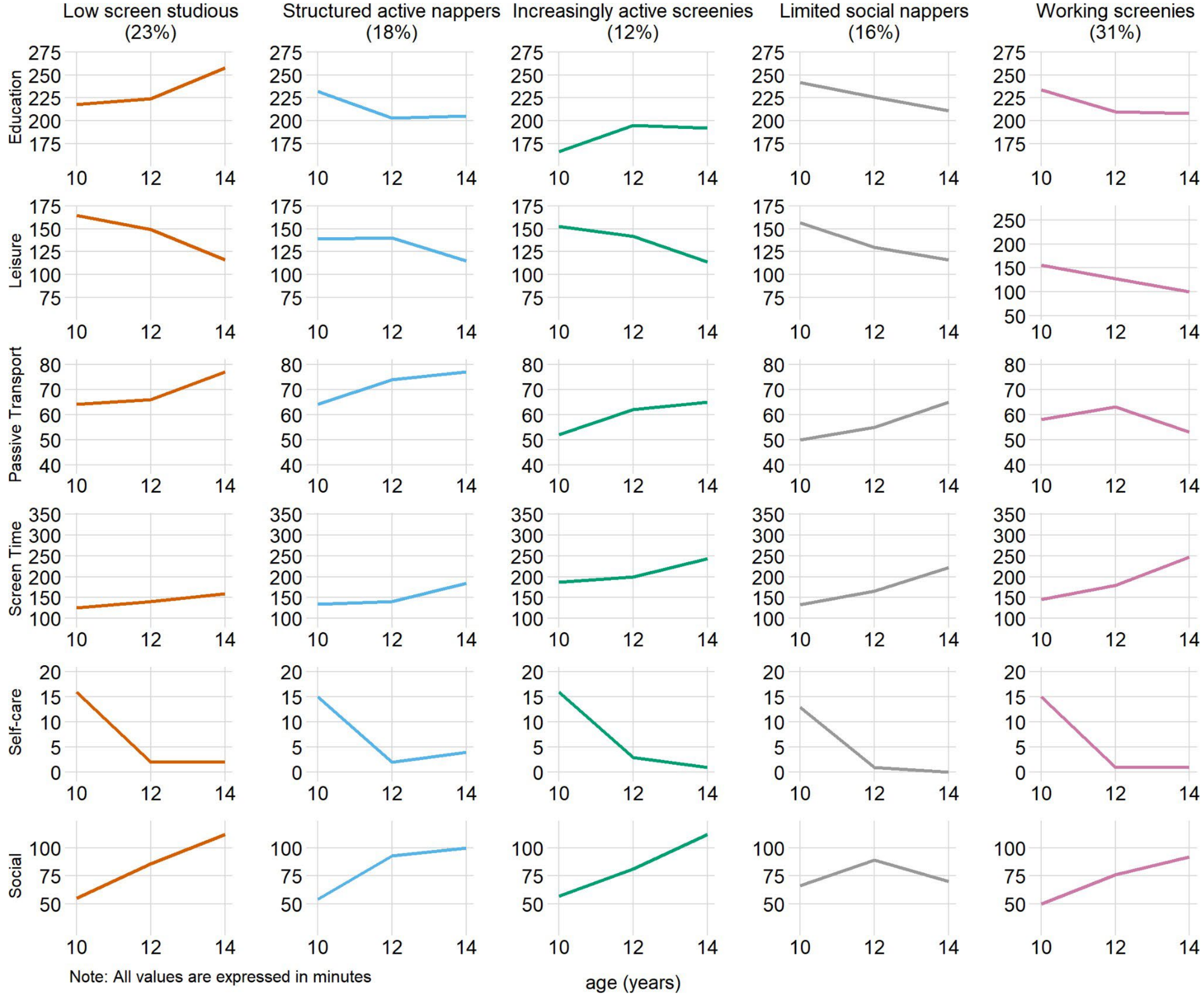
Male Domain-specific Sedentary Behaviour Trajectories



