UiT The Arctic University of Norway

Faculty of Health sciences
School of Sport Sciences

Accelerometer-measured physical activity in Norwegian adolescents

Results from The Fit Futures Study

Sigurd Klemetsen Beldo

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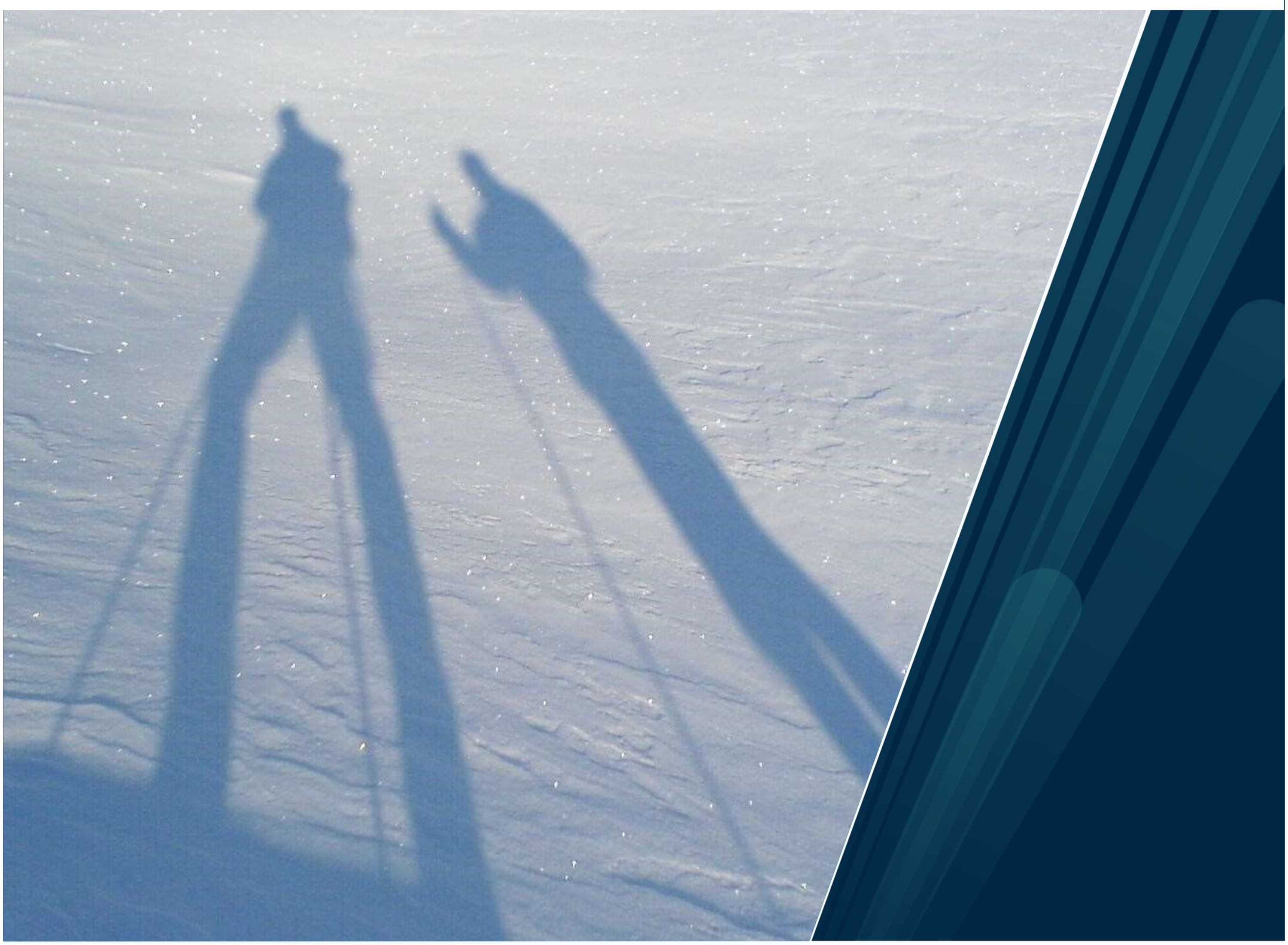

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Summary

Background: Evidence from both clinical interventions and epidemiological studies underlines that physical activity (PA) is essential for health. Although children and adolescents in general have not lived long enough to develop serious morbidity of non-communicable diseases, research indicates that PA has beneficial effects on musculoskeletal health, overweight, blood pressure, anxiety and depression, and academic performance in youth as well as adults. Moreover, there is an increase in childhood overweight and obesity worldwide, which might be linked to low levels of PA, although findings are ambiguous. For children and adolescents, the present recommendations on PA from the WHO are to accumulate on average at least 60 minutes of moderate-to-vigorous PA (MVPA) each day. Previous studies show large variations in PA levels among adolescents, which may be partly due to a lack of standardized ways of measuring PA in adolescents. In Norway there is a paucity of data on older adolescents and PA on several areas, and this thesis has sought to fill some of the gaps: Level of device measured PA, correlations between accelerometer measured PA and self-reported PA, and effects of measured PA on body composition during secondary high school.

Objectives: The aim of this thesis is 1) to examine the prevalence and patterns of accelerometer-measured PA in a cohort of 16-17-year-old adolescents in Northern Norway, 2) to assess to what extent accelerometer measurements coincide with self-reported PA in a sample of Norwegian adolescents, using a well-established questionnaire, and 3) to explore the association between accelerometer-measured PA and the change in five different measures of body composition over 2 years of follow-up.

Methods: The study is based on data from two surveys: Fit Futures 1 (FF1) performed in 2010-11 and Fit Futures 2 (FF2) performed in 2012-13. All students in their first (FF1) and third (FF2) year of upper secondary high school in the neighboring counties of Tromsø and Balsfjord were invited to attend a clinical examination and answer a questionnaire. The participants were also invited to wear an accelerometer (Actigraph GT3X) attached to their hip for seven consecutive days. In paper I, PA was expressed as total volume (counts per minute, CPM), time spent in intensity zones, steps per day, and fulfilment of WHO recommendation, i.e. accumulation of 60 minutes or more of at least moderate intensity PA per day. In paper II, we used Spearman's rho and one-way analyses of variance (ANOVA) to assess the validity of the SGPALS against the following accelerometry estimates of PA; mean counts/minute (CPM), steps/day, and minutes/day of MVPA. In paper III, participants underwent a low radiation Dual Energy X-Ray Absorptiometry (DXA) scan, which produced estimates of fat mass, lean mass and appendicular lean mass (sum of lean mass in the four extremities) used to calculate Fat Mass Index (FMI), Lean Mass Index (LMI) and appendicular Lean Mass Index (aLMI) for analyses of the association between PA and body composition.

Results: Less than 25% of the participants fulfilled current WHO recommendations for PA in adolescents. However, 73% of the adolescents acquired ≥30 minutes of MVPA per day. Boys were more physically active than girls in terms of accumulated minutes of MVPA and CPM, whereas steps per day were similar between boys and girls. Both boys and girls were more active on weekdays than weekends.

We found positive associations between self-reported PA measured with the SGPALS, and accelerometer-measured PA. Although the observed correlations between the SGPALS and accelerometer measured PA were weak, the ranking ability of the SGPALS was satisfactory, showing a notable and gradual increase in accelerometer measures for each increase in level of SGPALS.

Both boys and girls had statistically significant increases in the measures of body composition (except LMI and appendicular lean mass in girls) over the two-year follow-up. We found no associations between minutes spent in MVPA at baseline and subsequent two-year changes in BMI, waist circumference or FMI in boys or girls. In girls but not in boys, more sedentary time was associated with a reduction in LMI and aLMI, whereas more light activity had opposite effects on LMI and aLMI.

Conclusion: In this cohort of adolescents, less than 25 % of 16-17-year-old boys and girls fulfilled the WHO recommendations. In adolescents, the SGPALS seems able to rank PA levels, which indicates that short questionnaires on PA have sufficient validity to assess PA levels in many clinical settings as well as surveys, although the low correlation with accelerometer data suggests that the usefulness in estimating PA volumes is rather low. Minutes spent in baseline MVPA were not associated with subsequent changes in measures of body composition. Sedentary time and light PA were associated with changes in LMI and aLMI in girls, but not boys.

Norsk sammendrag

Bakgrunn: Både kliniske og epidemiologiske studier understreker at fysisk aktivitet (PA) er viktig for helsen. Selv om barn og ungdom ikke har levd lenge nok til å utvikle alvorlig sykelighet av ikke-smittsomme sykdommer, indikerer forskningen at PA har gunstige effekter på muskel- og skjeletthelse, fedme, blodtrykk, angst og depresjon og akademiske prestasjoner både hos ungdom og voksne. Videre er det en økning i overvekt og fedme hos barn over hele verden, noe som kan være knyttet til lave nivåer av PA, selv om funnene er tvetydige. De nåværende WHO-retningslinjene om PA for barn og ungdom anbefaler minst 60 minutter med moderat til hard PA (MVPA) i gjennomsnitt hver dag. Tidligere studier viser store variasjoner i PA-prevalenser blant ungdommer, noe som delvis kan skyldes mangel på standardiserte målemetoder for PA hos ungdom. Saltin-Grimby Physical Activity Level Scale (SGPALS) brukes ofte til å måle fysisk aktivitet i populasjonsstudier, men validiteten hos ungdom er ukjent.

Mål: Målet med denne avhandlingen var 1) å undersøke prevalens og mønstre av akselerometer-målt PA i en kohort av 16-17 år gamle ungdommer i Nord-Norge; 2) å undersøke validiteten av selvrapportert PA sammenlignet med akselerometermålinger som gullstandard, og 3) å undersøke sammenhengen mellom akselerometermålt PA og påfølgende endring i fem forskjellige mål på kroppssammensetning over 2 år.

Metoder: Studien er basert på data fra to undersøkelser: Fit Futures 1 (FF1) utført i 2010-11 og Fit Futures 2 (FF2) i 2012-13. Alle studenter i første (FF1) og tredje (FF2) år på videregående skole i nabokommunene Tromsø og Balsfjord ble invitert til å delta på en fysisk undersøkelse og svare på et spørreskjema. Deltakerne ble også invitert til å bruke et akselerometer (GT3X) festet til hoften i syv påfølgende dager. PA ble uttrykt som totalt PA-volum (tellinger per minutt, CPM), tid brukt i intensitetssoner, steg per dag og oppfyllelse av WHO-anbefaling (dvs. akkumulering av 60 minutter eller mer med PA med minst moderat intensitet per dag). I artikkel II brukte vi Spearmans rho og ANOVA for å vurdere validiteten av SGPALS mot følgende akselerometri-estimater av PA: Gjennomsnittlige tellinger/minutt (CPM), steg/dag og minutter/dag med moderat til hard fysisk aktivitet (MVPA). Deltakerne gjennomgikk også en skanning med lav-dose Dual Energy X-Ray Absorptiometry (DXA), for å estimere fettmasse, fettfri masse og appendikulær fettfri masse (summen av fettfri masse i de fire ekstremiteter og tilhørende indekser: Fettmasseindeks (FMI), fettfri masse-indeks (LMI) og appendikulær fettfri masse-indeks (aLMI). Disse indeksene ble brukt i analyser av sammenhengen mellom PA og kroppssammensetning i artikkel III.

Resultater: Mindre enn 25% av deltakerne oppfylte gjeldende WHO-anbefalinger for PA for ungdom. Imidlertid akkumulerte 73% av ungdommene ≥30 minutter MVPA per dag. Gutter var mer fysisk aktive enn jenter målt i minutter med MVPA og CPM, mens antall steg per dag var likt mellom gutter og jenter. Både gutter og jenter var mer aktive på hverdager enn i helgene.

Vi fant positive assosiasjoner mellom selvrapportert PA målt ved bruk av SGPALS og akselerometermålt PA. Mens de observerte korrelasjonene mellom SGPALS og akselerometermålt PA var svake, var rangeringsevnen til SGPALS tydelig, med en gradvis økning i akselerometermålt aktivitet for hver økning i nivået av SGPALS.

I løpet av den toårige oppfølgingsperioden var det både hos gutter og jenter statistisk signifikante økninger i estimatene for kroppssammensetning (unntatt LMI og appendikulær fettfri masse hos jenter). Vi fant ingen sammenhenger mellom minutter med MVPA ved baseline og endringer i BMI, midjeomkrets og FMI to år senere verken hos gutter eller jenter. Hos jenter, men ikke hos gutter, var mer stillesitting assosiert med reduksjon i LMI og aLMI, mens lett PA hadde motsatte effekter på disse målingene.

Konklusjon: I denne gruppen ungdommer oppfylte mindre enn 25% av 16-17 år gamle gutter og jenter WHOs anbefalinger. Fysisk aktivitet hos disse ungdommene var på nivå med det som tidligere er rapportert hos voksne. I vårt utvalg viste SGPALS en tilfredsstillende rangeringsevne for selvrapportert PA, men SGPALS bør ikke brukes til å estimere PA-volumer på grunn av lave korrelasjoner med akselerometer-målt PA. Minutter med MVPA ved baseline var ikke assosiert med påfølgende endringer i noen estimater for kroppssammensetning hos hverken gutter eller jenter etter to år. Stillesittende tid og lett fysisk aktivitet var assosiert med endringer i LMI og aLMI hos jenter, men ikke hos gutter.

List of papers

This thesis is based on the following papers, which are referred to in the text as Paper I, Paper II and Paper III.

Paper I:

Beldo SK, Morseth B, Christoffersen T, Halvorsen PA, Hansen BH, Furberg AS, et al. Prevalence of accelerometer-measured physical activity in adolescents in Fit Futures - part of the Tromsø Study. BMC Public Health. 2020;20(1):1127.
DOI:10.1186/s12889-020-09171-w.

Paper II:

Beldo SK, Aars NA, Christoffersen T, Furberg AS, Halvorsen PA, Hansen BH, Horsch A, Sagelv EH, Syed S, Morseth B. Criterion validity of the Saltin-Grimby Physical Activity Level Scale in adolescents. The Fit Futures Study. Submitted after revisions 1st of October.

Paper III:

Aars NA, Beldo SK, Jacobsen BK, Horsch A, Morseth B, Emaus N, Furberg AS and Grimsgaard S. The association between objectively measured physical activity and longitudinal changes in body composition in adolescents; The Tromsø Study Fit Futures Cohort. BMJ Open. 2020;10(10):e036991. DOI: 10.1136/bmjopen-2020-036991.

Abbreviations

aLMI: appendicular Lean Mass Index
ANOVA: Analysis of variance
BMI: Body Mass Index
CPM: Counts per minute
CVD: Cardiovascular disease
DEDIPAC: Determinants of Diet and Physical Activity Knowledge Hub
DLW: Doubly labeled water
DXA: Dual energy X-ray absorptiometry
FF1: Fit Futures 1 (2010-11)
FF2: Fit Futures 2 (2012-13)
FFMI: Fat-Free Mass Index
FMI: Fat Mass Index
HR: Heart rate
IOTF: International Obesity Task Force
IPAQ: International Physical Activity Questionnaire
LMI: Lean Mass Index
LPA: Light Physical Activity
NCD: Non-communicable disease
MVPA: Moderate-to-Vigorous Physical Activity
PA: Physical Activity
ProPASS: Prospective Physical Activity, Sitting, and Sleep consortium
QALY: Quality adjusted life years
QCAT: Quality Control & Analysis Tool
SD: Standard Deviation
SGPALS: Saltin-Grimby Physical Activity Level Scale
SES: Socio-Economic Status
TEE: Total Energy Expenditure
VMU: Vector Magnitude Unit
VO2: Oxygen consumption
WHO: World Health Organization

1 Introduction

1.1 Physical activity in a historical context

"In order for man to succeed in life, God provided him with two means, education and physical activity. Not separately, one for the soul and the other for the body, but for the two together. With these two means, man can attain perfection" (Plato, fourth century BC).
The importance of physical activity (PA) was anticipated even in the Antiquity. Structured PA to achieve health gain is assumed to have been utilized in China 2500 years BC, and through the Code of Hammurabi, the king of Babylon had laws about health practice and physicians as early as 2080 BC. Hippocrates, known as the "father of medicine", has also been described as the first epidemiologist. He kept records of associations between diseases and climate, living conditions and habits such as diet and exercise (1). Although these ancient scientists acknowledged the importance of PA, modern PA epidemiology evolved only after World War 2, beginning with the studies of Dr. Morris (London bus drivers), Taylor (railroad industry) and Paffenbarger (longshoremen) (2-4). Over the last 30 years PA epidemiology has had an exponential growth.

Even though solid documentation is lacking, there are societal indications that levels of PA have declined over time. Urbanization, mechanization, technology, increasing use of cars and several other labor-saving appliances have changed the lives of millions of people. Recent research indicates that working life has changed to a less physically demanding form, while at the same time leisure time PA has increased (5, 6). This increase, however, may not fully compensate for the increase in sedentary time and lack of PA at work. The rapid development of mechanization and technology also affects adolescents and may have substantial impact on PA levels.

Are children and adolescents today less physically active than in previous generations? Some studies have found that there has been a decrease in adolescents' PA over the last few decades (7), whereas others have not (8). We have in fact few reliable PA data that can confirm this. However, there is an indisputable increase in childhood overweight and obesity, to a combined prevalence of overweight and obesity in European adolescents of 22-25% (9). There has been an increase in time spent devoted to sedentary activities such as watching TV or playing video games, and positive associations between screen time and BMI among adolescents has been reported (10).

Moreover, there has been an increase in the use of motorized transportation, and a reduction in physically active transportation such as walking and biking (11). In the 90-ies, the so-called «comfort-travels» in Norway increased with 64 % (12). This represents transportation of children to different activities such as daycare, school and spare time activities. The same tendency have been found in all countries with statistics on transportation of children, not just in Norway (12). According to data from the USA, 41% of students walked or biked to school in 1969, but by 2001 the proportion was down to 13% (13).

Furthermore, there is a proven general decline in fitness among adolescents (14). A Swedish study reported a 3-4% decrease in fitness from 1974 to 1995 among 16- year-old boys and girls (15), and a Finnish study (16) found that performance in a running test in 13- and 18-year old boys and girls decreased by 6-10% from 1976 to 2001. In 2003 and 2007, Tomkinson found global change in aerobic running test performance in boys and girls aged 6-19 years old (17, 18). In the Swedish Conscript Study, where participants have a mean age of 18.3 years, a major increase in obesity in young men has been documented, and a shift in muscle strength: sons of parents with less education used to be the physically strongest group, but those now have the lowest muscle strength (19).

1.2 Why is physical activity important?

Evidence from both clinical interventions and epidemiological studies underlines that PA is essential for health as it is associated with decreased all-cause mortality (20-24). There are strong associations between levels of PA and prevention and treatment of several non-communicable diseases (NCDs), such as diabetes type 2 (25-27), cardiovascular disease (CVD) (28-30), asthma (31), mental illness (32) and sevaral types of cancers (33, 34). A study from 2012 concluded: “Elimination of physical inactivity would remove between 6% and 10% of the major NCDs of coronary heart disease, type 2 diabetes, and breast and colon cancers, and increase life expectancy” (24). In a systematic review from 2019, Ekelund et al. found that higher levels of total PA, at any intensity, and less time spent sedentary, are associated with substantially reduced risk for premature mortality, with evidence of a non-linear dose-response pattern in middle aged- and older adults (20).

In children and adolescents, there is a lack of hard health endpoints, as they generally have not lived long enough to potentially develop serious morbidity of NCDs. This should not be interpreted as PA not being important for the development and healthy growth of children and adolescents (35). Evidence indicates that PA has beneficial effects on musculoskeletal health (36, 37), adiposity in overweight youth (36, 37), blood pressure in mildly hypertensive adolescents (36, 37), self-concept (37), anxiety and depression (38, 39) and academic performance (37, 40, 41). Moreover, associations between cardio-respiratory fitness and risk factors for CVD in children and young adults has been shown (42, 43), and a recent large study presented associations between high abdominal fat and inflammatory markers (also a risk factor for CVD) in children (44). Maybe even more importantly, adiposity and PA habits tend to extend from adolescence to adulthood, and this is associated with an increase in CVD risk factors later in life (45-48). A Swedish study found a steeply rising risk of early heart failure in relation to overweight in adolescence (49).

1.3 Societal and clinical implications of physical inactivity

Low levels of PA are not only associated with premature mortality and morbidity, but also with substantial costs to the health care systems globally (50). The monetary costs come in addition to the costs of devoting manpower and resources to treatment of lifestyle diseases, resources which could have alternative applications to other diseases and illnesses. In an environmental perspective, shifting from passive to active transportation could have positive effects on ambient air pollution and carbon dioxide emissions (51). Because leisure-time PA for most people is no longer a necessity, the responsibility lies on both society and the individual, and the burden is shared by both. From a societal point of view, increasing levels of PA is in theory a promising strategy for prevention of numerous illnesses.

The Norwegian Health Directorate made a calculation on health gain from PA measured in quality adjusted life years (QALYs), and estimated with conservative measures that going from inactive to moderately physically active would give >8 QALYs in adolescents (95% CI 2.4-14.1) (52). Putting a price tag on a QALY is both difficult and problematic and can seem artificial. However, it is interesting to notice the amount politicians are willing to pay for treatment, medication and rehabilitation. Typical value benchmarks in the United States have historically ranged from approximately $50 000 to $150 000 per QALY (53). In 2016 the Norwegian Government estimated a threshold-value of 275 000 NOK per QALY (54).

The societal implication of physical inactivity in adolescence is not as high, as the disease-specific negative effects of physical inactivity in most cases has not yet had time to manifest. However, associations between PA and mental health in adolescents, academic achievement, and school dropout has been found, which can have major implications for the society (55, 56).

1.4 Definitions and basic principles of PA

PA is commonly defined as "any bodily movement produced by skeletal muscle that results in energy expenditure above resting levels" (57) and includes several types such as occupational work, domestic chores, leisure activity, playing, physical education, sports, active transportation, and exercise. An updated definition even includes fidgeting and maintaining upright posture (58). The amount of PA may vary considerably both from person to person and for a given person over time (57). PA is often confused with exercise, which is typically defined as a subset of PA that is planned, structured, repetitive and for a purpose of improving or maintaining physical fitness (57).

Moreover, PA is often estimated in terms of energy expenditure. Total energy expenditure is defined as the sum of basal metabolic rate (BMR, defined as the energy expenditure during complete resting (zero activity)), the thermic effect of food (the energy expenditure associated with digestion, absorption, and storage of food, which accounts for approximately 10% of total energy expenditure), plus energy expenditure generated by PA (activity thermogenesis) (58). Activity thermogenesis constitutes the most transitory factor and can vary from 5% in a sedentary person to 50 % of the total energy expenditure for a highly active person (59). Physical inactivity is commonly defined as lack of PA, especially the lack of fulfillment of recommendations for PA (60). Sedentary behavior is defined as any waking behavior that result in an energy expenditure of no more than 1.5 times resting energy expenditure and a sitting, reclining or lying posture (61, 62).

1.5 Recommendations for PA and sedentary behavior

For children and adolescents the present recommendations for PA from WHO (published in November 2020) are to accumulate on average at least 60 minutes of moderate-to-vigorous physical activity (MVPA) per day (60). This recommendation was kept unchanged from the previous WHO recommendations presented in 2010, with the exception of 60 minutes each day being replaced by an average of 60 minutes per day (27). The scientific background for the 60 minutes of MVPA per day is grounded on studies investigating PA and health, summarized in several reviews (37, 56, 63-66). Total time spent at higher intensity PA has been shown to be more important for the variation in cardiometabolic risk factors than the persistence measured in bouts (67).

Over the last decades, focus has been on primarily MVPA and its role for good health and reduced risk of premature death. More recently, increasing research indicates that the time spent being sedentary is a risk factor for bad health, even among people who are sufficiently active (68, 69), although very high levels of MPA (60-75 minutes per day) seem to eliminate the increased risk associated with high sitting time (69). The latest recommendations from WHO are the first recommendations to include sedentary time, and the recommendation for children and adolescents is to limit the amount of time spent sedentary, particularly recreational screen time (60). In addition, the recommendations include incorporating activities that strengthen muscles and bones at least 3 days per week (60).

Over the later years, there has been a greater focus on pattern of PA, not only as exercise or training, but as a lifestyle (70, 71) – for instance through active travels, choosing the stairs instead of the elevator and so on. There are emerging evidence that even though the recommendation of at least 60 minutes of MVPA per day stays strong, there is also potential benefits of light PA (60, 64).

1.6 Measuring PA

For a preventive measure to prove efficient in real world contexts, knowledge on PA in populations is vital. In essence: to change PA, you need to understand PA, and to understand PA it needs to be measured correctly. Therefore, knowledge on the type, frequency, duration, intensity and domain of PA in populations is a precursor to efficient, preventive strategies.

There are several methods to measure PA, all with different strengths and limitations. Self-report or “subjective” methods include questionnaires, diaries and logs, whereas “objective” methods include a variety of sensors such as pedometers, accelerometers, heart rate monitors, combined sensors and GPS.

1.6.1 Self-reported PA

The most commonly used tool for assessment of PA are questionnaires (72). Self-reported PA has the ability to capture both quantitative and qualitative information.

There are several PA-questionnaires (PAQ) available for PA researchers. PAQs are classified into 3 categories: global, recall and quantitative history (73).

Global questionnaires provide a quick overview of the level of PA of a person, and are used for classification purposes, such as “active” or “inactive”. It is easy to administer and constitutes a low burden for the participant as it not time consuming to fill out. Global questionnaires do not depend as much on a person’s ability to recall the near past in detail, as it attempts to cover a more “daily life” habit. One example is the SGPALS.

Short recall PAQs aim to provide a quick assessment of the total volume of PA, often classified by intensity level (often moderate and vigorous PA) or by domain (such as work-related PA, leisure time PA, or travel related). Examples are SHAPES (74, 75), IPAQ (76-78) and WHO HBSC (79). IPAQ and other recall questionnaires gives more information than global questionnaires, meaning that the potential for precision is higher. However, this also introduces a risk of less precision. With more questions and more details comes the risk of more noise. For many participants there might be problems with understanding the concepts of “moderate” and “vigorous” PA, recalling normal activities such as walking or sitting, and calculating total duration (80). This is especially true for those who do not have a regular exercise schedule.

Quantitative history PAQs are detailed surveys usually administered by an interviewer that may contain more than 50 detailed questions regarding the past month, year or even a lifetime.

Low costs, ease of administration and imposing a small burden on the participant makes self-reported PA feasible for use in large study cohorts. Another possible advantage is comparability with previous studies based on self-reported PA, which historically has been the dominating method of measurement. However, the limitations of PA self-reporting are well documented. The self-report methods rely on the participant's ability and willingness to recall and honestly report his or her level of PA with accuracy. To recall the amount and intensity of PA is an advanced cognitive task, and the results from questionnaires are therefore vulnerable for recall bias and also social desirability bias (81, 82). In addition, the comparability between studies may be hampered by a large number of different questionnaires used in PA research.

1.6.2 Accelerometers

Over 500 years ago, Leonardo da Vinci designed the first concept of a pedometer (1). A pedometer is inexpensive and noninvasive, and can be used nearly everywhere, including at work and in school. Over the last two decades, starting with pedometers, the market of motion sensors has increased exponentially. Consequently, pedometers have been replaced by accelerometers in PA research. Accelerometers measure acceleration, which is the change of velocity over time. The premise for the use of accelerometers to assess PA is that acceleration is directly proportional to the muscular forces and therefore to energy expenditure (83, 84). The degree of acceleration caused by skeletal muscles reflects the energy expenditure (85). The raw data acquired by a modern accelerometer can be downloaded and processed for further research. However, acceleration is typically converted to a proprietary count-value by the summation of the absolute values of the sampled change in acceleration over a given time frame. The intention is to quantify movement by this summation of accelerations, and the resulting count-values, typically averaged per minute (counts per minute; CPM) are used as key measurement units for quantifying intensity, duration, and frequency of PA. Accelerometers designed for research purposes are small and noninvasive, and few instructions are needed for the study participants. However, there are some serious limitations. A hip-mounted accelerometer does not measure the accelerations of other body parts. Many activities are therefore not measured accurately, for instance upper body movement, uphill walking and carrying loads (86). Many accelerometers are not water resistant or waterproof and for that reason they cannot be used to monitor water-based activities such as swimming. Placements of the monitor can vary between persons, and non-wear time is often high, especially in hip-mounted accelerometers, compared to wrist-worn accelerometers (87, 88). There are many manufacturers and many models of accelerometers, and, to a certain extent, they have different thresholds for registering accelerations and "counts". There is also a development of the technical possibilities of the accelerometer, from measuring one axis of acceleration (vertical) to measuring three axes, and further to the use of raw acceleration data without conversion to a count-value. This makes it hard to compare recent studies with earlier studies. Accelerometers are also comparably expensive, which makes them less accessible for use in large population studies, and they do not provide any information about activity context.

A combination of several of the above-mentioned methods, or combined with GPS data, has become more common and feasible, although more intrusive and expensive than single measures. Continuous, real-time, shared health data from for example smartwatches and mobile-phone accelerometers are to a certain extent available even for researchers (89) and show potential for PA research (90-92).

1.7 PA patterns in adolescence

Children and adolescents' PA levels and habits likely differ from adults' PA. Some reasons for this may be higher levels of active transport (walking or cycling) (93) and physical activities at school (94). Adolescence represents change in many ways (95), and this specific period in life represents an important transition from child to adult, with bodily changes as a result of puberty, breakaway from parents, construction of own identities and plotting the course of the future.

Children tend to be more physically active during their first years with a peak at around 6-7 years of age, after which the amount of PA is decreasing (96, 97). In children, PA is often characterized by free-play activities, but as one grows older PA tends to get more structured (96). For many adolescents, participation in organized sports constitute a large proportion of total PA (98, 99). However, it is also during adolescence that many young people, for a variety of reasons, quit organized sports (100, 101). The result is often an increase in sedentary time. On the other hand, adolescents can change their habits of PA in both directions over relatively short time, but the general pattern is a decline in amount of PA (102), and the global trend is that around 80% of adolescents are insufficiently active (103). Several studies have shown that PA appears to track reasonably well from childhood to adolescence and further to adulthood (104-107), supporting the encouragement of PA in children and adolescents as an important strategy for promotion of public health (108, 109).

Independent of study protocols in different accelerometry studies of children and adolescents, some general conclusions about prevalence and patterns of PA can be drawn: Boys are more physically active than girls (110-114), and this difference is particularly prominent in activities with higher intensities (114). Also, PA declines from childhood through adolescence (97, 110, 112, 113, 115-119). Although there is a lack of precise measurements of the development in level and pattern of PA among children and adolescents, it seems evident that the vast majority of Norwegians do not meet the PA recommendations (120). Prevalence of PA varies largely between studies due to different measurement instruments (99, 112, 121). As the variability of PA during school hours is lower due to predetermined amounts of physical education and sedentary time, the variability in PA is much larger during weekends than during weekdays (122, 123).

Determinants of PA during adolescence include factors such as socioeconomic status, support from parents and peers, neighborhood environment, enjoyment of activity and self-efficacy (124-127). Low self-efficacy, higher (perceptions of) barriers to PA (such as a bad neighborhood with little access to areas to be active), decline in enjoyment of PA, and low perceived parental or friend support is associated with a decline in PA during adolescence.

1.8 Body composition

1.8.1 Measurement of body composition

In the 20th century, clinicians, researchers and insurance companies found data indicating that body weight, adjusted for height, was associated with morbidity and mortality (128). Excess adiposity, which can be measured by various methods, is one of the primary drivers of these associations. **Body weight** is the simplest measure, as it is likely to be higher in overweight- and obese individuals. The most common measure of weight in relation to height is calculated as weight in kilograms divided by height in meters^2, known as **body mass index (BMI; kg/m^2)**. Height and weight can easily and accurately be measured, also as self-reported data from the participant (129). BMI will then be used to classify individuals as underweight, normal weight, overweight or obese. Because BMI naturally increases with age during childhood and adolescence, age- and gender specific cut-offs have been developed by the International Obesity Task Force (IOTF) (130, 131), based on large amounts of data from different countries.

A limitation of BMI is that it does not take into consideration whether excess body weight results from different body composition compartments. In consequence, lean people with relatively high muscle mass may incorrectly be classified as overweight. Vice versa, lean people with excess abdominal adiposity may be classified as normal weight. Furthermore, BMI does not give any information on distribution of excess fat mass. Accumulation of visceral fat mass has been recognized as a major cardiometabolic risk factor, and therefore determining the location of the excess fat mass is crucial to identify individuals with the same BMI, but with different cardiovascular risk profiles (132). **Waist circumference**, which typically is measured with light or no clothing at the umbilical level or at the point of the minimal waist, is a simple and feasible measure. A high waist circumference is an indication of abdominal adiposity and increased cardiometabolic risk, independent of BMI (133, 134) and even in adolescents (135).

A method to investigate to what extent the different body composition compartments contribute to the body weight of a person is **dual-energy x-ray absorptiometry (DXA)**. Although not as easily accessible as BMI, it has an acceptable precision, risk and cost even for larger studies. DXA is a three-component model of body composition assessment: skeletal mass, fat mass and soft tissue lean mass, which can be reported in absolute or relative values (136, 137). Soft tissue lean mass comprises all bodily tissue except fat and skeletal mass. As with body mass it is useful to estimate the different components in relation to the height of the person by creating indexes: Fat mass is used to calculate Fat Mass Index (**FMI**: fat mass in kilograms/height in meters^2), while soft tissue lean mass is used in the calculation of soft tissue lean mass index (**LMI**: lean mass in kilograms/height in meters^2). By subtracting fat mass from total mass, we can calculate Fat-Free Mass Index (**FFMI**: fat-free mass in kilograms/height in meters^2). The last index used for body composition assessment is the appendicular Lean Mass Index (**aLMI**, sum of soft tissue lean mass in the four extremities in kilograms, divided by height in meters^2). This index has been used as a surrogate of muscle-related lean mass, especially in elderly people in assessment of sarcopenia (muscle loss because of ageing or immobility) (138).

The gold standard for tissue-specific body composition assessment is the **four-compartment model** (136, 139). While DXA divides the body mass into three components, the four-compartment model divides lean mass further into protein and water (136). Hence, we get the following components: fat mass, bone mineral, total body water and other (protein, non-bone minerals, and glycogen). This model is costly and labor-demanding, which makes it unsuitable for large population studies.

1.8.2 Body composition in adolescents

Because adolescents are in a phase of growth, changes in body composition are expected in healthy individuals. For researchers, such natural changes in growth must be accounted for when studying this age group. Pubertal development includes increases of muscle mass in boys, with sex hormones leading to substantial increases in lean mass up to the point of Peak Height Velocity, the time where natural growth peaks and is subsequently reduced (140). In girls, pubertal development introduces a period of increases in fat mass (141). Because of these sex differences in adolescent body composition, results of studies investigating body composition in this age group is best understood when stratified according to sex (142).

1.9 PA and body composition during adolescence

It is an ongoing debate whether the primary cause of obesity is physical inactivity or overfeeding. Most scientists nowadays agree in that it is not a matter of either/or, but a combined issue including several other complex underlying factors such as genetic disposition and societal structures (143). Cross-sectional research on PA and body composition among adolescents indicates that higher levels of habitual PA are protective against adolescent obesity (144), and several studies have found associations between adiposity, PA and inflammatory markers, indicating a risk for metabolic disease in the future (44, 145-147). However, these studies cannot ascertain temporality. Longitudinal studies may show whether lower amounts of PA precede adiposity, and there are some indications of this (148), although not consistent (149, 150). However, such studies do not necessarily show that PA predicts changes in adiposity (151-153). Influencing factors may be how PA and adiposity are measured in such studies (144, 154). In addition, measurement of- and adjusting for puberty and growth rate during adolescence might be difficult and could impact the results. Even though a connection between PA and BMI has been difficult to find in children, an association has been shown between PA and FMI (155). A systematic review (with meta-analysis) from May 2021 found that VPA seems to be negatively related to adiposity and cardiometabolic risk score among children and adolescents later in life (156).

2 Aims, objectives and hypothesis

The aim of this thesis is to provide a broad understanding of PA in an adolescent population. In the first paper we aim to describe the prevalence and patterns of accelerometer-measured PA, which is the recommended method for measuring PA. In Paper II we explore how accelerometer measurements correlate with a common measure of self-reported PA. As self-administered questionnaire still is the preferred and most accessible and cost-reducing measurement method for PA, it is important to know to what degree self-reported PA is a valid alternative when accelerometry is not available. In paper III, we explore to what extent accelerometer-measured PA predicts changes in BMI and other measures of body composition, thereby applying the measurement of PA to an increasing public health problem.

Paper I:
Aim: To describe the prevalence of accelerometer-measured PA in adolescents 16-17 years of age in Northern Norway, and to examine potential correlates of PA in this age group.
Hypothesis: We expected PA levels in our sample of adolescents aged 16-17 years to be lower than in younger children but higher than in adults.

Paper II:
Aim: To assess to what extent accelerometer measurements coincide with self-reported PA in a sample of Norwegian adolescents, using a well-established questionnaire (SGPALS). A secondary aim was to examine whether the validity differed by sex, BMI, SES, or self-reported health status.
Hypothesis: We expected to find that the SGPALS could be used as a crude measure for PA in adolescents.