Female Domain-specific Physical Activity Trajectories

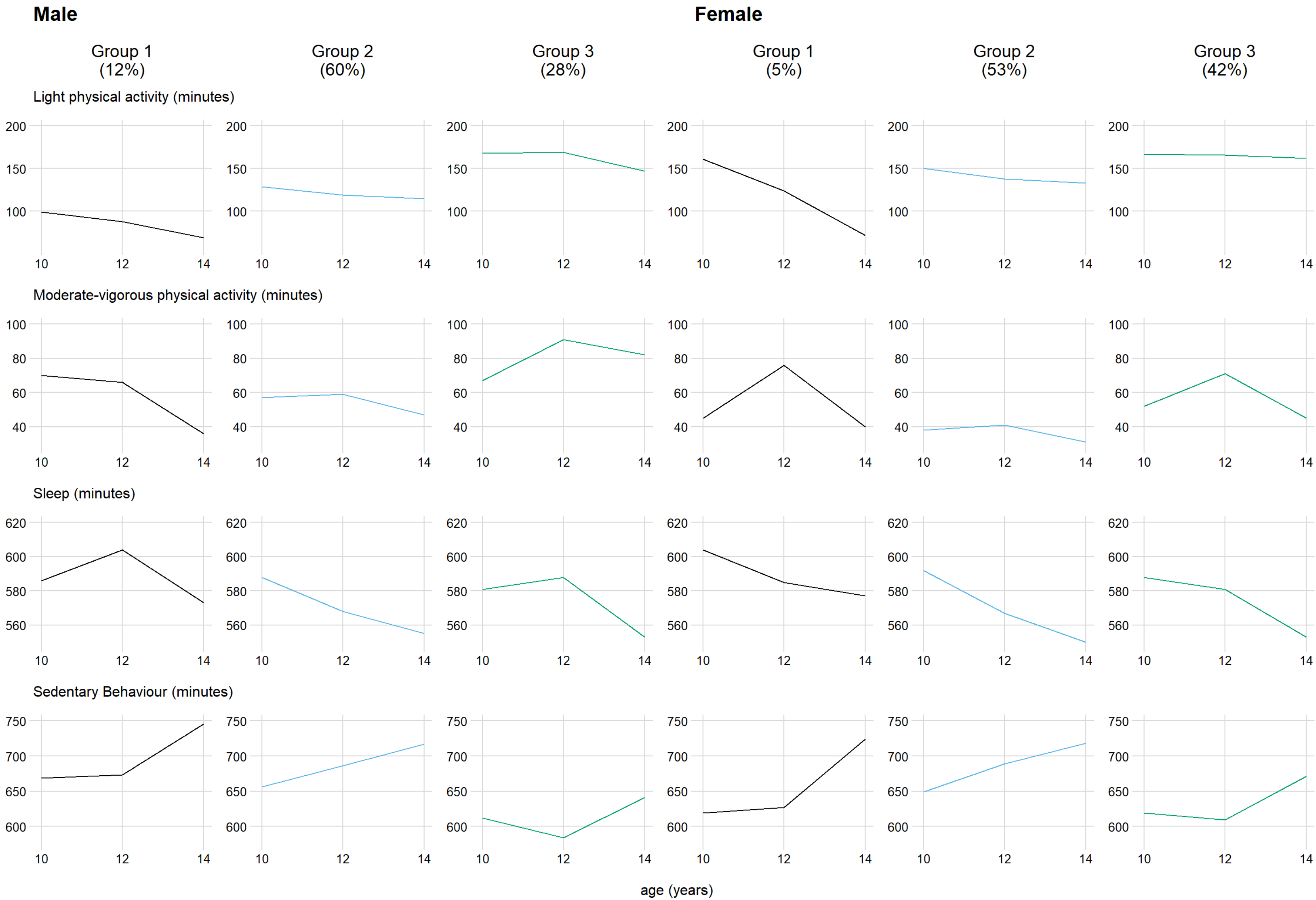