Paper III:
Aim: To investigate the association between accelerometer-measured PA and subsequent changes in body composition (BMI, WC, FMI, LMI and aLMI) over two years of follow-up in a cohort of Norwegian adolescents.
Hypothesis: We expected level of PA to be associated with different measures of body composition.

3 Material and methods

3.1 Study population: Fit Futures 1 and 2

The subjects in this thesis are participants in the Fit Futures Study. The Fit Futures Study is a collaboration between the University Hospital of North Norway, UiT The Arctic University of Norway and the Norwegian Institute of Public Health (NIPH). The main objective of the Fit Futures study is to investigate adolescence health and health behavior. In 2010-2011, the first Fit Futures study (FF1) invited all first year upper-secondary school students (mean age 16.1 years, n=1117) in the municipality of Tromsø (typically urban) and Balsfjord (typically rural) to a health examination that included clinical examinations, a questionnaire, and accelerometer measurements. In total 1038 students (93%) from eight different schools attended the survey. A follow-up study, Fit Futures 2 (FF2), conducted in 2012-2013, invited all students in their last year of upper-secondary school (mean age 18.2 years) from the same schools, also including students who had moved, left school, or started vocational training after their participation in FF1. In total, 1130 students were invited to participate in FF2, and 870 participated, of which 132 individuals had not attended FF1.

As shown in Figure 1, paper I includes participants from FF1 with valid accelerometer data (n=611). Paper II includes FF1participants aged ≤ 18 years with valid accelerometer and self-reported PA data (n=572). Paper III includes those who participated in both FF1 and FF2 and had valid measurements of body composition in both surveys, and also had valid accelerometer data in FF1 (n=431).

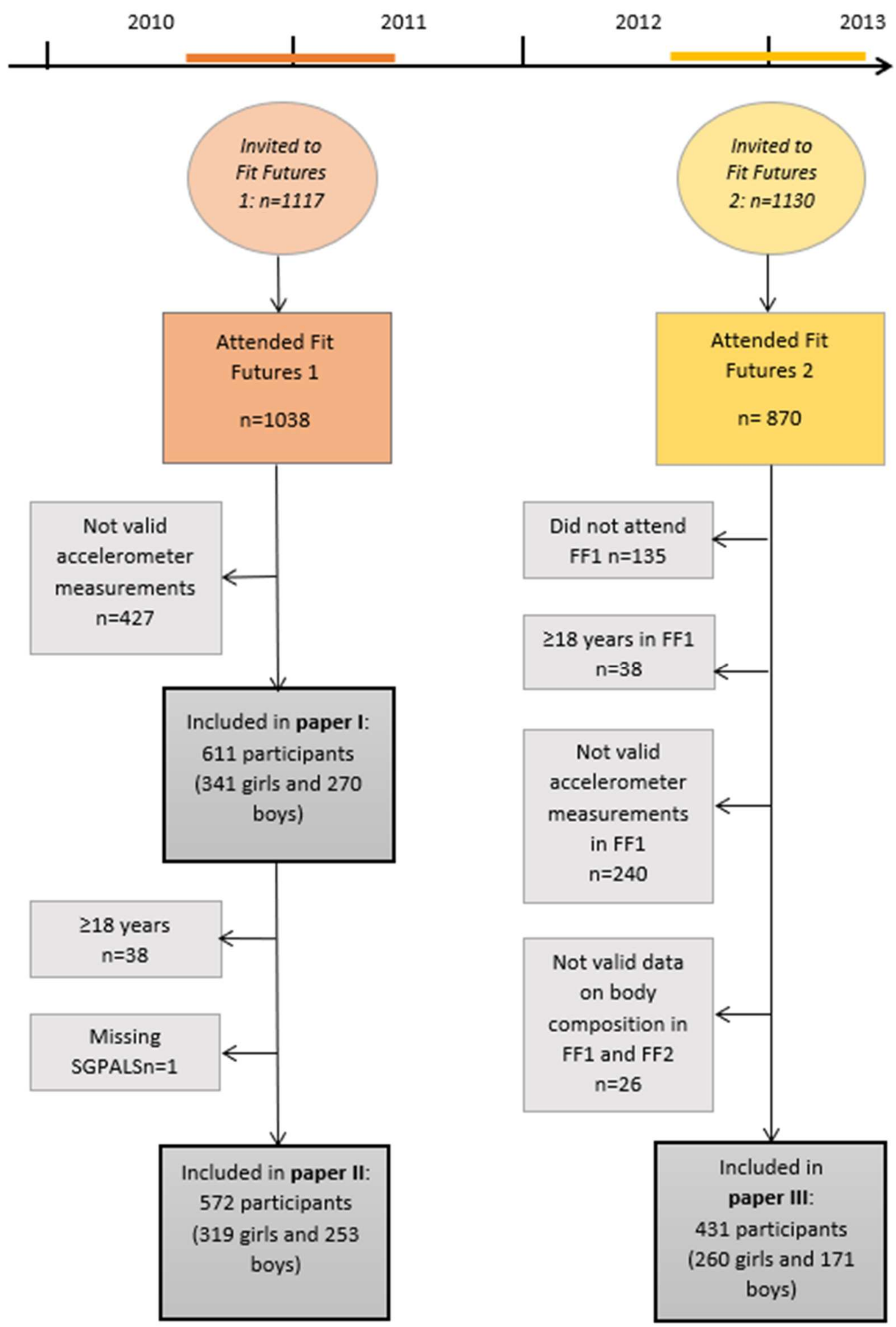

Figure 1: Flowchart of participants included in Papers I-III

The participants attended a half-day visit at the Clinical Research Department at the University Hospital of Northern Norway, Tromsø, and all procedures were performed by trained research technicians. The data collection included electronic questionnaires, clinical examinations and accelerometer measurements. The participants were transported to the research center from their respective schools, and participation in FF was approved as legitimate leave of absence from school. All examinations were performed in one day, with a subsequent week of accelerometer wear. The accelerometer was handed in at school, after which all participants received a voucher of NOK 200,- as a small reward for participation.

3.2 Measurements

3.2.1 Accelerometer-measured PA (Paper I, II and III)

PA was measured with the ActiGraph GT3X (ActiGraph, Pensacola, FL), recording accelerations in three axes (axial, coronal and sagittal). The participants were instructed to wear the accelerometer on their right hip attached with an elastic band for seven consecutive days (in addition to the initial day), and to remove the ActiGraph only for water-based activities and during sleep. The devices were initialized in ActiLife, which is the software from the manufacturer of ActiGraph used to prepare ActiGraph devices for data collection and to download, process, score and securely manage collected data (157). Sampling frequency was 30 Hz, and default filter was used to aggregate raw data into epochs of 10 seconds. By an inadvertency, in Paper I sampling frequency was said to be 100 Hz, but this has later been proven wrong. An erratum has been sent to the BMC Public Health as this was discovered. Data were collected between 14:00 on the first day until 23:58 on day eight. Afterwards the ActiGraph devices were collected at the schools and returned to the research facility for downloading of the data in ActiLife. The first day of measurements was removed to reduce reactivity (158). In accordance with other studies (159), measurements were included in the analysis if the participant had accumulated at least four valid days, i.e. days with at least 10 hours of wear time. The data was then imported into the Quality Control & Analysis Tool (QCAT), a custom-made software for processing of accelerometry data developed in Matlab (The MathWorks, Inc., Natick, Massachusetts, USA) by the research group of professor Horsch. The QCAT software is under development and is planned to be made publicly available as an open-source software in the future (160). Prior to analyses in QCAT, the data was aggregated to epochs of 60 seconds.

Accelerometer wear time and intensity categories

Wear time was identified by triaxial vector magnitude (the square root of the sum of squared activity counts) counts per minute (CPM) as described by Hecht et al. (161), based on the following questions guiding the classification of minutes in wear time or non-wear time: 1) Is the VMU CPM (vector magnitude units in counts per minute) value >5? 2) Of the following 20 minutes, do at least two minutes have VMU CPM values >5? 3) Of the preceding 20 minutes, do at least two minutes have VMU CPM values >5? If, and only if, the answer was yes for at least 2 of these questions, the minute was considered wear-time. All other minutes were defined as non-wear time. A day with at least 10 hours of wear time was considered a valid day. Actual mean wear time per valid day ranged from 10.6 – 18.6 hours, and mean number of valid days was 5.6 (range 4-7 days).

The raw data from the accelerometer is categorized into four different levels of intensity, using the cut-points developed by Freedson (162): Sedentary (0 – 99 CPM), light (100 – 1951 CPM), moderate (1952 – 5723 CPM) and vigorous (≥ 5724 CPM) PA.

Sedentary behavior was included in Paper I and III but has not been an essential part of this thesis, due to lack of inclination on the accelerometer (to inform posture), and lack of information on sleep time.

3.2.2 Self-reported PA (using SGPALS) (Paper II)

Participants answered the SGPALS questionnaire by stating their PA level according to four hierarchical levels (163, 164) (Table 1). Compared with the original wording by Saltin and Grimby in 1968, designed for adults, the participants in this study answered a slightly modified version with activity examples suited for adolescents, and with a duration requirement also for level 3 (in addition to level 2), which has later been recommended by Grimby and colleagues (164). Grimby et al. (2015) summarized the modifications; stating that "A number of modifications to the questionnaire have been published. These are mostly minor changes, such as adding practical examples of activities to illustrate the levels of PA. Some authors have also added duration requirements that were not included for all levels of PA in the original version". Grimby et al. (2015) further stated that both concurrent and predictive validity has been shown to be good, and they justify the modification by the necessity to incorporate more modern examples of leisure time activities, which may have improved the specificity of the different PA levels of the questionnaire.

Table 1 Saltin-Grimby Physical Activity Level Scale (SGPALS) in the FF

	Leisure Time Physical Activity Level
Question	Which description fits best regarding your physical activity level in leisure time?
Answering alternative 1	Almost completely inactive: *"Sitting by the PC/TV, reading or other sedentary activity"*
Answering alternative 2	Moderately active: *"Walking, cycling, or other forms of exercise at least 4 hours per week (here, you should also consider transport to/from school, shopping, Sunday strolls etc.)"*
Answering alternative 3	Highly active: *"Participation in recreational sports, heavy outside activity, shoveling snow etc. at least 4 hours per week"*
Answering alternative 4	Vigorously active: *"Participation in hard training or sports competitions regularly several times a week"*.

3.2.3 Body composition (Paper I, II and III)

Weight and height were measured on a portable electronic scale and stadiometer, respectively. Weight was measured in kilograms (kg) and height in meters (m).

Body mass index (Paper I, II and III)

According to International Obesity Task Force the ISO-BMI cut-offs for overweight at the age of 16 is 23.9 kg/m^2 for boys and 24.37 kg/m^2 for girls (165). As ISO-BMI and adult cut-offs for BMI become more similar by increasing age, BMI was calculated according to adults' cut-offs in paper I and II. In paper II we dichotomized this variable and categorized as normal weight (<24.99 kg/m^2), and overweight and obese (>25 kg/m^2). In paper III we applied the ISO-BMI reference values for adolescent populations to classify participants as either underweight, normal weight, overweight or obese in FF1, using age in half years. The classification terms for categories of BMI correspond to the adult classifications (130, 131). In FF2, all included participants were aged ≥ 17.75 years, and thus BMI was not adjusted for age in the classification of weight status in FF2.

Waist circumference (paper III)

Waist circumference was measured to the nearest cm at the height of the umbilicus after expiration. Norwegian reference values described in 2011 were used (166).

Fat mass index, lean mass index and appendicular lean mass index (paper III)

Participants underwent a DXA scan (GE Lunar Prodigy, Lunar Corporation, Madison, WI, USA). We used DXA estimates of fat mass and soft tissue lean mass in grams to calculate FMI, LMI and aLMI.

3.2.4 Socioeconomic status/parents' education (paper I and II)

Household income is often used as a marker of socioeconomic position. The FF1 questionnaire did not ask for parents' income and thus the family economic status could not be used here. However, education is a strong determinant of employment and income (167). In addition, knowledge and skills attained through education may affect the cognitive functioning of a person, making them more receptive to health or lifestyle education messages (167, 168). In this study parents' education was used as a proxy of socioeconomic status (SES). This was collected from the questionnaire, and the response alternatives were 1) Do not know, 2) Primary school 9 years, 3) Occupational high school, 4) High school, 5) College / university <4 years and 6) College/university 4 ≥ years. The participants reported education level for both parents separately, and the one parent with the highest education was regarded as "parents' education".

3.2.5 Self-perceived health (paper I and II)

There are strong relations between poor self-rated health and mortality in adults (169). A study of Norwegian adolescents has shown that self-perceived health in adolescence predict allostatic load (biological dysregulation associated with risk of disease) in young adulthood (170). The participants in FF1 rated their self-perceived health according to the question: *"How do you in general consider your own health to be?"* with five alternatives: 1) Very poor, 2) Poor, 3) Neither good nor poor, 4) Good or 5) Excellent. Only four participants rated their health as very poor, thus we categorized 1) Very poor and 2) Poor into *"1) Very poor/poor"*.

3.2.6 Study program (paper I, II and II)

The participants came from 8 different schools with 3 different study programs: General, vocational, and sports studies (171). Information on study program was retrieved from the schools' student database. For practical reasons students from the same school and study program were measured during the same period. It is well known that the level of PA differs with professions (172), and by including this variable we wanted to investigate if this difference appears as early as in secondary high school. Obviously, we assumed that those who chose sports studies were more physically active than the rest, but we also wanted to assess if there was a difference between the participants from general studies and those from vocational programs. In Paper III, study program was included as a covariate in the adjusted analyses.

3.2.7 Other variables

Age

The age range in FF1 was 15-28 years of age, and 15-25 years among those with valid accelerometer measurement. A total of 92.6% (93.8% among those with valid measurements) of the participants were younger than 18 years. We included those 18 years and above in paper I because one could argue that being a high school student, they live a life comparable to their school mates. In the following papers we decided to exclude the participants who were ≥18 years while attending FF1, because a person who is 25 years may in many ways differ considerably from a 15-year old student (for example in terms of body composition, organized sports, transportation modes, and life situation).

Pubertal development (paper III)

Puberty and maturation are important factors to consider when studying PA and body composition in adolescents (173, 174). Questionnaire data on pubertal development was available in the form of the pubertal development scale (PDS) for boys and age at menarche for girls. However, the questions on PDS were included roughly a month after FF1 had commenced, and therefore 121 participating boys missed data on PDS. Puberty was therefore not included as an adjustment variable in the primary analyses, and in paper III we performed sensitivity analyses limited to those boys and girls with complete data on maturation.

Other adjustments

In paper III we adjusted for self-reported screen-time on weekdays, where response alternatives ranged from “none” to “10 hours or more. We also adjusted for frequency of breakfast consumption, as breakfast often is considered an indicator of healthy meal habits (175, 176).

3.3 Statistical methods

In paper I, differences in wear-time and PA levels between girls and boys were analyzed using Student’s t-test, and differences between weekday and weekend PA levels were analyzed using paired-samples t-test. Differences in wear-time and PA levels by SES, self-perceived health and study program were analyzed using Fisher’s one-way analysis of variance (ANOVA). In cases of unequal variances, Welch’s ANOVA was used.

In paper II, we used Spearman’s rho (ρ) to assess the ranked correlation between the SGPALS and accelerometer estimates of PA (mean CPM, mean steps/day and min/day MVPA) in total and in strata of sex, BMI, parental level of education, self-reported health, and study program. We visually inspected scatter plots following our correlation analyses to identify outliers. We used Fisher´s ρ to z transformation to compare rho correlations within demographic strata, as previously done by others (177). To decrease false discovery rates, we adjusted the p-values from Spearman´s rho, and for comparison between rho´s, according to the Benjamin-Hochberg method (178) with 25% false discovery rate. A coefficient (ρ) of 0.00 to 0.10, 0.10 to 0.39, 0.40 to 0.69 and ≥0.70 was considered a negligible, weak, moderate and strong correlation, respectively (179). We used ANOVA to assess the associations between indices of device-measured OA (CPM, steps and MVPA) and the SGPALS. Differences in accelerometer wear time between boys and girls, and between under- and normal weight and overweight and obese participants were assessed by independent t-test, and for study program, parental education and self-reported health status we used ANOVA.

In paper III, sex-specific difference in body composition between baseline and follow-up was tested using a paired samples t-test. The difference in PA between sexes was tested using a two-sample t-test, while sex differences in categories of minutes spent in MVPA was tested using a chi-square test. Difference in linear trend across categories of minutes spent in MVPA was tested using STATA’s non-parametric test for trend. We used linear regression to assess the association between baseline PA and changes in body composition, computed as the difference in body composition parameters between baseline and follow-up. Baseline PA was defined in three different ways: 1) minutes per day spent in sedentary activity, 2) minutes per day spent in light physical activity (LPA), and 3) minutes per day spent in MVPA. Sedentary time and LPA were divided by 30 and MVPA by 15, thus presenting the beta coefficient for change in body composition per 30 minutes of sedentary time or LPA and per 15 minutes of MVPA. Adjustments were made for baseline measurement of body composition (model 1), and also for time between measurements, baseline wear time of accelerometer, age (in half years), questionnaire data on screen time on weekdays, study specialization and frequency of breakfast consumption (model 2). Analyses with sedentary time and LPA as exposure were adjusted for minutes spent in MVPA. Self-reported pubertal status was adjusted for in a sub-analysis, only including those with valid data on pubertal status (pubertal development scale for boys; n=143, and age at menarche for girls, n=256).

The statistical analyses in paper I and II were performed using Statistical Package for Social Science (SPSS, Version 25, International Business Machines Corporation, United States). The statistical analysis in paper III were performed using STATA, version 14 (StataCorp, Texas, USA). The level of significance was set at $p < 0.05$. All accelerometry estimates (CPM, steps, and MVPA) were considered normally distributed by visual inspection of histograms and QQ-plots.

3.4 Ethical considerations and compliance with ethical guidelines

Research on children and adolescents requires extra considerations. For example, measuring weight and body composition in adolescents might initiate unfavorable processes regarding their self-concept. Measurements and questions about lifestyle might encourage a healthier lifestyle but might also cause stigma and elicit bad conscience. However, in order to provide knowledge-based health initiatives for adolescents, we need to do research on adolescents. All together it is reasonable to assume that this project will involve low risk of physical, mental or social injury, discomfort, strain or inconvenience now or in the future for the individual participant or for any specific group of participants. We therefore consider the benefits in this project to outrange the disadvantages.

Participation was voluntary. Participants aged 16 years or above signed a written informed consent, whereas participants under 16 years signed with written permission from their legal guardians. In cases where participants under 16 years did not bring signed consent forms, research nurses telephoned their parents on site and asked for consent, in line with approval from the Regional Ethics Committee North (Rec North). All participants were informed about the purpose of the study, and about the possibility to withdraw from the study, or to decline to take part in specific parts of the study. All employees who worked with the survey had a duty of confidentiality. Processed data did not include name, birth number or other information that could identify a participant, and the researchers did not have access to the identification key code.

Rec North approved Fit Futures 1 (2009/1282), Fit Futures 2 (2011/1702) and this project (2012/1663/REK Nord). Both Fit Futures 1 (27.07.2010 (Ref. 07/00886-7/CGN)) and Fit Futures 2 (31.10.2012 (Ref. 07/00886-15/EOL)) were approved by the Norwegian Data Inspectorate. The study has been performed in accordance to the Helsinki declaration (180), the Vancouver rules for co-authorship (181) and the Norwegian Health Research Act (182).

4 Results and summary of papers

4.1 Paper I

Insufficient PA is one of the leading risk factors for mortality globally (22, 183) and is associated with higher risk of NCDs (26, 29, 33, 184). PA as behavior tends to track from adolescence to adulthood (118, 185-187), and knowledge about PA levels and patterns in adolescents could help direct efforts and resources to prevent physical inactivity as adults. Thus, the aim of this study was to describe accelerometer-measured PA in adolescents aged 16 years in Northern Norway and to examine potential correlates of PA in this age group. Of the 1038 participants in Fit Futures I, 611 participants had valid accelerometer measurements. Only 16% of the girls and 25% of the boys fulfilled current WHO recommendations and 73% accumulated ≥30 minutes MVPA. Total PA volume (CPM) was higher in boys than in girls (353 (SD 130) versus 326 (SD 114) CPM, $p<0.05$). Both boys and girls were more active on weekdays than weekends (altogether; 350 (SD 124) versus 299 (SD 178) CPM, $p<0.05$). PA levels were in general lower among the participants from the vocational study program (especially girls) and were higher among those with better self-perceived health but were not associated with SES.

We concluded that the majority of 16-17-year-old adolescents living in Northern Norway did not fulfil the current WHO recommendations for PA. Total PA volumes were similar to those reported in Norwegian adults. PA varied with sex, self-perceived health, and study program, but not SES.

4.2 Paper II

Self-reported PA is likely influenced by social desirability bias, which may introduce misclassification and influence the validity of self-reported PA (72, 82, 188, 189). Validation of self-reported PA instruments is therefore crucial for interpreting prevalence estimates of PA and associations between PA and health outcomes (190). The aim of this paper was to assess the validity of the self-reported PA using the SGPALS against accelerometry measures of PA in a sample of Norwegian adolescents. A secondary aim was to examine the validity by strata of sex, BMI, parental education, school program, and self-reported health status.

The SGPALS was positively correlated with steps/day ($\rho=0.35$, $p<0.01$), min/day MVPA ($\rho=0.35$, $p<0.01$), and mean CPM ($\rho=0.40$, $p<0.01$). We observed no differences in correlations between socio-demographic strata (all $p>0.001$). We observed statistically significant increases in all indices of accelerometer measured PA by increasing SGPALS levels (all $p<0.001$). Mean difference between lowest and highest SGPALS categories was 163 CPM (278 vs. 441 mean CPM), 2947 steps/day (6509 vs. 9456 steps/day) and 27 min/day MVPA (35 minutes vs 62 minutes).

We concluded that the SGPALS has a satisfactory ranking validity measured against accelerometry in adolescents, and the validity is fairly stable across strata of sex, BMI and parental education. However, the validity of SGPALS in providing information on absolute physical activity levels is limited.

4.3 Paper III

Self-reported PA commonly overestimates the total amount of PA (191). Body composition is most commonly assessed using BMI, but BMI does not distinguish between fat- and muscle mass (192). Inaccurate measures of exposure and outcome may thus fail to detect an association between PA and body composition. In this study, we sought to overcome these limitations by applying accelerometer measures of PA and tissue-specific measures of body composition. Our aim was to investigate the association between device-measured PA and changes in five different measures of body composition over two years of follow-up in a cohort of Norwegian adolescents.

Both boys and girls had statistically significant increases in the measures of body composition (except LMI and appendicular lean mass in girls) over the two-year follow-up. There were no associations between minutes spent in MVPA at baseline and subsequent two-year changes in BMI, waist circumference or FMI in either boys or girls. In girls but not in boys, more sedentary time was associated with a reduction in LMI ($p < 0.01$) and aLMI ($p < 0.05$), whereas LPA had opposite effects on these measures ($p < 0.01$ and $p < 0.05$, respectively).

5 Discussion of results

In this thesis we have investigated PA prevalence, patterns, validity, and associations with adiposity in a cohort of older adolescents in Northern Norway. In paper I, we have looked specifically at accelerometer-measured PA in this cohort, the prevalence of participants meeting WHO-recommendations and potential correlates of PA. However, in many settings, self-reported measures are still the only viable option for assessing PA, as both administration of accelerometers and interpretation of data from accelerometers requires certain competence. In light of this, Paper II sought to investigate the performance of a commonly used physical activity questionnaire (PAQ) in relation to accelerometer measured PA, with the aim of establishing the criterion validity of the SGPALS in adolescent populations. In Paper III, the aim was to examine PA in a relation to adiposity, by investigating how accelerometer-measured PA predicted changes in measures of body composition.

In this chapter the results from each paper are first discussed individually, followed by a common interpretation and discussion of all papers. Specific limitations, methodological considerations and generalizability of the results are discussed in greater detail in Chapter 6.

5.1 Main findings

First, our results suggest that only about 20% of older adolescent boys and girls fulfilled the current WHO recommendations for PA. However, 73% of the participants acquired 30 minutes or more of MVPA per day. Boys were more physically active than girls in terms of MVPA and total PA volume. The participants were more active on weekdays than weekends, and PA was higher among those with better self-perceived health. PA was not associated with SES.

Second, we found positive associations between self-reported PA measured with the SGPALS, and accelerometer-measured PA, although the observed correlations between the SGPALS and accelerometer-measured PA were weak. The dose-response association indicates that the ranking ability of the SGPALS was satisfactory, showing a notable and gradual increase in accelerometer measures for each increase in level of SGPALS. This was in line with the hypothesis.

Lastly, contrary to our hypothesis, we found no associations between accelerometer-measured PA at baseline and two-year changes in BMI, waist circumference and FMI, with one exception; in girls, minutes of sedentary time and LPA at baseline predicted subsequent changes in indices of lean mass.

5.2 Prevalence of accelerometer-measured PA in adolescents

Our results in paper I are at large in accordance with other studies assessing PA prevalence by accelerometry in adolescents (97, 112, 123, 193).

The main challenge when comparing different studies of accelerometer-measured PA is the lack of standardization of accelerometer processing options such as sampling frequency and epoch length, and data processing procedures such as cut points for intensity categories and wear time algorithms (123, 194, 195).

For example, the lower cut-point for MVPA ranges from 1000 CPM to 3000 CPM (123), affecting comparison between studies. A cross-sectional study by Ruiz et. al. (2011) including nine European countries (the HELENA study) using compatible, although not identical cut-points for MVPA showed that 41% of adolescents (mean age 14.9 years) met the recommended activity levels (27.5% of the girls and 56.8% of the boys) (196). These proportions are substantially larger than in our study, but the HELENA study included a wider age-span, and the sample was somewhat younger than ours. A recent review suggested that the proportion meeting PA recommendations ranged from 0-60%, depending on intensity threshold used (123), emphasizing the need for data harmonization for cross-study comparisons. Collaborations across different countries such as the Determinants of Diet and Physical Activity (DEDIPAC) Knowledge Hub (197, 198) and Prospective Physical Activity, Sitting, and Sleep consortium (ProPASS) (199, 200) hold promise for a better understanding of PA via harmonization of approaches to measurement procedures and data processing.

Although most studies use similar accelerometer cut-points to ours, epoch settings and wear time criteria were slightly different between the studies and results are therefore not directly comparable. For example, in our study we used epoch settings that are more commonly used in adults than in children. A 60-second epoch setting might have led to less time in higher intensities (201), however - the PA behavior pattern of the participants of FF1 (with a mean age of 16 years) is probably closer to that of adults than that of children. Furthermore, we used the nonwear-time algorithm from Hecht (161), and to our knowledge this algorithm has not been validated in children or adolescents. However, in a recent study comparing the Hecht algorithm to other wear time algorithms, the Hecht algorithm was shown to overestimate the amount of non-wear time, which in our studies mainly will have affected sedentary time and only to a small degree MVPA estimates (202). The implications of epoch settings, wear time algorithm, sampling frequency and choice of cut-points are further discussed in section 6.3.2, on methodological considerations.

We expected the PA levels in our sample of adolescents aged 16-17 years to be lower than in younger children, but higher than in adults. However, we found that the mean CPM in our sample was similar to that previously observed in Norwegian adults (120, 203). In a Norwegian study on levels of PA across the lifespan, a marked decline in PA between adolescents aged 15 years and adults aged 20-64 years was found (203). Although speculative due to some differences in accelerometer data processing, comparing these results with those from this study suggests that a large decline occurs already at the age of 16-17 years, when adolescents move from lower secondary school to upper secondary school (Figure 2).

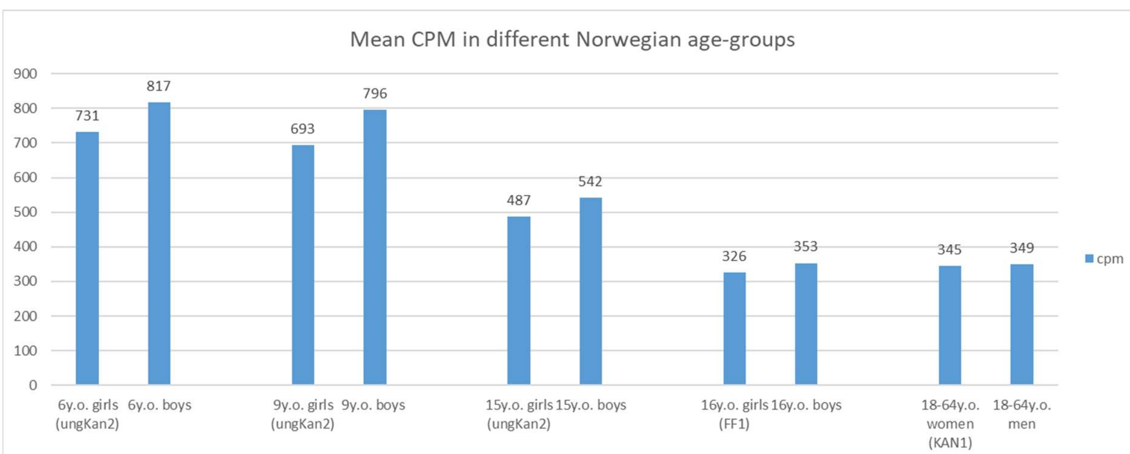

Figure 2: Mean CPM values in children, adolescents, and adults in Norwegian studies (120, 204), stratified by sex.

The higher activity levels in boys than girls in our study is consistent with previous studies (122, 123, 193). Even though we found that boys and girls accumulated about the same number of steps, there is a general agreement that MVPA is essential for health benefits (63), and step counts embrace the whole range of intensities of PA. The difference between girls and boys in this study seems to be more similar to national studies performed on children and adults (97, 203), than to international studies performed on adolescents (123, 196, 205).

We found lower PA during weekends compared to weekdays, which is in line with other studies (122, 123, 206). It is also worth mentioning that the observed variation is larger during weekends, as some of the adolescents increase their activity at this time.
Self-perceived health has been shown to be associated with a wide range of physical and mental health concerns (207). A longitudinal study from Norway found a consistency in self-perceived health from adolescence to young adulthood, and that self-rated health in adolescence predicted allostatic load in young adulthood (170). The positive association between self-perceived health and PA is consistent with the findings in several other studies, independent of age in the studied population (207-212). This is a young and physically healthy population, but despite this we found a significant correlation between the level of PA and self-perceived health status. This study did not investigate causality, and it is therefore not possible to ascertain the direction of this association. Nevertheless, a low level of PA might contribute to a lower health status over time, which again may lead to even less PA.

We have not been able to find other studies comparing levels of PA in different school programs. It might be considered obvious that students in a sports class are more physically active than peers in general studies and vocational studies. This raises the question of whether these students are more active because they are attending a sports study program, or if they attend the sports study program because they lead a more active lifestyle. The two are not mutually exclusive. This study did not differentiate between school time and after school activity. However, several studies imply that increased PA during the school day increases total PA (213-215). We consider our result to be in accordance with these studies. In the Fit Futures cohort, the 10% most active participants accumulated >70 minutes of MVPA per day, and the 10% least active participants <20 minutes of MVPA per day (Figure 2). This gives a picture of PA being an individual choice carried out mainly at leisure-time among most adolescents, and the school per se does not provide a sufficient structure for PA and MVPA.

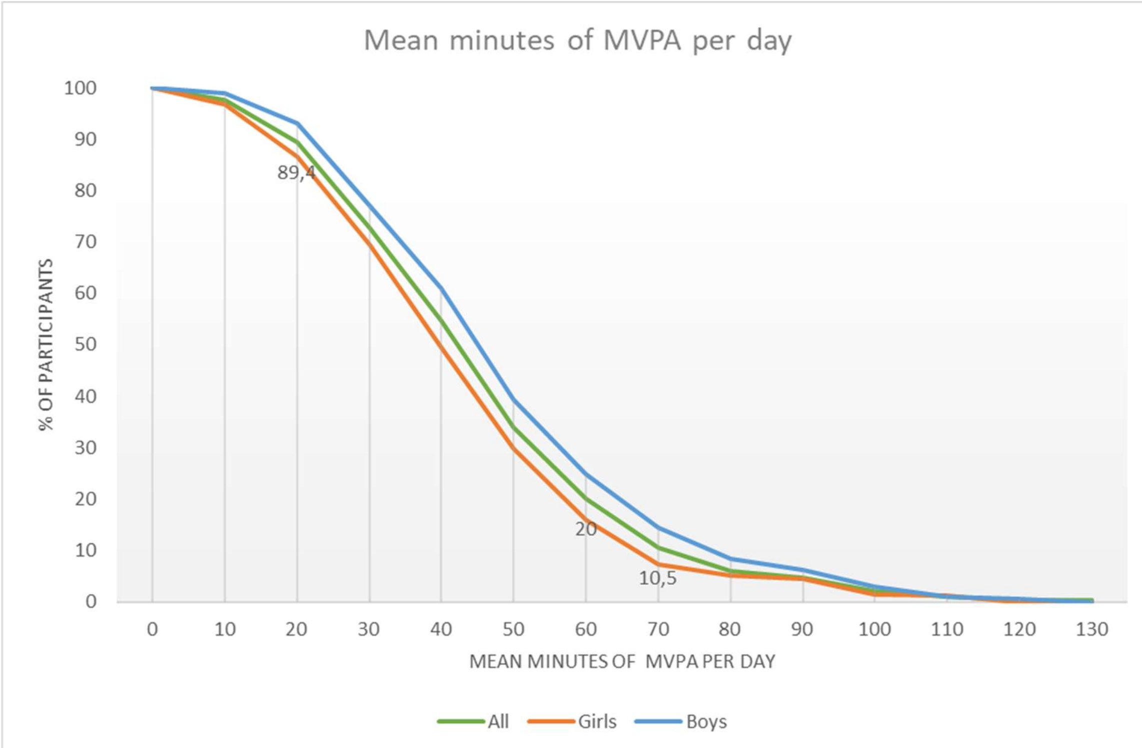

Figure 2: Distribution of mean minutes of MVPA per day in older adolescents participating in the Fit Futures Study 1

5.3 Criterion validity of SGPALS in adolescents

Although accelerometry is regarded as a more precise and objective measure of PA as it eliminates the limitation of recall and social bias related to self-reported PA, accelerometry is a more expensive and time-consuming method and thus not always available in clinical settings with limited time and resources, or in large surveys due to high costs. Therefore, knowledge on the validity of using simple self-report instruments is essential. The SGPALS has been frequently used in population studies in adults and its concurrent and predictive validity is good. In this study, we showed that the ability of SGPALS to rank physical activity levels in adolescents measured against accelerometry was adequate. In paper II, we found positive correlations between the SGPALS and accelerometer-measured mean CPM, steps/day and minutes of MVPA/day. These observations are consistent with previous studies in adults (216-218). To our knowledge no validation studies on SGPALS and accelerometer-measured PA in adolescents has previously been published. The weak correlations between accelerometry estimates of PA and the SGPALS highlight the biases associated with self-reported PA (219) and shows that the SGPALS poorly reflects PA volumes. A more detailed questionnaire might have given a more accurate view on volume; however, a more detailed questionnaire requires accuracy from the respondent and is therefore vulnerable to errors, especially with regards to higher intensities (220). This is further discussed in chapter 6.3.2.

Although the accuracy of PA volume and intensity is limited when measuring PA using the SGPALS, crude ranking of self-reported PA at population level is valuable (219). A satisfactory ranking ability of the SGPALS has been demonstrated against accelerometry (216, 221) and cardiorespiratory fitness measures in adults (216, 221-223). In our study of adolescents, the SGPALS demonstrated similar ranking ability of PA levels. For example, for every increase in SGPALS level, steps per day increased with ~1000 steps and MVPA with ~ 8 minutes per day. This sums up to ~7000 steps and ~60 minutes of MVPA extra per week if individuals increase their PA by one SGPALS level. Such increases would have relevant impact on public health and thus highlights the SGPALS´ ranking ability at the population level. In our study we have demonstrated that a short questionnaire which is simple to administer and understand has sufficient validity to rank PA levels in surveillance and in clinical settings. SGPALS can be recommended as a quick and easy tool to establish a crude classification on level of PA among adolescents and to identify those with low PA levels. The SGPALS may not be accurate in identifying moderate and high PA levels, which is in line with the results of a review on validity of self-reported PA compared to direct measures in both adults and adolescents (82, 224).

The ranking ability of the SGPALS was fairly similar across various strata. To our knowledge, the validity across strata has not been examined for the SGPALS in adolescents, and only to a small degree for PA instruments in general. A study on 8-10 year old girls found that social desirability was negatively associated with accelerometer measured PA, and positively associated with self-reported PA (225). In contrast, a study of adolescent boys, controlling for social desirability did not improve the relationship between self-reports and accelerometer assessments of PA (226).

Compared to other PAQs validated in adolescents, the SGPALS showed a similar degree of correlation with accelerometry as previous studies, such as the validity of the short version of the IPAQ and the International Physical Activity Questionnaire for Adolescents (IPAQ-A, developed from the long version of the IPAQ) (227), the latter when validated in older adolescents. Low correlation coefficients in the range of -0.02 to 0.02 were found between the

WHO HBSC questionnaire and accelerometer in adolescents aged 13-18 years (228). A systematic review from 2010 (229) showed that correlation coefficients between PA questionnaires and accelerometer around 0.3-0.4 for most studies in adolescents. Overall, the correlation of SGPALS with accelerometer seems to have similar magnitudes as other questionnaires and thus are feasible also in adolescents to rank PA levels in large population studies.