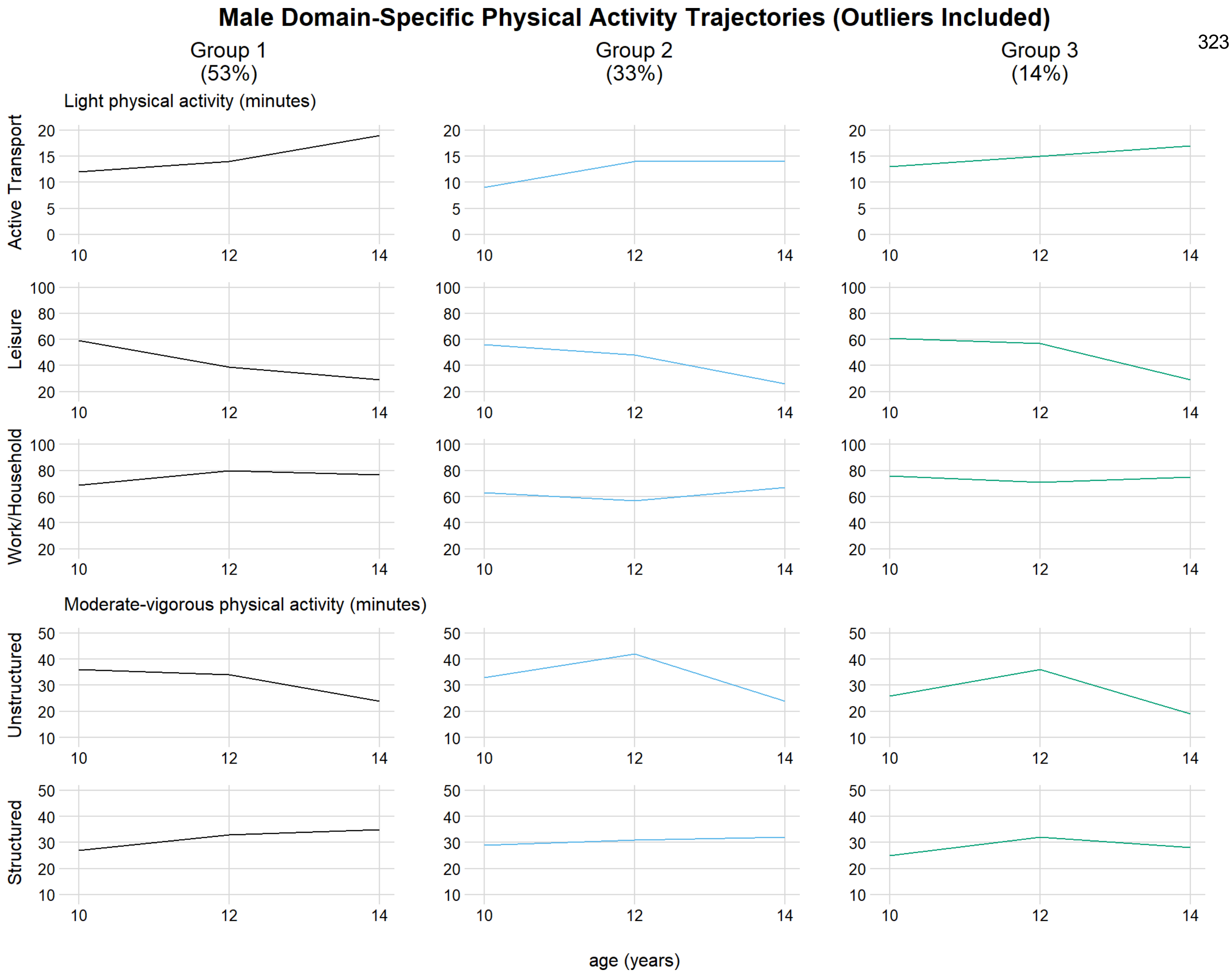
Female Domain-specific Sleep Trajectories