5.4 Associations between accelerometer-measured PA and changes in body composition in adolescents

In paper III, there were no associations between objectively measured PA and change in BMI, waist circumference and FMI for either sex. These results are in line with a systematic review including prospective studies using device-measured PA, which showed that accelerometer-measured PA is not an important predictor of change in adiposity in children, adolescents and adults (151). For adolescent populations the potential negative effects of physical inactivity might not yet have had time to manifest, as the adolescents are still undergoing physiological changes as a result of natural growth.

The observation that sedentary behavior and LPA predicted changes in LMI in girls, but not boys, may be explained by expected biological differences, as fat-free mass is relatively stable in girls after the age of around 15 years, whereas it increases up to 18 years of age in boys (230).

We found that sedentary behavior and LPA had opposite effects on lean mass in girls. Sedentary estimates are vulnerable to misclassification due to in inaccurate wear time algorithms and therefore more likely to wrongfully to be classified as non-wear time than higher intensities. This may have influenced the association with indices of lean mass in the paper III, as higher wear time may result in more sedentary time or LPA (231). However, adjusting for wear time did not change the associations substantially for sedentary activity, although they had some effect on the associations with LPA. Because of the inverse relationship between minutes spent sedentary and in LPA, it is not possible to determine whether it is time spent in sedentary behavior or time spent in LPA that is associated with change in LMI. The practical conclusion is that being active increases lean mass in girls.

Moreover, the low levels of PA in this cohort means that documenting change in body composition from different levels of PA is "comparing little PA with a little less PA". This is true for all study specializations, as even in the sports classes only 60% of the participants with valid accelerometer measurements fulfilled the recommendations of 60 minutes of MVPA/day. Among the remaining participants, only 16% reached this universal goal.

In paper III, we chose to use baseline PA as exposure, as follow-up data on device measured PA was not available at the time. However, baseline measurements of PA, being a changing and alternating behavior, is not necessarily representative of actual habits during the period of follow-up (151, 232). In adolescents, PA is less stable than in adults (173, 233, 234).

Some studies have found that the decline in PA is relatively stable from the age of 6-7 years to around 15 years (235) , and that the decline from 12 years to 15-16 years is mainly a decline in LPA (236, 237). Reductions in level of PA during the transition from adolescence to young adulthood are common, and there is an evident decline in MVPA (238). A previous study from the Fit Futures-cohort showed that change in self-reported PA between baseline and follow-up was a stronger predictor of change in body composition than self-reported baseline PA (239). Other studies have suggested that change in activity during follow-up might obscure an association with body composition (240, 241).

In paper III we could not find associations between PA and body composition only two years later. Two years of follow-up might be short in this context (119, 242). A review including 13 studies on PA and adiposity in young people found that nine of the studies reported an inverse association between PA-level and adiposity (242). One of the studies included almost 3000 children with a follow-up after 4 years (at the age of 15-16 years), and concluded that baseline MVPA was beneficially linked to all adiposity indicators, as well as several other cardiometabolic risk factors such as triglycerides (TG), low-density lipoprotein (LDL) and systolic blood pressure (243).

However, an interesting aspect here is what comes first, inactivity or adiposity? In a previous study from the Fit Futures, there was no statistically significant effect of physical activity levels at baseline on change in neither BMI, FMI nor LMI during the following 2 years (244)

This indicates that the association, whether it be one-directional or bi-directional, between PA and overweight is weak in adolescents.

A study following children from 7 to 10 years with annually measurements concluded that physical inactivity seems to be the result of fatness rather than the cause (245). In general, studies of children and adolescents show inconsistent findings on the association between PA and overweight (119, 149, 150, 153, 245, 246)

A systematic review and metanalysis concludes that there is evidence for a consistent and inverse association between MVPA and clustering of cardiometabolic risk factors; however, the prospective associations between MVPA and adiposity was inconsistent among the included studies (246). A recently published study using accelerometer data from the International Children's Accelerometry Database (ICAD), including participants from 3 different countries in a longitudinal fashion, with investigations done 3-6 years apart (mean age at time of first data collection was 11.3 years and at follow-up 15.6 years), found that a decrease in MVPA was associated with an unfavorable change in certain cardiometabolic risk factors (TG and LDL cholesterol) (119). Determinants of body composition was not included in this study, though. A review of randomized-controlled trials on high-intensity interval training as intervention on children found similar effects on total cholesterol, TG and LDL cholesterol (247), but a small and not statistically significant effect on BMI. Adding our study to these findings, the association between PA and adiposity in adolescents seems weak and possibly bi-directional, and other factors such as diet, puberty, and transitions may largely influence the association.

Despite these finding, we know that many diseases develop from early age. For example, atherosclerosis is shown to develop at young ages; autopsy studies have shown that in children killed in motor accidents, over 50% of children aged 10-14 years had some evidence of early atherosclerosis (248). Prevention thus should begin as early as possible, and although the associations may have not manifested to a large degree in adolescents, PA may be of large importance for prevention of disease later in life. Adding to this, PA habits tend to track into adulthood, resulting in health gains later in life (249).

5.5 Discussion - common

Application and the interpretation of accelerometry results requires detailed knowledge concerning the devices – and what the device actually measures. While accelerometers are widely used, they are to less extent fully understood by their users. Accelerometers measure acceleration, which is used as a proxy for intensity of physical activity. This is in contrast to self-reported measures of physical activity, which applies concepts people are familiar with: time, type of activity, and settings.

The participants of FF were asked to wear the accelerometer for one week, and to be included in the analysis wear-time had to be at least 4 days. The consequences of those requirements are that 30-40% of the participants who actually wore the accelerometer still did not contribute to the data collection. Obviously, devices to measure PA adds a lot to research, but for the everyday mapping of children and adolescents and their lifestyle habits a questionnaire that takes 5 seconds to answer is much more accessible. Cut points and mean CPM is difficult to understand, but inactive vs. very active is understandable for both teachers, students and school nurses. The load for the users is substantially lower by asking them a single question, then asking them to wear a device for a full week. Understandably, for research purposes, this is necessary, but for clinical purposes it might be overcomplicating. For instance, presently, the height and weight of all children in Norway are measured annually in schools by school nurses. If a school nurse finds a student with an alarmingly high BMI, attaching an accelerometer to the student would in most cases be too time consuming, but health personnel may easily use the SGPALS to quickly get an indication of the activity level of the student and can thus act immediately.

While we have shown that the SGPALS instrument can be used to rank PA levels in accordance with ranking of PA with accelerometers, both self-report and accelerometry has its limitations, which we will discuss in the following chapter.

6 Methodological considerations

6.1 Study design

Fit Futures is an observational study, which is cross-sectional by design, but can also be longitudinal and prospective when examining longitudinal data from Fit Futures 1 and 2. Paper I uses a cross-sectional design, paper II is a validation study, whereas paper III is a longitudinal study. Cross-sectional studies can establish associations, but not the direction of the association. Longitudinal studies can suggest cause-and-effect relationships (250), but given that the studies are observational, causal effects cannot be established. Moreover, in the setting of Fit Futures the follow-up-time is only approximately 2 years, and there are only two observation points. In paper III, the exposure variable is PA measured at baseline, and the outcome variable is change in body composition between baseline and follow-up 2 years later. In such a design, conclusions are based on the assumption that baseline PA is representative of PA the two following years. This is not necessarily the case in any study, but is perhaps especially so when the participants observed are adolescents. During adolescence, changes in body composition are expected because of natural growth and substantial changes in behavior such as PA during adolescence which represents a transition period.

6.2 Random errors

Random errors represent the variability in the data that we cannot explain, such as sampling variation and random measurement variation (251). Random errors are often referred to as "chance" and "noise". It is common practice to always assume a degree of sampling variation, as no sample will ever truly be identical to the target population (251). One of the most important determinants of the extent to which chance affects the findings of a study is sample size (252). Large samples reduce the effect of random error and approach the true estimate of the population. The confidence interval can inform how close the estimate is to the underlying true population value. Random measurement variation may negatively affect the reliability of the measurements, and the risk of this error can be reduced by securing precision in measurements (251). The Fit Futures study was performed at UNN HF in a specialized department designed for medical research, with dedicated and experienced research technicians who are trained in procedures for data collection to reduce interobserver variability. The Fit Futures administration worked out detailed protocols before the study, and data quality were monitored throughout the survey. The way the study was conducted and with a sample size of more than 1000 participants, with almost equal sex distribution, it is likely that the precision and random errors are at an acceptable level. However, even with a large sample size, some of the stratified analyses had small samples in certain subgroups.

6.3 Systematic errors

Bias refers to any systematic error in an epidemiologic study that results in an incorrect estimate of the true effect of an exposure on the outcome measured (253).

6.3.1 Selection bias

Selection bias occurs when the sample that is studied is not representative for the target population on which conclusions are to be drawn. The sample in Fit Futures 1 consists of students in first year upper secondary school in the municipalities of Tromsø and Balsfjord. The Norwegian educational system allows all adolescents to enroll at this level, but it is not part of the compulsory school attendance. About 98 % of those finishing the last year of compulsory education continues directly into upper secondary school (254). Of the 1301 individuals registered to start first year secondary high school in the fall of 2009, 70 were missing probably because they dropped out of school before Fit Futures started including participants. There are reasons to believe that those quitting (or not starting) upper secondary school to a certain degree differ from those fulfilling (255). Another 114 individuals did not attend school due to persistent disease, or unknown cause. The remaining 1117 students were invited to the study, of which 92.9% (1038 individuals) attended. School dropout and persistent disease may be associated with several life-style factors of interest in our study (55, 256).

In addition to those not participating a considerably large proportion did not provide valid accelerometer wear time. The non-wear time algorithms might exclude more overweight and obese participants, assuming this group spends more time being very sedentary and therefore misclassified as accelerometer not worn (257). However, in a recent publication based on the same population from Fit Futures, missing accelerometer data were imputed and a sensitivity analysis showed that the participants with missing accelerometer data did not differ significantly from the participants with valid data (258). In paper III we compared those participants with valid data on body composition, but without valid accelerometer

measurements, to those included in the study. They did not differ significantly in any measure of baseline body composition, except FMI in boys which was slightly higher in those without valid accelerometer measurements (5.0 vs. 4.2, $p<0.05$).
More boys than girls were lost to follow-up between FF1 and FF2. In girls, but not boys, those lost to follow-up had slightly less minutes in both LPA and MVPA. More students attending vocational study programs were lost to follow-up; the reason for this might be apprenticeship. In paper II we found that a larger proportion of girls than boys provided valid accelerometer data (68% vs 52%, $p<0.001$), while distribution of parental level of education, BMI and self-reported health did not differ between those with and without valid accelerometer data.

In summary, given the high attendance rate and the analysis done on the participants without valid accelerometer measurements and those lost to follow-up, we do not consider selection bias to have substantial effects on our findings.

6.3.2 Validity of physical activity measurements

Valid measures of PA are essential to allow researchers to accurately answer questions about prevalence and patterns of PA, about the relationship between PA and other health-related variables and whether an intervention has an effect on PA (58).

Questionnaires

Questionnaires are the most frequently used measure of PA in population studies (190). There are several PAQs available for PA researchers (73). Questionnaires are valid to assess structured PA, however, self-reported PA is likely influenced by recall bias and social desirability bias, which may introduce misclassification and influence the validity of self-reported PA (72, 82, 188, 189).

In a population study a global questionnaire might be more valid than a more detailed questionnaire. If you want to examine the prevalence who fulfill the WHO recommendations for PA, the researcher could preferably use IPAQ or a similar questionnaire. However, to categorize level of activity, the ranking ability of the SGPALS was shown to be acceptable.

A systematic review regarding practical PA measurement in youth conclude that the practical advantages of self-reported measures justifies the lack of precision, especially in large samples if the purpose of the PA evaluation does not require a high degree of measurement precision for each individual (227). A study assessing validity of SGPALS in adults found a correlation of 0.21 for mean CPM (218) and an older review argue that they found evidence that questionnaire looking at the past year ("habitual PA") is valid also in adolescents (259).

Recall bias refers to bias arising when those who are most physically active for example keep an exercise diary or exercise more regularly, and thus are more aware of their PA habits. On the other hand, those who are less physically active or do not attend a regular activity might have more difficulties recalling the amount of past PA. In paper II we used a "global self-report" questionnaire, characterized by brief measures used to stratify populations into high and low PA exposure categories (58). The reports on PA from these instruments are derived from generic memory (memories of general knowledge, as opposed to "episodic memories"), and seasonal variation and day-of-the-week effects should be minimal because of the long timeframe of these questions. This may make the questionnaire used in this thesis less prone to recall bias.

Social desirability bias refers to the tendency to give responses they believe to be consistent with social norms and expectations, instead of choosing the response that is closer to the actual fact. This may lead to over- or underreporting of PA (72). A study on young adults showed little evidence of an influence of social desirability on scores from two self-report instruments for measuring PA (260). In paper II we found that the ranking ability of the SGPALS was similar across various socio-demographic strata. A previous study on 8-10 year old girls found that social desirability was negatively associated with BMI and levels of accelerometer measured PA, and positively associated with higher self-reported PA (225). In a study of adolescent boys, controlling for social desirability did not improve the relationship between self-reports and accelerometer assessments of PA (226). A study on obese adults showed a tendency to over-estimation of PA and under-reporting of food intake (261). It is possible that over-estimation of PA could be related to the perceived PA load being of moderate or vigorous intensity, while the actual accelerometer counts were not high enough to be classified as such. Questionnaires were not used in paper I and III.

Accelerometer

Accelerometers are seen as more reliable than self-report, as devices are not based on recall and to a lesser degree affected by social desirability. However, the concept that accelerometers provide “objectively measured PA” is debated, as indices of PA determined by accelerometers are affected by how accelerometer data are reduced from the recorded acceleration signal to indices of activity.

<u>Frequency</u>

First, accelerations are sampled at a certain frequency, typically ranging from 30-100 Hz. This is a setting in the accelerometer done by the researcher, previous to handling it out to the participants. During slow walk there is not much difference, however during fast run there is a larger mean difference and results are more scattered (262). In general, a sampling frequency of 100 Hz generates more counts than a sampling frequency of 30 Hz.

<u>Filtering</u>

In addition, there is a possible measurement error depending on frequency filtering: Less restrictive filtering includes more movement-related signals, but may include more noise, and a more restrictive filter weakens the acceleration signal for walking and especially running. This affects shorter individuals (children) more than taller individuals (adults) (263). In our population the mean height was 170.3 cm, close to adult height. We used normal filtering, meaning that the acceleration signal is markedly attenuated if the frequency of acceleration peaks falls outside of the range of 0.25-2.5 Hz (85). The reason for using this filter is that most forms of human movement fall within this frequency range, and hence the filter will eliminate artifact vibrations. However, newer ActiGraph models have an option of low frequency extension (LFE) filter, which could be used for “greater sensitivity to lower intensity activity, more comparable results to studies using the older models, and more appropriate application of established calibration cut points” (264).

The different brands of devices measuring PA have different algorithms for processing the raw data into counts, and the transformation from raw accelerometry to counts represents a “black box” when using the ActiGraph.

Classification of intensity (cut-points for intensity)

The lack of a consensus on cut-points for the different intensity categories is a major issue when comparing different studies (194, 265, 266). The cut-points from Freedson (162) are widely used and were chosen in this study. These cut-points were developed for adults (mean age in study population was 23.9 years), but since the participants in Fit Futures are in late adolescence it is probable that their body movements are not as different from those of a young adult. In the European Youth Heart Study the lower cut-point for MVPA was set at 2000 CPM (267), and this was also the cut-point used in a Norwegian study of 9- and 15-year-olds (97). A Norwegian study on adults used a cut-point of 2020 CPM as the lower limit for MVPA. These cut-points are close to the Freedson cut-point at 1952 CPM. The cut-point for sedentary time has been validated in adolescent girls (268) and is widely used in the literature.

Also worth noting is that the accelerometer cut-points are set independent of the physical fitness of the participant, and perceived intensities as moderate or vigorous PA might therefore be registered as LPA through the accelerometer, especially in unfit subjects (269).

Epoch length

Studies have shown that the choice of epoch length impacts the results (201, 270, 271), especially regarding vigorous intensities. Epoch settings represents a balance in precise quantification of PA: On one hand the fact that PA of vigorous intensity must last for a certain time for an association with health benefits to be visible, and on the other hand epochs must be short enough to avoid that bursts of vigorous PA are averaged out by low CPM. Thus, the longer the epoch, the more we mask the vigorous PA as moderate or even light PA.

Our choice of epoch settings of 60 seconds must be kept in mind when making comparisons between our study and similar studies in Norway or abroad. Our epoch settings might have led to estimates that mask time in higher intensities (201), which might contribute to a false low percentage of participants meeting the WHO recommendations of PA. However, our choice of epoch settings reflects the fact that the participants of FF1 are closer to adult PA behavior pattern than that of children. In addition, our choice of epoch settings makes it easier to follow the participants of Fit Futures in a longitudinal fashion, through FF2 (2012-13) and the coming FF3.

Wear time

We used the non-wear time algorithm from Hecht (161), which was originally developed for adult patients with chronic obstructive pulmonary disease (COPD). Obviously, the participants of the FF1 differ from older COPD-patients, and to our knowledge this algorithm has not been validated in children or adolescents. However, in a recent study comparing the Hecht algorithm to other wear time algorithms, the Hecht algorithm was shown to perform well on accuracy and sensitivity, suggesting that Hecht correctly inferred a high percentage of the true non-wear time (202). However, the Hecht algorithm performed poorly on positive predictive value, indicating misclassification of true wear time as non-wear time, overestimating the amount of non-wear time. This may have largest impact on sedentary behavior and less on MVPA (202). Even so, one should take into consideration that the study comparing the non-wear time algorithms were done on an adult population (participants of the 7^{th} Tromsø study, ≥40 years old), and hence we do not know if the results apply to adolescents.

Moreover, previous studies have different requirements when defining valid measurements in terms of wear time, i.e. number of days and hours per day required (272, 273). Wear time criteria for a valid day in our work was 10 hours, which leaves potentially 14 hours of non-wear time, with unknown amount of activity. The potential "happenings" during these hours of no registration of activity are as follows:

1. Accelerometer not worn – unregistered sedentary time?
2. Accelerometer not worn – unregistered PA such as water-based activity or contact sports?
3. Accelerometer worn – misclassification because of almost no moving, for example because of napping, sitting very still or watching TV on the sofa?

The fact that the researcher makes decisions on how to define intensities and how to define wear-time makes the term "objective" somewhat imprecise, and therefore "device-based measures of PA" is emerging as the preferred term. However, "device" may include other devices such as heart rate monitors and GPS, and therefore "accelerometer-measured PA" was used in this thesis, as it is exactly what was investigated. The choice of terms has been an internal process during the project; in paper I and III we still used the term "objective".