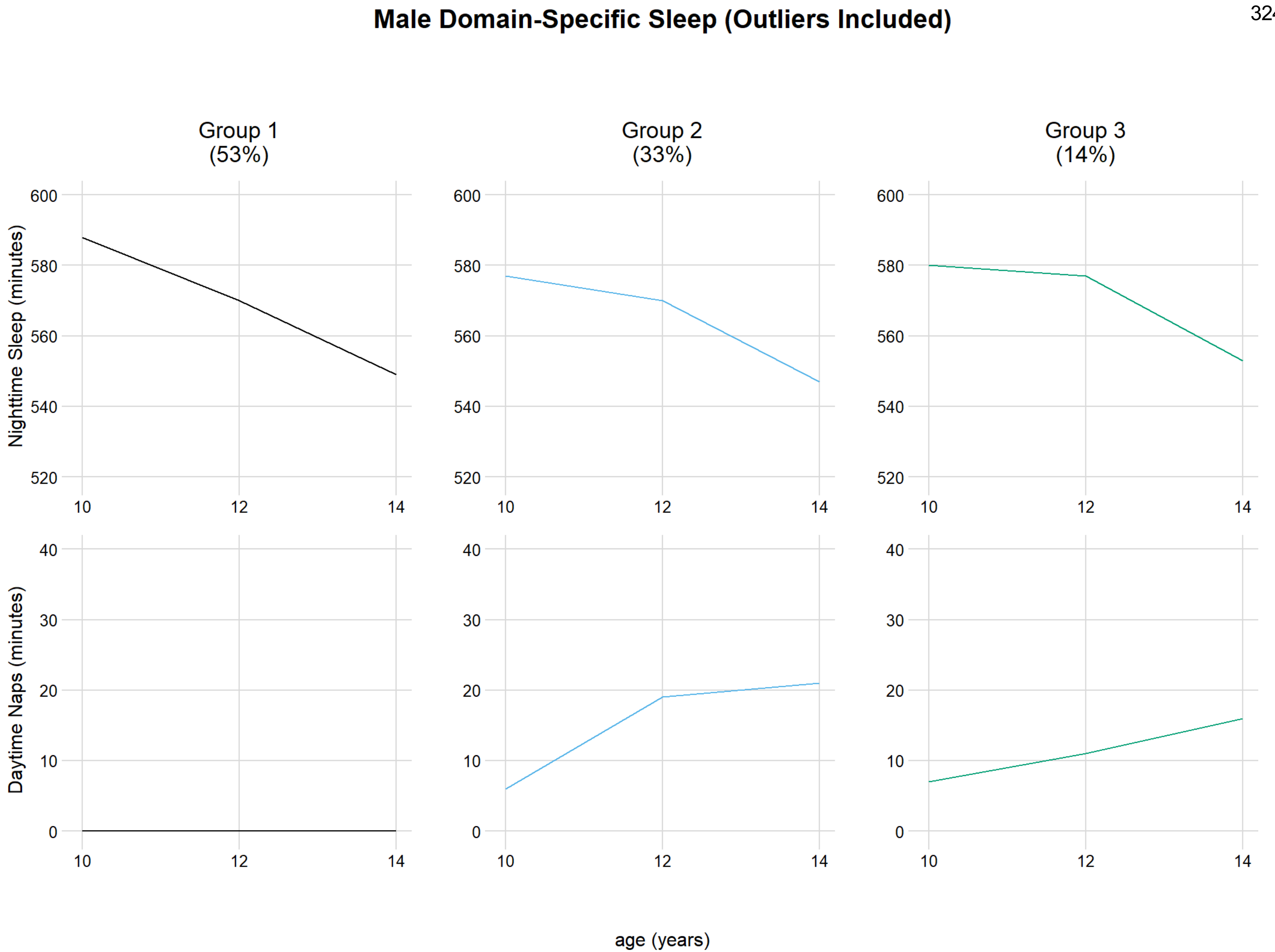


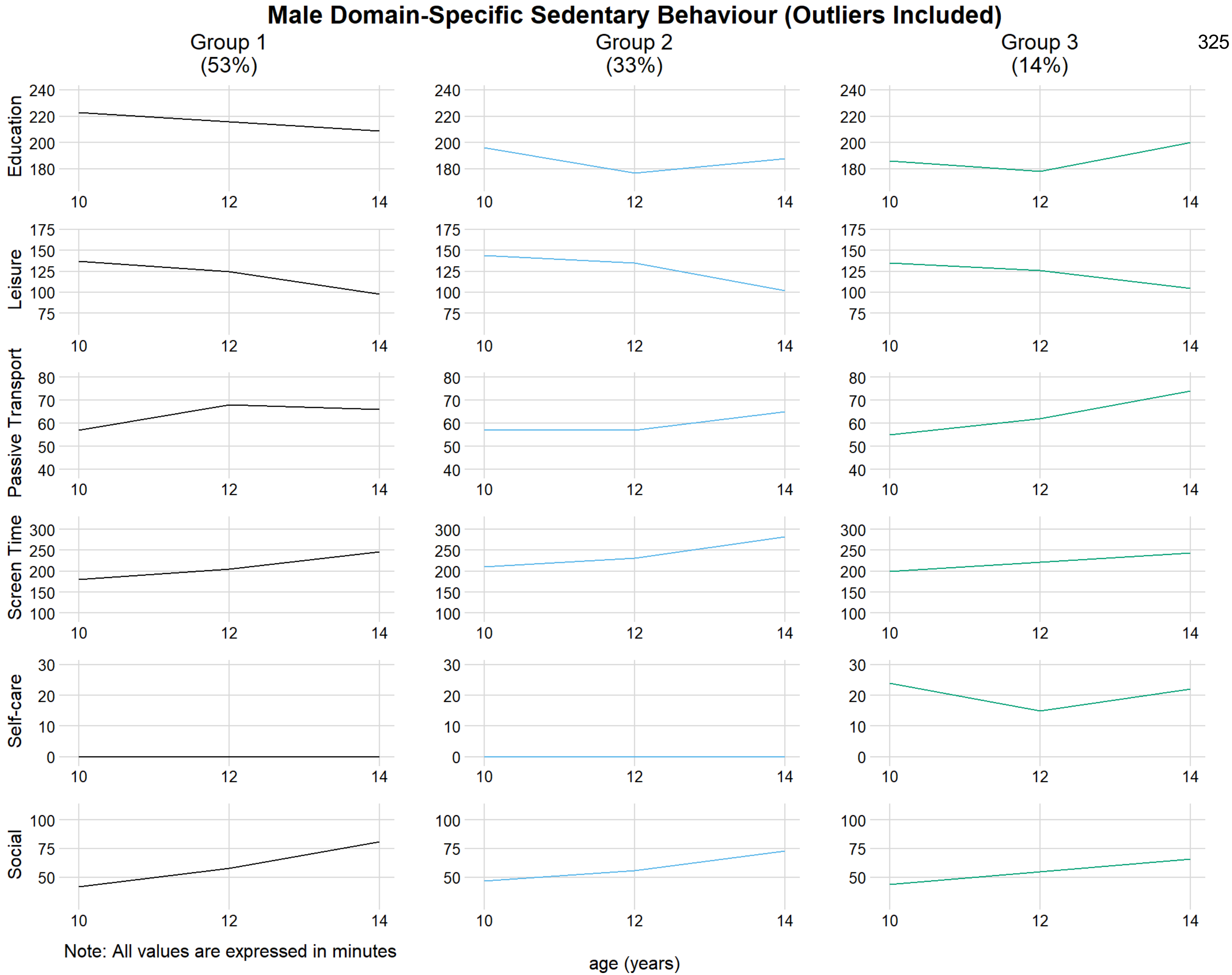
Female Domain-specific Sedentary Behaviour Trajectories

General Movement Behaviour Trajectories (Outliers Included)