Comparability

Comparability to other models of accelerometers (or generations of the ActiGraph) seems satisfactory, as different accelerometers have shown satisfactory general agreement, validity and reliability (274-277). Triaxial accelerometry has shown better ability to capture differences in movement pattern between sports, but for most people, the amount of time spent on sport is so little that – across the whole day – uni- and triaxial accelerometer measurements correlate closely (278, 279).

In Fit Futures a hip worn accelerometer was used. These are shown to underestimate PA when cycling, going uphill, carrying loads and swimming, and overestimate when walking or running downhill (86, 280). Under- and overestimation of PA may weaken the associations between PA and health outcomes.

Data processing

The processing of the accelerometer data was done using the QCAT software. QCAT was developed at UiT to be able to maintain a better control of the accelerometer data analysis, which is usually done by ActiLife (the software by ActiGraph), and to develop the research environment at UiT. A study has shown very strong correlations for light, moderate and vigorous PA data processed in both ActiLife and QCAT (Pearson $r \geq 0.94$), and a strong correlation for sedentary behavior ($r=0.61$) (281). Currently, processing of data in QCAT is based on pre-processed .agd-files from ActiLife, and such processing of the data through the QCAT software differs from ActiLife in the choice of wear time algorithm and the ability to create custom variables.

Reactivity

We deleted the first day of accelerometer measurement, which was incomplete due to the fact that the ActiGraph was initiated to start measuring by the time of attendance, to diminish reactivity, which is the possible change in behavior from the participants while under study. The size of this problem is not thoroughly studied. In a reactivity study on pedometers (282), the participants were first told that the device measured posture, being unaware of the pedometer function. After one week, they were made aware of the pedometer function, with visual display of step count. As the participants simultaneously logged their daily step count in a diary, the researchers concluded that reactivity seemed to last one week (as step count went significantly up the second week compared to the first, but back to the same count as the first week in the third week) (282). Another study showed that there was no significant difference between participants wearing a pedometer thinking it was a "posture monitor" and the same participants wearing a sealed pedometer with no display the subsequent week, even if they then were aware that it was a pedometer (283). The ActiGraph has no display and therefore provides no information of activity level while they are worn. Hence, reactivity is probably not a source of great concern in our study, especially since the first day was removed.

Weekend and seasonal variation

From the literature, there is consensus that PA is lower during weekends than during weekdays among both children, adolescents, and adults (97, 204, 206, 213, 284). Our study encompass measurement of both weekdays and weekends PA, although the data processing criteria of at least 4 days with 10 hours accelerometer wear time left us with less participants with valid weekend than weekday measurements.

From the literature there is certain evidence for seasonal variability in PA prevalence (285-290). Several studies on children and younger adolescents have shown an increase in BMI during summer vacation, especially in the overweight and obese ones, and a decline in physical fitness (291). In FF1, the accelerometer measurements were done from September 2010 to June 2011, which introduces a possibility to adjust for seasonal variation in PA. However, all of the measurements were conducted during the schoolyear, and we therefore lack accelerometer data from the summer season, which is the time of the year with the most daylight, the highest temperature and better outdoor conditions. Moreover, participation was clustered by school, for example; all students in the sports program attended the survey in January. A difference in level of PA between seasons would likely be the result of differences between schools or study programs, rather than season itself, therefore we did not adjust or stratify according to seasonal variation.

6.3.3 Validity of body composition measures

6.3.3.1 Body mass index (BMI)

Since there are known limitations associated with BMI such as lack of the ability to distinguish between fat mass and fat-free mass, we chose to not rely on BMI alone for the purpose of paper III, as more sophisticated methods were available. BMI as a measure of body composition was included for comparison with other studies.

6.3.3.2 Waist circumference (WC)

In addition to BMI, WC was also included as a body composition measure in paper III, to reflect abdominal adiposity. This measure is commonly used in studies and included as a component in the metabolic syndrome (292). Waist circumference is simple, cost-effective, and non-invasive (293) and considered more specific to abdominal overweight and obesity than BMI, and may therefore be better suited to detect adiposity. This may be especially relevant considering that BMI fails to identify tissue-specific changes in body mass, and pubertal development has gender-specific effects on muscular- and adipose tissue (294). However, while WHO has recommended a certain procedure for measuring WC, different studies apply different procedures, hampering comparability between studies (295).

6.3.3.3 Dual-energy X-ray absorptiometry (DXA)

DXA is considered high quality compared to weight alone, BMI or WC, and has good ability to determine bone- and lean mass, although slightly less precise in determining fat mass, particularly in very lean or very obese people (137). By using DXA measures, we were able to extend the research field in adolescents by measuring fat and lean mass. DXA has some limitations as well. The precision of DXA varies between manufacturers and software and care should be taken when comparing estimates of fat mass performed using different DXA scanners. Like with ActiLife, the estimates of fat- and lean mass are based on algorithms built into the software of manufacturers, which is therefore also a "black box" not readily available to researchers.

6.4 Generalizability of results (external validity)

Internal validity of an observational study is vital to be able to discuss external validity. In the paragraphs above we have discussed internal validity and argued that errors and biases are within acceptable range. The next step is to discuss to what extent the findings are generalizable to a larger population.

The sample of adolescents in Fit Futures 1 is comparable to other Norwegian data in terms of weight status (296). According to national data from 2018 (UngKan3), the number of 15-year-olds meeting guidelines on MVPA was considerably higher (40% of girls and 51% of boys) than the participants in FF1 (296). This might be due to actual differences between 15- and 16-year-olds, but can also be due to differences between the north and the south of Norway, or technical data handling. In UngKan3, the number of 15-year-old participants from the northernmost county (Troms and Finnmark) was small. The cut-points for MVPA were similar, but the wear-time criteria were different (fewer days and fewer minutes per day to be included in UngKan3 than in Fit Futures).

One could argue that adolescents living in the northern part of Norway are exposed to other environmental factors than adolescents growing up further south, such as longer winters and polar nights. This may affect the types and volume of PA performed, but according to national data on 15-year olds' PA there were no differences in CPM between the regions in Norway (297). In summary, we believe the cohort has acceptable generalizability to Norwegian adolescents.

7 Conclusion

The main conclusion of this thesis is that

- In the population based Fit Futures study, the majority of 16- to 17-year-old adolescents did not fulfil the current WHO recommendations for PA. Total PA volumes were similar to those reported in Norwegian adults.
- The SGPALS shows satisfactory ranking validity measured against accelerometry in adolescents, and the validity is fairly stable across strata of sex, BMI, and education, which indicates that short questionnaires on PA have sufficient validity to assess PA levels in many clinical settings as well as large surveys. However, the validity of SGPALS in providing information on absolute physical activity levels is limited.
- Accelerometer-measured PA at baseline was not significantly associated with change in objectively measured BMI, waist circumference or FMI after two years in this cohort of North Norwegian adolescents. There was evidence to suggest that sedentary behavior and LPA affected indices of lean mass in girls, but not in boys.

8 Implications for public health and future research

Our studies showed that PA levels in older adolescents are substantially lower than in younger adolescents, and at the same low levels as in adults. A large body of research demonstrates lack of adherence to PA guidelines, and future research should focus on interventions to address this. Inadequate levels of PA constitute a significant challenge for public health, and efforts should be made to increase PA to recommended levels. As few adolescents seem to adhere to the PA guidelines, there may be need for a debate of both the guidelines, particularly in late adolescence, and how to motivate adolescents to be more physically active.

A continued focus on standardized ways to measure and analyze PA is warranted. The use of raw accelerometer data to harmonize different studies is a good start (298). Researches coming together as in the DEDIPAC Knowledge Hub (197) and ProPASS (199) should continue. In addition, further research on the use of smart devices could be a way to reach larger groups of the population.

In June 2020 the Norwegian government published a plan of action for PA, “Together for active lives” (299), with a vision based on the goals from the WHO Global action plan on physical activity 2018-2030 (300). The goal is to reduce physical inactivity in the population by 10% by 2025 and by 15% by 2030. We acknowledge the work and the focus on PA. Health officials would profit from a future research focus on identifying the least physically active individuals and specifically target these groups for interventions.

The Norwegian Parliament declared in 2017 one hour mandatory PA each school-day from 1st to 10th grade (301). This has so far not been introduced in the Norwegian schools, due to lack of political and economic priority of the resolution. Socioeconomic differences when it comes to adherence to recommendations on PA are a public health challenge, and providing the recommended amount of PA to adolescents during the school hours may be a practical and evident solution to this challenge. In paper I, we observed higher amount of PA in adolescents with higher education among the parents. This calls for implementation of the one-hour mandatory PA per day not only in 1st to 10th grade, but also further on in upper secondary school (11th through 13th grade).

One challenge with measures addressing increased PA in adolescence is that many of the health gains are noticeable in some remote future. This applies to the motivation of the individual adolescent, but also to the politicians who allocate funds to improve health. The timeframe for budgets and evaluations of effect are much narrower than the time it takes to see hard endpoint health gain from increased PA. The estimated annual costs for one hour daily of PA in school is estimated to 6 billion Norwegian kroner (NOK), which may be a hard sell considering that the effects lie in the future and by definition therefore are uncertain.

Many people see exercise and PA as something negative, something hard and a cause of bad consciousness because they do not have the time or the energy to implement PA into their life. As we try to achieve more and get more things done, we replace the opportunity of an active transport (and thus a less need for exercise) with passive transport such as cars and trains. In Norway almost 40% of all car-travels are less than 3 km (302). This distance is easily reached by bike or on foot. Switching back to active transport could be more sustainable in several ways – it's good for the body, the mind and the earth.

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Paper I

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Prevalence of accelerometer-measured physical activity in adolescents in Fit Futures – part of the Tromsø Study

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Abstract

Background: Previous studies show large variations in physical activity (PA) levels among adolescents. However, the number of studies is limited and even fewer studies have assessed PA in adolescents by accelerometer devices. This study aimed to describe accelerometer-measured PA levels in adolescents in a population-based cohort in Northern Norway.

Methods: In 611 students aged 16–17 years attending the Fit Futures Study, PA was measured by Actigraph GT3X for seven consecutive days. PA was expressed as total PA volume (counts per minute, CPM), time spent in intensity zones, steps per day, and fulfilment of WHO recommendation (i.e. accumulation of 60 min or more of at least moderate intensity PA per day). Potential correlates of PA such as sex, socioeconomic status, study program, self-perceived health, and PA variations by weekday versus weekend were also examined.

Results: 16% of the girls and 25% of the boys fulfilled current WHO-recommendations. Total PA volume (CPM) was higher in boys than in girls (353 (SD 130) versus 326 (SD 114) CPM, $p < 0.05$). PA levels differed with study program and increased with better self-perceived health, but were not associated with socioeconomic status. Both boys and girls were more active on weekdays than weekends (altogether; 350 (SD 124) versus 299 (SD 178) CPM, $p < 0.05$).

Conclusions: In this cohort of adolescents, less than 25% of 16–17-year-old boys and girls fulfilled the WHO recommendations. The levels of physical activity in 16–17-year-old adolescents are similar to previous data reported in adults.

Keywords: Population-based cohort, ActiGraph GT3, Physical activity recommendations, Self-perceived health, School program, Socioeconomic status

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Background

Insufficient physical activity (PA) is one of the leading risk factors for mortality globally [1, 2], and is associated with higher risk of non-communicable diseases (NCDs) [3–6]. Levels and patterns of PA seem to differ across the lifespan [7], and current literature indicates that PA levels are highest at the age of 6–9 years [7–9]. Studies indicate a 30% reduction in PA throughout adolescence from age 15 years [10] to age 20 years [11]. Moreover, a review of worldwide secular trends concludes that PA levels among adolescents are declining [12]. A recently published paper shows that this is a global phenomenon, independent of income levels of a country and cultural diversity [13]. PA as behaviour tends to track from adolescence to adulthood [14–17], and knowledge about PA levels and patterns in adolescents could help direct efforts and resources to prevent physical inactivity as adults.

There are different ways to measure PA, with different strengths and weaknesses. Questionnaires gives an insight in what kind of activity (behaviour) and can include types of activities not recognized by accelerometers. However, accelerometers are objective indicators of body movement (acceleration) and yield more precise measures of intensity, frequency and duration [18]. Most population-based studies of PA are based on self-reported data, which have been shown to overestimate PA [19] and therefore may yield crude and inaccurate estimates. To develop high quality evidence-based public health interventions, more precise PA estimates are warranted.

The use of devices such as accelerometers to measure PA is increasing, providing more accurate data on PA levels and patterns [20]. Device-based measured PA levels among adolescents indicate large variations, and existing studies report low compliance to PA recommendations [10, 20–23]. However, there is a paucity of data on accelerometer measured PA among older adolescents. The aim of this study was therefore to fill this gap, by describing accelerometer-measured PA in adolescents aged 16–17 years old in Northern Norway and to examine potential correlates of PA in this age group.

Methods

Study population and design

The Fit Futures Study (TFF) is a population-based cohort study of adolescents in Northern Norway and part of the population-based Tromsø Study [24, 25]. We used data from the Fit Futures 1 (TFF1), which was carried out from September 2010 to April 2011. All students in their first year upper secondary school, which is the 11th school year in Norway, were invited to participate. The data collection included questionnaires, clinical examinations, and blood samples. Altogether 1117 students from one urban and one rural municipality were invited, and 1038 (92.7%) participants attended, involving 8 different schools and 3 different study programs (general, vocational, and sports studies). The participants were recruited through the schools, and the examinations were conducted during a school day.

Participants without valid accelerometer data were excluded

The participants signed a written informed consent. Participants younger than 16 years of age signed with written permission from guardians and those aged 16 and above signed at the study site. The Regional Committee for Medical and Health Ethics has approved the study (2012/1663/REK nord).

Data collection

The participants filled out an electronic health and lifestyle questionnaire including self-reported PA, self-perceived health (very bad, bad, neither good nor bad, good, excellent), and parents' education as a proxy of socioeconomic status (SES) (don't know, primary school 9 years, occupational high school, high school, college < 4 years, college 4 ≥ years) (Additional file 1). The parent with the highest education was regarded as "parents' education". Experienced technicians conducted a physical examination. Height and weight were measured following standardized procedures including light clothing and no shoes on an automatic electronic scale, Jenix DS 102 stadiometer (Dong Sahn Jenix, Seul, Korea). BMI was calculated as weight in kilograms divided by the squared height in meters and categorized into $< 18\ kg/m^2$ (underweight), $18–24.9\ kg/m^2$ (normal weight), $25–29.9\ kg/m^2$ (overweight) and $\geq 30\ kg/m^2$ (obese). Study program (vocational, general studies and sports) was registered. At the end of the examination, the accelerometer was handed out. After 8 days the accelerometer was collected at school.

Assessment and processing of physical activity data

Physical activity was assessed with the ActiGraph GT3X (ActiGraph, Pensacola, FL), recording accelerations in three axes (axial, coronal and sagittal). Trained technicians instructed the participants to wear the accelerometer on their right hip attached with an elastic band for seven consecutive days, and to remove the ActiGraph only for water-based activities and during sleep. The devices were initialized in ActiLife with sampling frequency 100 Hz and default filter was used to aggregate raw data into epochs of 10 s. Data were collected between 14:00 on the first day and until 23:58 on day eight. The first day of measurements was removed to reduce reactivity [26]. In accordance with other studies [27], measurements were included in the analysis if the participant had accumulated at least four days of ≥10 h per day of activity.

2Non-wear time was identified using a triaxial method described by Hecht et al. 2009 [28]. A minute was considered wear time if: either its value was > 5 vector magnitude units (VMU) CPM and there were at least 2 min > 5 VMU CPM during the time span of 20 min before and / or after this epoch, or its value did not exceed 5 VMU CPM, but both on the preceding, and on the following 20 min there were 2 or more minutes > 5 VMU CPM, otherwise as non-wear time. The ActiLife v6.13.2 software was used for downloading of accelerometer data (ActiGraph, LLC, Pensacola, USA), and further data processing was done with the Quality Control & Analysis Tool (QCAT). Prior to analyses in QCAT, the data was aggregated to epochs of 60 s. This was considered reasonable for the basic variables related to volume, intensity and duration of PA, and made our study comparable to other Norwegian studies [8–10, 29]. In this study, uniaxial data are presented for comparability with previous studies. Freedson uniaxial intensity cut-points were used to categorise time (min/d) into different intensity levels as follows [30]: Sedentary behaviour 0–99 CPM, light PA ≥100–1951 CPM, moderate PA ≥1952–5724 CPM, and vigorous PA ≥5725 CPM [31]. Moderate and vigorous PA were merged into moderate to vigorous PA (MVPA). Step counts are accumulated on a per-epoch basis and based on accelerometer data collected from the vertical axis [32].

PA was quantified as counts per minute (CPM) from the vertical axis. The following PA variables were extracted for use in this study: Accumulated minutes per day spent in the different intensity categories; mean number of counts per minute (CPM); percentage of the population fulfilling

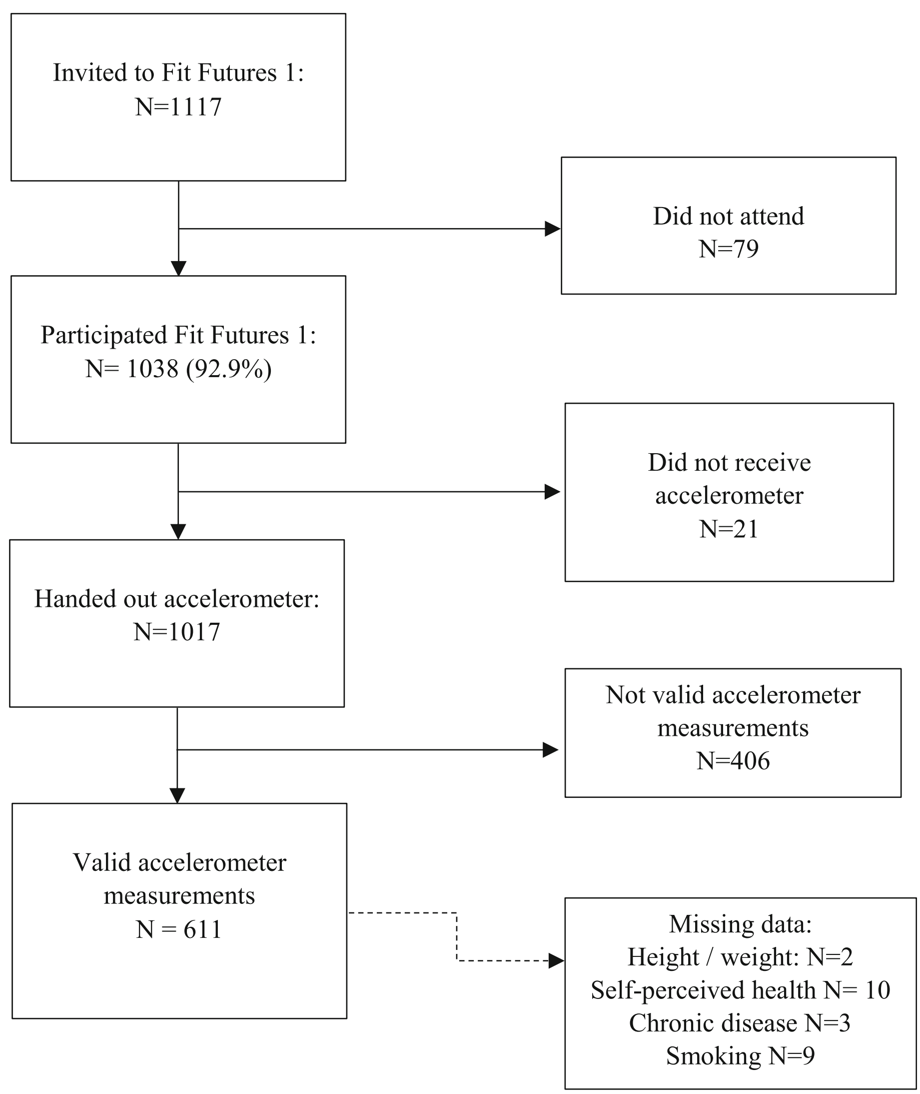

Fig. 1 Participation in the Tromsø Study: Fit Futures 2010–11

the WHO minimum recommendations of ≥60 min MVPA per day [33]; steps per day; and the percentage of participants accumulating ≥10.000 and ≥ 6000 steps per day. We chose 10.000 steps per day because this is a commonly used cut off value, and several studies have shown a correlation to fulfilment of activity recommendations of 60 min MVPA per day [34, 35]. On the other hand a cut off of 6000 steps per day has been associated with a sedentary lifestyle [35, 36].

Statistical analyses

Differences in PA levels between girls and boys were analysed using Student's t-test, and differences between weekday and weekend PA levels were analysed using paired-samples t-test. Differences in PA levels by SES, self-perceived health and study program were analysed using Fisher's one-way ANOVA. In cases of unequal variances, Welch's ANOVA was used. All analyses were performed using Statistical Package of Social Science (SPSS v. 25) and all values of $p < 0.05$ were considered statistically significant.

Results

In total, 611 participants had valid accelerometer measurements (Fig. 1).

The majority of the respondents were non-smokers and considered their health to be good or excellent (Table 1). About 30% reported one or more chronic diseases (in order of prevalence): Asthma (7.2%), allergic rhinitis (5.6%), migraine (2.5%), eczema (2.3%), Attention Deficit Hyperactivity Disorder (ADHD) (1.1%), others (all < 1.0%).

In total, mean (SD) accelerometer wear time was 14.1 (1.14) hours per valid day (girls 13.98 SD 1.07 and boys 14.25 SD1.21, $p = 0.053$). Participants with valid accelerometer data did not differ significantly from those who did not wear an accelerometer with respect to sex, BMI, and self-perceived health (data not shown).

Participants spent 67% of the accelerometer wear time within the sedentary category, 28% in light intensity activities, 4.8% in moderate and 0.4% in vigorous activity (Table 2).

Mean time spent in MVPA per day was 44.1 (SD 21.5) minutes. Boys spent 6.4 min more in MVPA than girls (95%CI boys 44.9–50.4, girls 39.1–43.4). There was no significant difference in MVPA between BMI groups. Both boys and girls who rated their self-perceived health as excellent accumulated more minutes of MVPA than all the other groups ($p < 0.05$, Table 3). Participants with parents' education ≥4 years of college spent 8.8 min more in MVPA per day compared to participants with parents educated from vocational school ($p < 0.05$). Study program was associated with the amount of registered MVPA ($p < 0.05$), with sports-students presenting 79.5% more MVPA than vocational students (Table 3). Overall, 20.0% fulfilled the WHO recommendations for PA accumulating ≥60 min of MVPA per day; 16.1% of the girls and 24.5% of the boys ($p < 0.05$) (Fig. 2).

Mean total PA (CPM) was 8.3% higher in boys than in girls ($p < 0.05$). In both boys and girls, PA levels were lower during weekend days compared to weekdays (for girls 12.9% and for boys 15.3% lower on weekends, $p < 0.001$). The only exception to this was boys studying sports, with 13% more CPM during weekend (data not shown). Variations in CPM were greater during weekends (mean CPM 299.4, SD 178.4) than during weekdays (mean CPM 348.3, SD 126.6). Mean CPM increased significantly with better rating of self-perceived health ($p < 0.05$), and with parents' education for girls ($p < 0.05$), but not for

Table 1 Participant characteristics. The Tromsø Study: Fit Futures

	N (girls/boys)	All	Girls	Boys
Age, mean (SD)	611 (341/270)	16.3 (1.0)	16.4 (1.1)	16.2 (0.8)
Height, cm (SD)	609 (339/270)	170.3 (8.9)	165.0 (6.6)	176.9 (6.7)
Weight, kg (SD)	609 (339/270)	65.4 (13.8)	61.3 (11.7)	70.6 (14.4)
Body-mass index, kg/m2 (SD)	609 (339/270)	22.5 (4.1)	22.5 (4.0)	22.5 (4.2)
< 18.0	609 (339/270)	9.7%	7.7%	12.2%
18.0–24.9	609 (339/270)	69.4%	72.4%	65.6%
25–29.9	609 (339/270)	14.6%	13.2%	16.3%
≥30	609 (339/270)	6.1%	6.2%	5.9%
No chronic diseases	608 (339/269)	69.6%	66.9%	73.0%
Smoking	602 (335/267)			
Daily		3.8%	3.6%	4.1%
Sometimes		13.1%	14.0%	12.4%
Never		81.7%	82.4%	83.5%

Table 2 Minutes in different intensity levels in 16/17-year-old boys and girls. The Tromsø Study: Fit Futures

	N	Sedentary activity (CPM 0–99)Mean (95% CI)	Light activity (CPM 100–1951)Mean (95% CI)	Moderate activity (CPM 1952–5724) Mean (95% CI)	Vigorous activity (CPM ≥5725) Mean (95% CI)
All	611	566.5 (560.8–572.1)	235.5 (231.2–239.9)	41.1 (39.6–42.7)	2.9 (2.6–3.3)
Boys	270	571.0 (561.5–580.5)	236.3 (229.0–243.7)	44.5 (42.1–46.9)	3.2 (2.6–3.7)
Girls	341	562.8 (555.9–569.7)	234.9 (229.6–240.1)	38.5 (36.6–40.4)	2.7 (2.3–3.2)

boys ($p > 0.05$). Participants who attended the sports program had considerably higher means of CPM than the other study programs ($p < 0.05$, Table 3).

Mean steps were similar in boys and girls (total steps 7831, 95% CI 7632–8030, Table 3). In total, 18.3% of the participants (15.9% of the girls and 21.3% of the boys) accumulated ≥10,000 steps per day, whereas 76.9% of the participants accumulated ≥6000 steps per day and almost all (99%) accumulated at least 3000 steps per day (Fig. 3).

Discussion

Our results suggest that approximately 20% of 16–17-year-old boys and girls fulfilled the current WHO recommendations for PA. Boys were more physically active than girls, as they accumulated more minutes in MVPA and higher CPM. However, steps per day were similar between boys and girls. Moreover, both boys and girls had higher mean CPM during weekdays than weekends.

Our results are at large in accordance with other studies assessing PA by accelerometry in adolescents [10, 20–22]. A challenge when comparing different studies of accelerometer measured PA is the lack of standardization of cut-points for intensity categories [20]. For example, the lower cut-point for MVPA ranges from 1000 CPM to 3000 CPM [20], affecting comparison between studies. A cross-sectional study by Ruiz et al. (2011) including nine European countries (the HELENA study) using compatible, although not identical cut-points for MVPA showed that 41% of adolescents (mean age 14.9 years) met the recommended activity levels (27.5% of the girls and 56.8% of the boys) [37]. These proportions are substantially larger than in our study, but the HELENA study included a wider age-span and the sample was somewhat younger than ours. A recent review suggested that the compliance with meeting PA recommendations ranged from 0 to 60%, depending on intensity threshold used [20], emphasizing the need for data harmonization for cross-study comparisons.

The higher activity levels in boys in our study is consistent with previous studies [20, 22, 38]. Even though boys and girls accumulate about the same amount of steps, there is a general agreement that MVPA is essential for health benefits [39], and step counts do not assess the intensity of PA. The difference between girls and boys in this study seems to be more similar to national studies performed on children and adults [9, 10], than to international studies performed on adolescents [20, 37, 40]. Even though there is a statistically significant difference between girls and boys also in the Norwegian studies, the difference is much higher in the international studies. We don't know why, but perhaps it could be due to a strong gender equality policy in Norway, where parents and school endeavour to give boys and girls an equal upbringing. It is less probable that this is only due to methodological differences, as these are studies done with objective measurements, and accelerometer cut points are similar in the different studies.

We expected the PA levels in our sample of adolescents aged 16–18 years to be lower than in younger children but higher than in adults. However, we found that the mean CPM in our sample was similar as that previously observed in Norwegian adults [9, 41]. Here, a decline in PA of 30% in females and 35% in males between adolescents aged 15 years and adults between 20 and 64 years of age, was found [9]. Although speculative, comparing these results with those from this study, suggests that this decline occurs at the age of 16 to 18 years, when adolescents move from lower secondary school to upper secondary school.

We found lower PA during weekends compared to weekdays, which is in line with previous studies [20, 38]. Also worth mentioning is that the variation is larger during weekends, as some of the adolescents increase their activity.

The positive association between self-perceived health and PA is consistent with the findings in several other studies [42–46]. This is a young and physically healthy population, but despite this we found a significant correlation between the level of PA and self-perceived health status. This study did not investigate causality, and it is therefore not possible to ascertain the direction of this association. Nevertheless, a low level of PA might contribute to a lower health status over time, which again may lead to even less PA.

We have not been able to find other studies comparing levels of PA in different school programs. It might be considered obvious that students in a sports class are more physically active than peers in general studies and vocational studies. This raises the question of whether these students are more active because they are

Table 3 Physical activity by sex, self-perceived health, SES and study program in 16/17-year-olds. The Tromsø Study: Fit Futures

Total		N	MVPA Mean (95% CI)	CPM Mean (95% CI)	Steps Mean (95% CI)
		611	44.1 (42.4–45.8)	338.2 (328.5–347.8)	7831 (7632–8030)
Self-perceived health	Very bad /bad	34	38.1 (31.2–45.1)	307.4 (267.9–347.0)	7161 (6371–7952)
	Neither good nor bad	122	42.0 (38.4–45.6)	317.4 (295.9–339.0)	7438 (6994–7882)
	Good	295	41.7 (39.5–44.0)	326.7 (314.5–339.0)	7741 (7471–8010)
	Excellent	150	52.0 (47.9–56.0)	385.4 (362.7–408.1)	8469 (8022–8917)
	ANOVA statistics		F 9.4, $p < 0.01$	F 10.7, $p < 0.01$	F 5.3, p < 0.01
Parents highest level of education (SES)	Don't know	125	42.9 (39.0–46.8)	329.1 (307.8–350.4)	7614 (7187–8041)
	Primary school 9 years	22	37.7 (29.0–46.3)	309.5 (266.5–352.4)	7546 (6424–8669)
	Vocational high school	78	39.1 (34.9–43.3)	312.3 (289.4–335.1)	7620 (7101–8138)
	High school	82	41.9 (37.4–46.5)	330.1 (304.1–356.1)	7791 (7270–8311)
	College < 4 years	117	45.8 (41.9–49.6)	347.5 (325.0–370.0)	7961 (7480–8443)
	College ≥4 years	178	47.9 (44.5–51.3)	356.8 (337.1–376.5)	8030 (7638–8423)
	ANOVA statistics		F 2.7, p < 0.05	F 2.1, $p = 0.06$	F 0.6, $p = 0.67$
Study program	Vocational	276	38.5 (36.3–40.7)	309.5 (297.6–321.4)	7359 (7088–7629)
	General studies	274	44.1 (41.9–46.4)	336.5 (323.2–349.9)	7791 (7506–8076)
	Sports	61	69.1 (62.3–76.0)	475.1 (435.3–514.8)	10,135 (9441–10,812)
	ANOVA statistics		F 60.4, p < 0.01	F 54.3, p < 0.01	F 34.0, $p < 0.01$
BOYS, total		270	47.6 (44.9–50.4)	353.3 (337.8–368.8)	7853 (7545–8162)
Self-perceived health	Very bad /bad	13	46.4 (32.7–60.1)	334.3 (263.5–405.1)	7866 (6251–9480)
	Neither good nor bad	60	44.3 (38.3–50.2)	332.3 (295.4–269.3)	7310 (6610–8010)
	Good	114	45.2 (41.5–49.0)	338.7 (318.4–359.1)	7731 (7265–8196)
	Excellent	79	53.9 (48.2–59.6)	391.9 (360.2–323.8)	8383 (7819–8946)
	ANOVA statistics		F 2.9, p < 0.05	F 3.5, p < 0.05	F 2.1, $p = 0.1$
Parents highest level of education (SES)	Don't know	66	48.2 (41.8–54.6)	359.4 (325.9–393.0)	7859 (7179–8538)
	Primary school 9 years	10	40.5 (26.2–54.7)	296.5 (222.5–370.6)	6990 (4946–9034)
	Vocational high school	34	39.7 (33.2–46.3)	306.7 (272.7–340.7)	7375 (6544–8205)
	High school	41	49.2 (42.0–56.5)	370.7 (328.5–412.9)	8380 (7530–9230)
	College < 4 years	44	51.9 (45.4–58.4)	372.5 (334.0–411.0)	8149 (7445–8852)
	College ≥4 years	71	48.1 (42.9–53.3)	353.1 (320.5–385.7)	7634 (7031–8237)
	ANOVA statistics		F 1.4, $p = 0.23$	F 1.6, $p = 0.15$	F 1.0, $p = 0.41$
Study program	Vocational	146	44.2 (41.1–47.4)	318.4 (323.3–357.3)	7759 (7363–8155)
	General studies	90	42.8 (38.9–46.7)	340.3 (295.0–341.7)	7080 (6614–7547)
	Sports	34	75.2 (65.7–84.7)	501.8 (442.5–561.2)	10,298 (9379–11,217)
	ANOVA statistics		F 36.2, p < 0.01	F 32.5, p < 0.01	F 22.8, p < 0.01
GIRLS, total		341	41.2 (39.1–43.4)	326.2 (314.0–338.3)	7814 (7553–8075)
Self-perceived health	Very bad /bad	21	33.0 (25.5–40.5)	290.8 (240.5–341.1)	6725 (5854–7596)
	Neither good nor bad	62	39.8 (35.5–44.2)	303.0 (279.6–326.4)	7561 (6988–8134)
	Good	181	39.6 (36.8–42.3)	319.2 (303.8–334.5)	7747 (7415–8079)
	Excellent	71	49.8 (43.9–55.7)	378.1 (344.9–411.3)	8568 (7844–9291)
	ANOVA statistics		F 6.2, p < 0.01	F 7.0, p < 0.01	F 3.9, $p < 0.01$
Parents highest level of education (SES)	Don't know	59	37.0 (33.1–40.8)	295.1 (271.9–318.3)	7340 (6836–7844)
	Primary school 9 years	12	35.3 (22.9–47.7)	320.3 (260.4–380.1)	8010 (6582–9437)
	Vocational high school	44	38.6 (32.9–4.2)	316.6 (284.6–348.5)	7809 (7127–8492)

Table 3 Physical activity by sex, self-perceived health, SES and study program in 16/17-year-olds. The Tromsø Study: Fit Futures *(Continued)*

	High school	41	34.6 (29.8–39.5)	289.5 (262.8–316.2)	7216 (6625–7807)
	College < 4 years	73	42.0 (37.3–46.8)	332.4 (304.6–360.2)	7850 (7193–8505)
	College ≥4 years	107	47.8 (43.3–52.2)	359.2 (334.2–384.2)	8293 (7776–8811)
	ANOVA statistics		F 4.2, p < 0.01	F 3.7, p < 0.01	F 1.8, *p* = 0.12
Study program	Vocational	130	32.0 (29.3–34.7)	275.0 (260.3–289.7)	6912 (6558–7265)
	General studies	184	44.8 (42.0–47.6)	345.4 (329.2–361.6)	8139 (7789–8489)
	Sports	27	61.5 (51.8–71.1)	441.4 (390.2–492.6)	9910 (8817–11,004)
	ANOVA statistics		F 36.2, p < 0.01	F 35.5, p < 0.01	F 22.9, p < 0.01

attending a sports study program, or if they attend the sports study program because they lead a more active lifestyle. The two are not mutually exclusive. This study did not differentiate between school time and after school activity. However, several studies imply that increased PA during the school day increases total PA [47–49]. We consider our result to be in accordance with these studies.