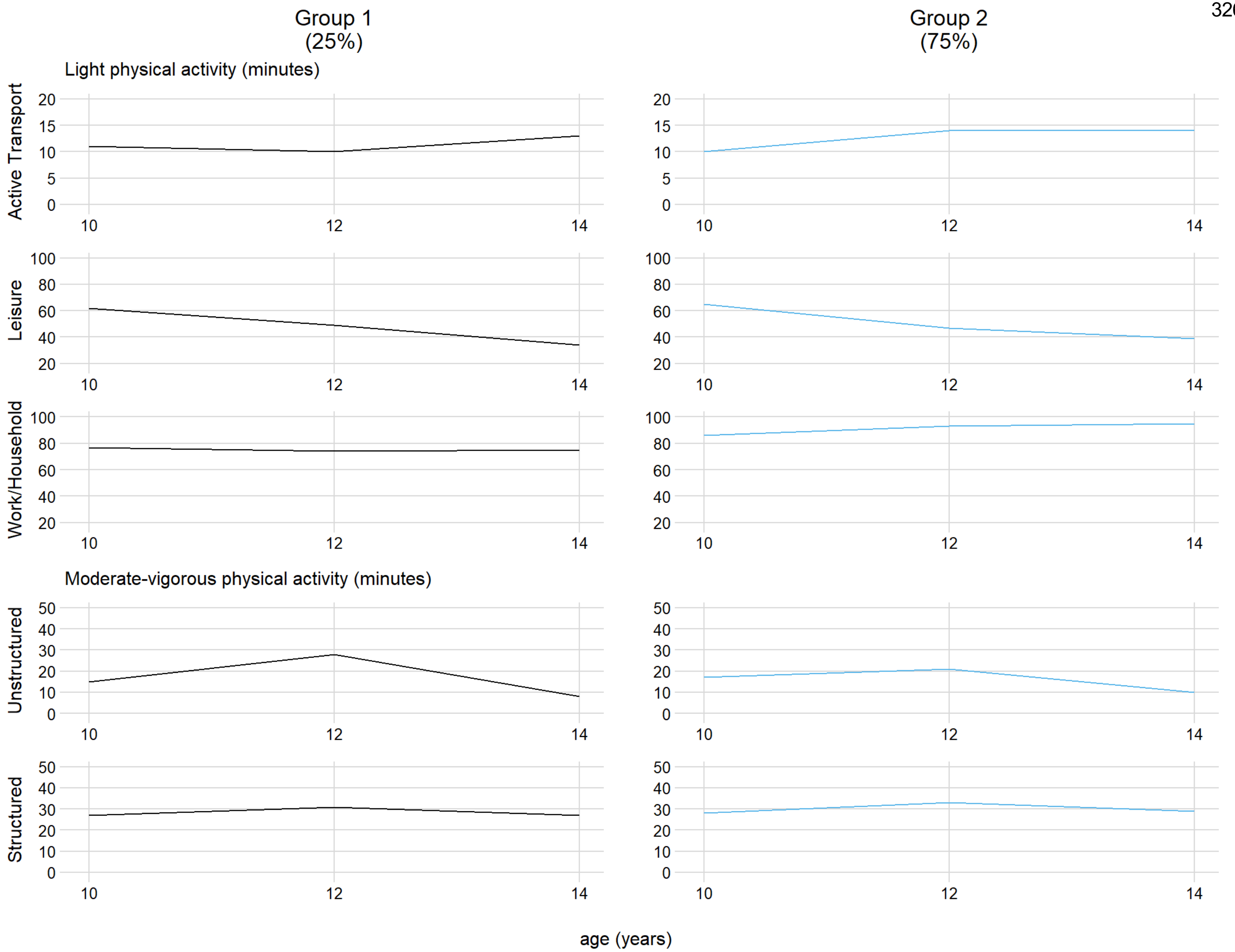


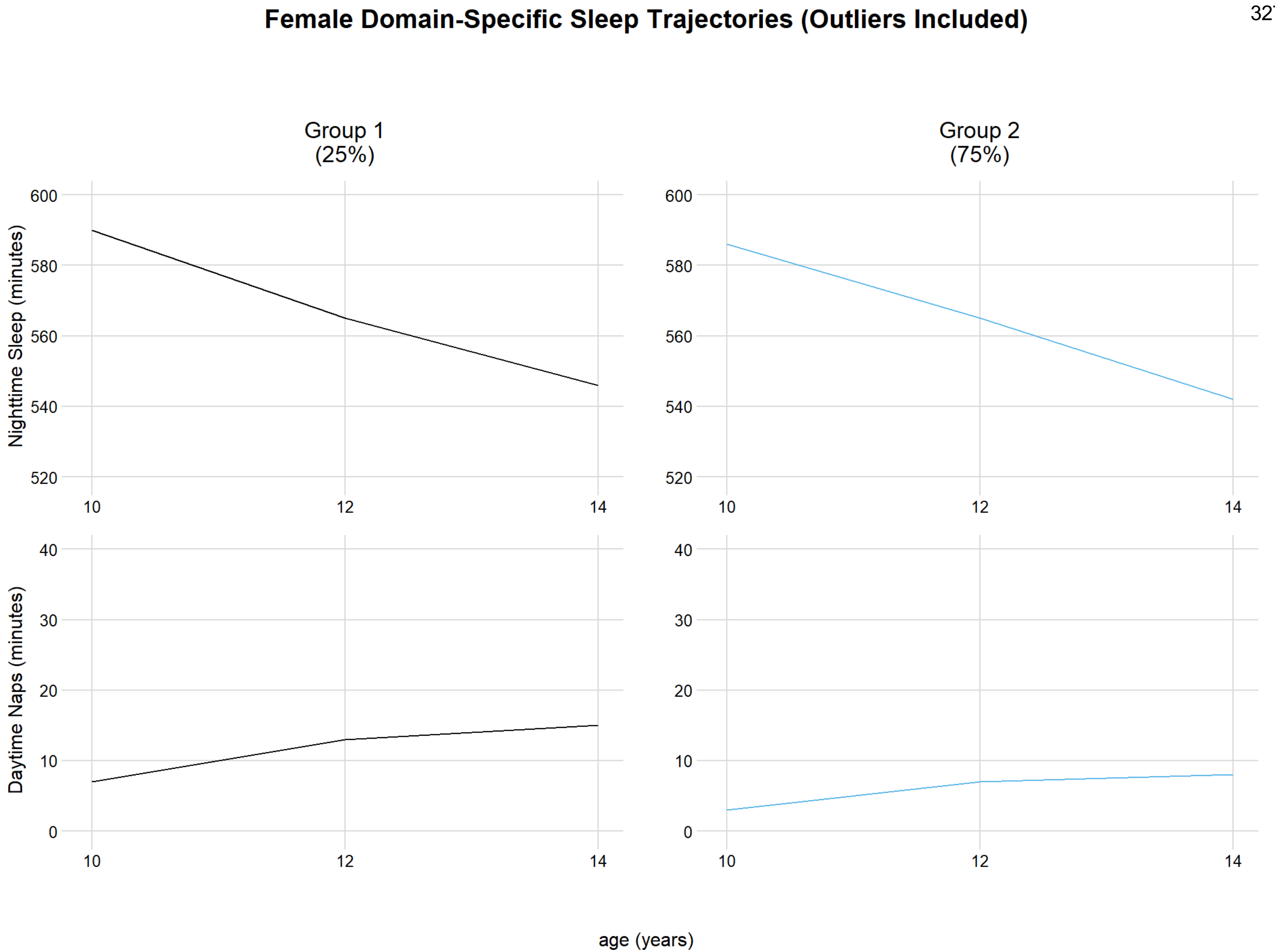

Male Domain-Specific Physical Activity Trajectories (Outliers Included)
Group 1 (53%)
Group 2 (33%)
Group 3 (14%)
Light physical activity (minutes)
Active Transport
Leisure
Work/Household
Moderate-vigorous physical activity (minutes)
Unstructured
Structured
age (years)

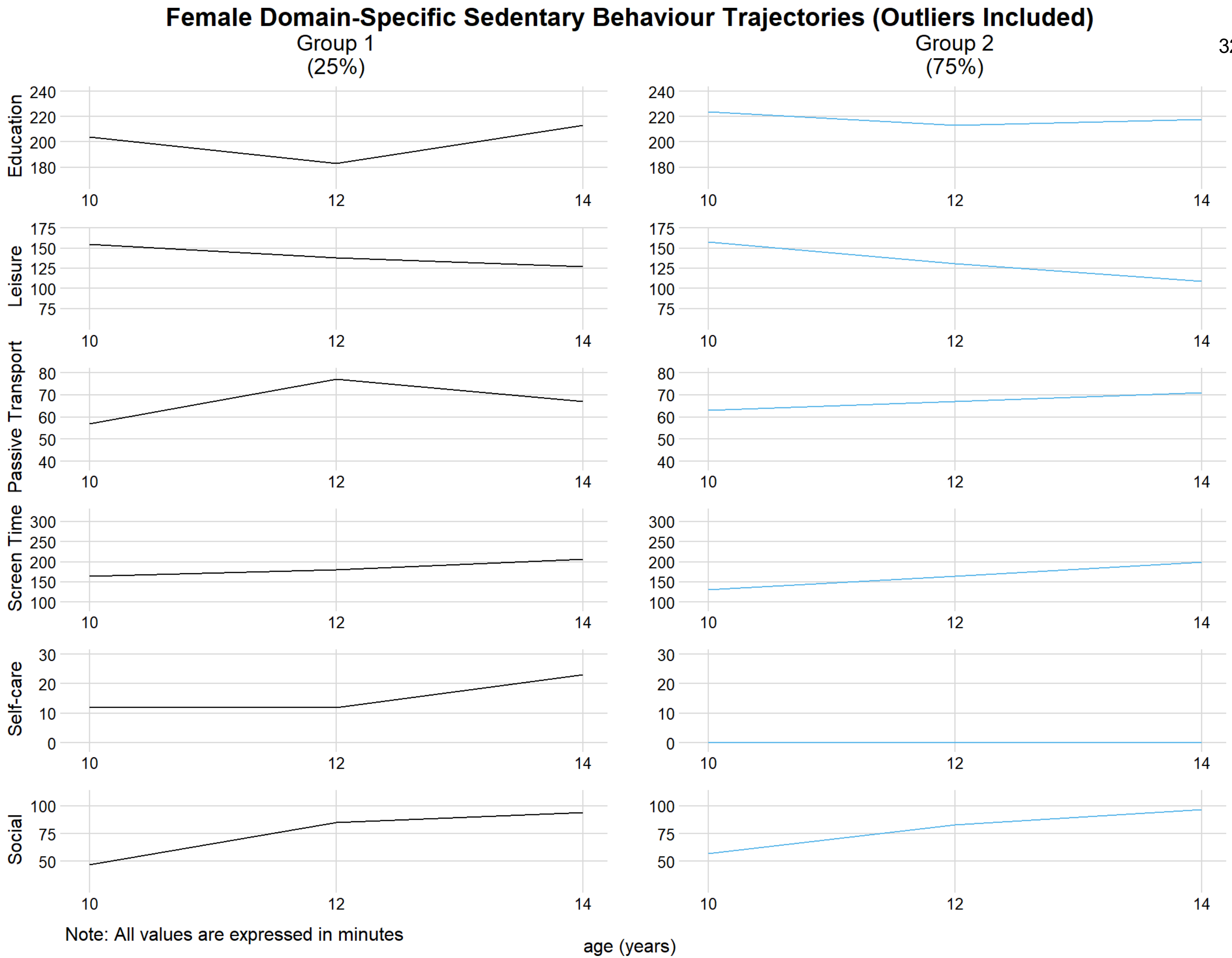

Male Domain-Specific Sleep (Outliers Included)
Group 1
(53%)
Group 2
(33%)
Group 3
(14%)
Nighttime Sleep (minutes)
600
580
560
540
520
10
12
14
Daytime Naps (minutes)
40
30
20
10
0
age (years)


Male Domain-Specific Sedentary Behaviour (Outliers Included)
Group 1
(53%)
Group 2
(33%)
Group 3
(14%)
Education
Leisure
Passive Transport
Screen Time
Self-care
Social
Note: All values are expressed in minutes
age (years)

Female Domain-Specific Physical Activity Trajectories (Outliers Included)




Female Domain-Specific Sleep Trajectories (Outliers Included)
Group 1
(25%)
Group 2
(75%)
Nighttime Sleep (minutes)
Daytime Naps (minutes)
600
580
560
540
520
40
30
20
10
0
10
12
14
age (years)



Note: All values are expressed in minutes

Appendix D.1 Lasso Model Selection

Socio-emotional outcomes	bic	lambda
Males (Single General Movement Behaviours)		
Prosocial behaviour	2777.441	0.14
Hyperactivity-inattentiveness	2777.087	0.19
Emotional problems	2782.418	0.19
Peer problems	2785.158	0.10
Conduct problems	2773.323	0.14
Total score	2774.458	0.15
Males (Combinations of General Movement Behaviours)		
Prosocial behaviour	6978.683	0.18
Hyperactivity-inattentiveness	6975.991	0.18
Emotional problems	6980.934	0.09
Peer problems	6982.523	0.09
Conduct problems	6973.854	0.20
Total score	6973.043	0.20
Females (Single General Movement Behaviours)		
Prosocial behaviour	2626.542	0.13
Hyperactivity-inattentiveness	2615.887	0.20
Emotional problems	2622.148	0.20
Peer problems	2618.425	0.20
Conduct problems	2624.345	0.18
Total score	2611.746	0.20
Females (Combinations of General Movement Behaviours)		
Prosocial behaviour	7010.416	0.13
Hyperactivity-inattentiveness	6999.748	0.20
Emotional problems	7006.026	0.20
Peer problems	7002.294	0.20
Conduct problems	7008.224	0.18
Total score	6995.596	0.20
Males (Single Domain-Specific Movement Behaviours)		
Prosocial behaviour	12619.931	0.12
Hyperactivity-inattentiveness	12618.048	0.12
Emotional problems	12625.798	0.13
Peer problems	12631.335	0.12
Conduct problems	12621.921	0.11
Total score	12622.681	0.12
Males (Combinations of Domain-Specific Movement Behaviours)		
Prosocial behaviour	4996.298	0.20
Hyperactivity-inattentiveness	22159.335	0.18
Emotional problems	5840.788	0.19
Peer problems	29179.170	0.18
Conduct problems	25688.735	0.20
Total score	22352.636	0.20
Females (Single Domain-Specific Movement Behaviours)		
Prosocial behaviour	12215.894	0.12
Hyperactivity-inattentiveness	12213.278	0.20
Emotional problems	12218.268	0.18
Peer problems	12215.824	0.20
Conduct problems	12218.988	0.10
Total score	12205.443	0.12
Females (Combinations of Domain-Specific Movement Behaviours)		
Prosocial behaviour	-25424.044	0.19
Hyperactivity-inattentiveness	18137.279	0.20
Emotional problems	-57320.384	0.20
Peer problems	13248.269	0.18
Conduct problems	-23063.234	0.19
Total score	9857.506	0.20

Note:

Socio-Emotional Outcomes are based on scores from the Strengths and Difficulties Questionnaire.