Strengths and weaknesses

We consider the high participation rate and the objective PA measurements as the main strengths of our study. The ActiGraph wGT3X has high validity compared with self-reported PA [50] and compared with other accelerometer devices [51, 52] and is used in several other cohort studies [10, 20, 21, 53]. However, accelerometer measurements have limitations, such as being unable to accurately assess the intensity while graded walking, carrying loads such as groceries or a rucksack, and cycling [54]. Recommendations for PA for both children, adolescents and adults include strength conditioning exercises, and many adolescents tend to shift from team-sports to gym based strength exercising [55], which is not measured accurately by accelerometry [56]. The accelerometer was mounted on the hip with a belt and was removed when sleeping and during water activities. This may increase non-wear time if participants forgot to attach the monitor after these activities. Therefore, continuous 24-h measurements with waterproof equipment are preferable. We chose to use the uniaxial data to be able to compare our results to previous studies. The choice of 60 s epoch will obscure the actual variation

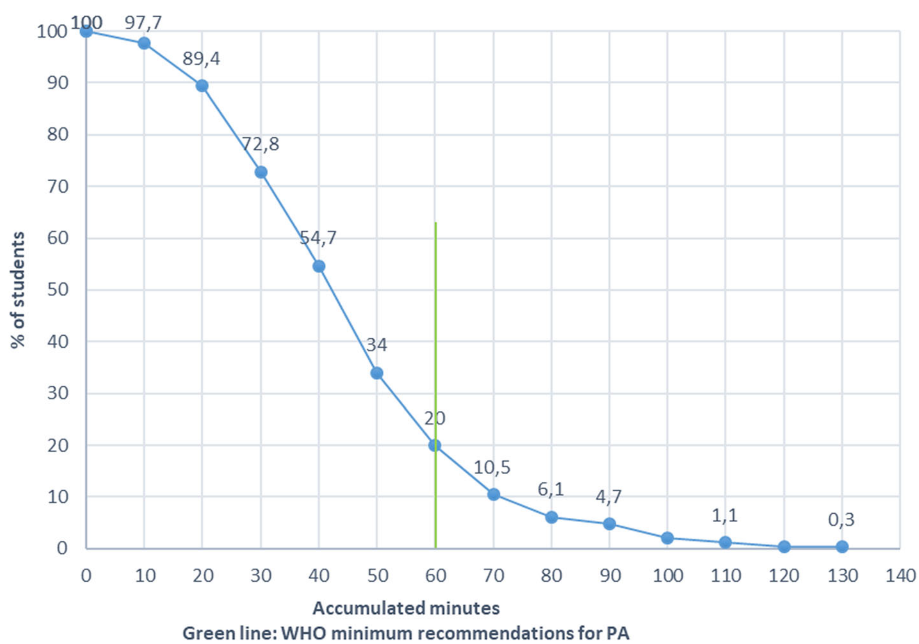

Fig. 2 Distribution of mean minutes of MVPA per day in 16/17 years old boys and girls, The Tromsø Study -Fit Futures

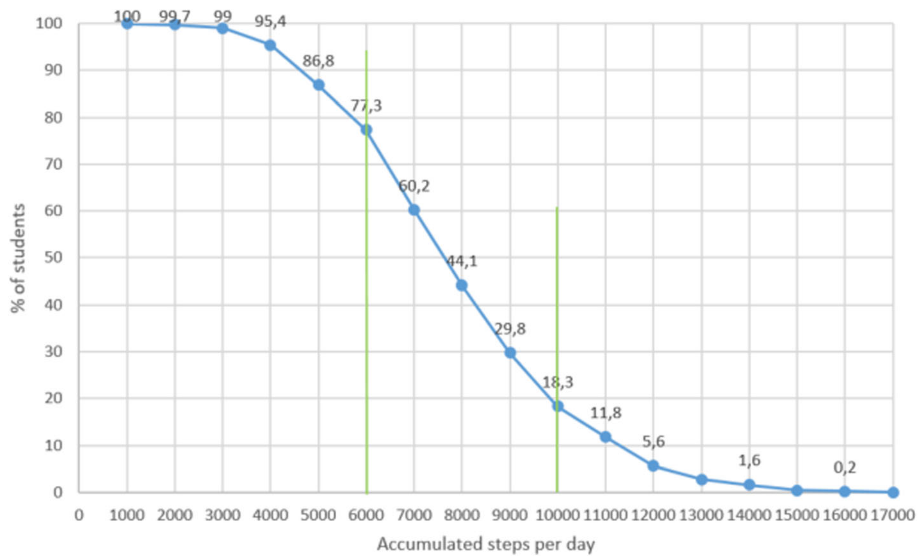

Fig. 3 Distribution of mean number of steps per day in 16/17 years old boys and girls, The Tromsø Study -Fit Futures

in activity, and possibly result in fewer minutes of VPA than if 10 s epochs were used [57].

PA levels tend to fluctuate during the day, week, and between seasons. A limitation of this study is that the measurements were done during one single week, and do not capture seasonal variability. Previous studies have documented lower PA levels during the winter and during periods with poor weather conditions [58–60]. In Norway, and particularly in the northern part with substantial difference in temperature and daylight between winter and summer, it is likely that the seasonal variability affects PA levels. The measurements in our study were conducted between September and May, covering 3 seasons. However, for practical reasons students from the same school and study program were measured during the same period. Although the difference between study programs were as expected, it precludes robust analyses of the influence of season.

Conclusions

The majority of 16- to 17-year-old adolescents living in Northern Norway do not fulfil the current WHO recommendations for physical activity. Total PA volumes were similar to those reported in Norwegian adults. PA varied with sex, self-perceived health and study program. Inadequate levels of PA is a significant challenge for public health, and efforts should be made to increase PA to recommended levels. Health officials would profit from a future research focus on identifying the least physically active individuals and specifically target these groups for interventions.

Supplementary information

Supplementary information accompanies this paper at https://doi.org/10.1186/s12889-020-09171-w.

Additional file 1. Overview of questions from questionnaire used in this study. Contains the questions and the response alternatives to each question, translated from Norwegian to English.

Abbreviations

BMI: Body Mass Index; CPM: Count per minute; MVPA: Moderate to vigorous Activity; PA: Physical activity; SES: Socioeconomic Status; TFF1: Tromsø Study-Fit Futures 1; VM: Vector Magnitude; WHO: World Health Organisation.

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Authors' contributions

ASF is the project director of Fit Futures, and has contributed with the formulation and design of the article. SB, AH, PH and BM analysed and interpreted the data. SB drafted the manuscript and BM, PH, TC, BHH and UE were major contributors in writing the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The data that support the findings of this study are available from The Tromsø Study, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are available from the The Tromsø Study upon application. To apply for data, please visit the Tromsø Study web page at: https://en.uit.no/forskning/forskningsgrupper/sub?p_document_id=453582&sub_id=71247

Ethics approval and consents to participate

The participants signed a written informed consent. Participants younger than 16 years of age brought written permission from their guardian and those aged 16 and above signed at the study site. The Regional Committee for Medical and Health Ethics has approved the study (2012/1663/REK nord).

Consent for publication
Not applicable.

Competing interests
None.

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Publisher's Note

Paper II

Criterion validity of the Saltin-Grimby Physical Activity Level Scale in adolescents. The Fit Futures Study

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Abstract

Background: The Saltin-Grimby Physical Activity Level Scale (SGPALS) is commonly used to measure physical activity (PA) in population studies, but its validity in adolescents is unknown. This study aimed to assess the criterion validity of the SGPALS against accelerometry in a large sample of adolescents. A secondary aim was to examine the validity across strata of sex, body mass index (BMI), parental educational level, study program and self-reported health.

Methods: The study is based on data from 572 adolescents aged 15-17 years who participated in the Fit Futures Study 2010-11 in Northern Norway. The participants were invited to wear an accelerometer (GT3X) attached to their hip for seven consecutive days. We used Spearman's rho and linear regression models to assess the validity of the SGPALS against the following accelerometry estimates of PA; mean counts/minute (CPM), steps/day, and minutes/day of moderate-to-vigorous physical activity (MVPA).

Results: The SGPALS correlated with mean CPM (ρ=0.40, $p<0.01$), steps/day (ρ=0.35, $p<0.01$) and MVPA min/day (ρ=0.35, $p<0.01$). We observed no differences between correlations within demographic strata (all $p>0.001$). Higher scores on SGPALS were associated with a higher CPM, higher number of steps per day and more minutes of MVPA per day, with the following mean differences in PA measurements between the SGPALS ranks: CPM increased by 53 counts (95% CI: 44 to 62), steps/day increased by 925 steps (95% CI: 731 to 1118), and MVPA by 8.4 min/day (95% CI: 6.7 to 10.0). Mean difference between the highest and lowest SGPALS category was 2947 steps/day (6509 vs. 9456 steps/day) and 26.4 min/day MVPA (35.2 minutes vs 61.6 minutes).

Conclusion: We found satisfactory ranking validity of SGPALS measured against accelerometry in adolescents, and the validity is fairly stable across strata of sex, BMI, and

education. However, the validity of SGPALS in providing information on absolute physical activity levels is limited.

Keywords: accelerometer, adolescents, counts per minute, MVPA, physical activity.

Introduction

Low levels of physical activity (PA) in adolescence are associated with an increased risk of obesity and non-communicable diseases in adulthood (1, 2). PA levels in childhood and adolescence seem to decline with increasing age (3) and tend to track into adulthood (4). Consequently, surveillance of PA in childhood and adolescence is vital to inform public health policies aimed at increasing or maintaining PA levels in childhood and adolescence (4).

In population-based studies, questionnaires are the most common measure of PA, being inexpensive, practical and serve as a quick and scalable method for collecting data. However, self-reported PA is likely influenced by recall and social desirability bias, which may introduce misclassification and influence the validity of self-reported PA (5-8). Validation of self-reported PA instruments is therefore crucial for interpreting prevalence estimates of PA and associations between PA and health outcomes (9).

One of the most frequently used physical activity questionnaires (PAQs) in Scandinavia is the Saltin-Grimby Physical Activity Level Scale (SGPALS), introduced by Saltin and Grimby in 1968 (10, 11). The SGPALS includes four hierarchical ranks of PA (10) and is included in numerous population studies (11-14). The SGPALS is predominantly used in adult cohorts, but is also included in some adolescent cohort studies (15, 16). In adults, higher SGPALS ranks has been shown to represent higher criterion measure estimates, such as accelerometry and cardiorespiratory fitness (11). In children and adolescents, differences between self-reported and device measured PA has been reported (17, 18). A modified Motric Module PAQ underestimated LPA and MVPA during school hours, but overestimated leisure-time activity, compared to accelerometry (17). To our knowledge, the SGPALS has not been compared to such criterion measures in adolescents.

In adults, previous research indicate that the agreement between self-reported and device measured PA may differ within strata, showing a higher discordance among individuals with low education (19-21). Moreover, men are found to report higher PA than women despite accumulating similar device measured PA (20) but not consistently (19, 22, 23).

In contrast to adults, among adolescent higher education groups show higher differences between self-reported and device measured PA than lower education groups (24). Although not consistent (25), sex differences between self-reported and device measured PA also seem evident in adolescents (18, 26, 27). Moreover, there are inconsistent findings in validity of self-reported PA by BMI groups in adolescents, where some studies found no differences by BMI groups (18), whilst others report BMI to influence the discrepancies between self-reported and device measured PA (28). As several factors may influence the validity of self-reported PA in adolescents, further exploration on demographic factors that can influence discrepancies between self-reported, especially SGPALS and device measured PA is warranted.

Thus, the aim of this study was to explore validity of the SGPALS in a sample of Norwegian adolescents. A secondary aim was to examine the validity by strata of sex, BMI, parental educational level, self-reported health status and school program.

Materials and Methods

Design and participants

The Fit Futures Study (FF) is a population-based cohort study of adolescents in Northern Norway (15, 16). Our data are from the first survey of the FF (FF1), collected between September 2010 and April 2011. All first-year high school students (n=1117) from one urban (Tromsø) and one rural (Balsfjord) municipality in Northern Norway were invited to participate, of which 1038 (92.7%) attended. The participants attended a half-day visit at the Clinical Research Department at the University Hospital of Northern Norway, Tromsø, and all procedures were performed by trained research technicians. The data collection included electronic questionnaires, clinical examinations and accelerometer measurements. The accelerometers (ActiGraph GT3X, ActiGraph, Pensacola, FL, United States) were handed out to the participants with instructions to wear the device on their right hip for seven consecutive days. In the present study we excluded participants with accelerometer wear time <10 hours for at least 4 days (n=427) and those aged ≥18 years (n=38). The final sample included 572 participants with valid accelerometer wear time and complete data on the SGPALS questionnaire. A larger proportion of girls than boys provided valid accelerometry data (68% vs 52%, p<0.001), while distribution of parental level of education (p=0.30), BMI (p=0.41) and self-reported health (p=0.81) did not differ between those with and without valid accelerometry data (data not shown).

Participants aged 16 years or above signed a written informed consent. Participants under 16 years signed with written permission from their legal guardians. The Regional Committee for Medical and Health Ethics approved the study (2012/1663/REK nord).

Socio-demographic variables

Weight and height were measured on a Jenix DS-102 stadiometer (Dong Sahn Jenix co Ltd, Seoul, Korea), an automatic electronic scale. Weight was measured in kilograms (kg) with a precision of 0.1 kg and height in meters (m) to the nearest 0.1 cm. BMI was calculated as kg divided by the square height (kg/m^2). According to the International Obesity Task Force (iso-BMI), at the age of 16 the cut-off for overweight is 23.9 kg/m^2 for boys and 24.37 kg/m^2 for girls (29). As iso-BMI and adult cut-offs for BMI become more similar by increasing age, BMI was calculated according to adults' cut-offs and categorized as normal weight (<25 kg/m^2), and overweight and obese (≥25 kg/m^2). Socioeconomic status was determined by questionnaire data on the parent with the highest level of education, categorized as either; 1) Do not know, 2) Primary/high school, 3) University <4 years, and 4) University 4 ≥ years. The participants rated their self-perceived health according to the question: *«How do you in general consider your own health to be?"*, with five alternatives: 1) Very poor, 2) Poor, 3) Neither good nor poor, 4) Good, or 5) Excellent. Only four participants rated their health as very poor, thus we categorized 1) Very poor and 2) Poor into "1) Very poor/poor". Information on study program (vocational, general studies or sports) (30) was retrieved from the schools' student database.

In Norway, first year of upper secondary school means the 11th year of Norwegian school attendance, where the students can choose between different study programs. About 38% choose general studies, 6 % choose sports specialization, and the remaining students choose between 11 different vocational studies such as health programs, technical programs, maritime programs, creative schools and economic and administrative programs (31).

The Saltin-Grimby Physical Activity Level Scale - SGPALS

Participants answered the SGPALS by stating their PA level according to four hierarchical levels (10, 11). Compared with the original wording by Saltin and Grimby in 1968, designed for adults (10), the participants in this study answered a slightly modified version with examples of activities suited for adolescents (Table 1), and with a duration requirement also for level 3 (in addition to level 2). This has later been the version recommended by Grimby and colleagues (11, 32).

Table 1 Saltin-Grimby Physical Activity Level Scale (SGPALS)

	Leisure Time Physical Activity Level
Question	Which description fits best regarding your physical activity level in leisure time during the last year?
Answering alternative 1	Almost completely inactive: *"Sitting by the PC/TV, reading or other sedentary activity"*
Answering alternative 2	Moderately active: *"Walking, cycling, or other forms of exercise at least 4 hours per week (here, you should also consider transport to/from school, shopping, Sunday strolls etc.)"*
Answering alternative 3	Highly active: *"Participation in recreational sports, heavy outside activity, shoveling snow etc. at least 4 hours per week"*
Answering alternative 4	Vigorously active: *"Participation in hard training or sports competitions regularly several times a week"*.

Accelerometer data collection and processing

The ActiGraph GT3X records accelerations in three axes (axial, coronal and sagittal). The devices were initialized using the manufacturer's software (ActiLife, LLC, Pensacola, FL, USA) with 30 Hz sampling frequency, and set to record data from when the ActiGraph was attached to the hip and until 23:59 on day 8. The ActiLife software was used to download the accelerometer data using the normal (default) filter to aggregate raw acceleration data into 10-

seconds epochs using a proprietary algorithm designed by the manufacturer. The data were further analyzed using the Quality Control & Analysis Tool (QCAT), a custom-made software developed in Matlab (The MathWorks, Inc, Natick, MA, USA). The 10-second epochs were summed to 60 seconds, and the first day of measurements was excluded from further analyses to reduce reactivity (33).

Wear time was calculated from triaxial vector magnitude (the square root of the sum of squared activity) counts per minute (CPM) as described by Hecht et al. (34), based on the following three criteria; 1) A vector magnitude value (VMU) in counts per minute (CPM) >5; 2) Of the following 20 minutes, at least 2 minutes have VMU CPM values >5; and 3) Of the preceding 20 minutes, at least 2 minutes have VMU CPM values >5. If at least 2 of the criteria were positive, the 1-minute epoch was considered as wear-time. All other minutes were defined as non-wear time.

We expressed volume estimates of PA as mean uniaxial CPM per day, number of steps per day and moderate-to-vigorous physical activity (MVPA). The step count was derived from the vertical axis using a proprietary algorithm from the manufacturer. MVPA was defined as a CPM ≥1952 (35), measured in minutes per day (min/day).

Statistical analyses

Participants who did not meet our wear time criterion of at least four days with ≥10 hours of activity (36) were excluded from the analysis. All accelerometer estimates (CPM, steps, and MVPA) were considered normally distributed by visual inspection of histograms and QQ-plots. We used independent t-tests to assess differences in accelerometry wear time between boys and girls, and between under- and normal weight and overweight and obese participants.

Differences in accelerometer wear time between study programs, parental education and self-reported health status were assessed by univariate analyses of variance (ANOVA). We also used ANOVAs to assess the association between indices of device-measured PA (CPM, steps, and MVPA) and the SGPALS. We used Spearman's rho (ρ) to assess the ranked correlation between the SGPALS and accelerometer estimates of PA (mean CPM, mean steps/day and min/day MVPA) in total and in strata of sex, BMI, parental level of education, self-reported health, and study program. We visually inspected scatter plots following our correlation analyses to identify outliers. We used Fisher´s ρ to z transformation to compare rho correlations within demographic strata, as previously done by others (37). To decrease false discovery rates, we adjusted the p-values from Spearman´s rho, and for comparison between rho´s, according to the Benjamin-Hochberg method (38) with 25% false discovery rate. A coefficient (ρ) of 0.00 to 0.10, 0.10 to 0.39, 0.40 to 0.69 and ≥0.70 was considered a negligible, weak, moderate and strong correlation, respectively (39). Alpha was set to $p<0.05$. All data are presented as mean ± standard deviation (SD), mean with 95% confidence interval (CI) or as frequency (percentage). All analyses were performed using the Statistical Package for Social Science (SPSS Version 25, International Business Machines Corporation, USA).

Results

The descriptive characteristics of participants are presented in Table 2. Among the 253 boys and 319 girls in this study, mean BMI was 22.4 kg/m^2 (both sexes) and the mean age was 16.0 and 16.1 years, respectively. Among the 572 participants, 98 (17.1%) classified themselves in the first category of the SGPALS, 197 (34.4%) in the second category, 164 (28.7%) in the third and 113 (19.8%) in the last category. Girls were more likely to report lower self-reported health status than boys (p=0.26). There were differences in wear time per valid day between sexes (p=0.01), but not between BMI categories (p=0.83), study program (p=0.35), parental education (p=0.23) and self-reported health status (p=0.38) (Supplementary Table 1). Mean MVPA was 44.8 (SD 21.7) minutes per day, mean CPM 340.8 (SD 123.0) and mean number of steps per day was 7875 (SD 2508).

Table 2. Characteristics of boys and girls, The Fit Futures Study 2010-2011

	All (n = 572)	**Girls (n=319)**	**Boys (n=253)**	**SGPALS**			
				1	2	3	4
Age (years)	16.1±0.4	16.1±0.4	16.0±0.4	16.1±0.4	16.1±0.4	16.1±0.4	16.1±0.3
Height (cm)	170.4±8.8	165.2±6.4	177.0±6.8	170.9±8.8	169.2±8.5	170.1±8.6	172.6±9.3
Weight (kg)	65.3±13.6	61.2±11.3	70.4±14.4	65.6±15.1	65.5±13.5	65.0±14.6	65.0±10.7
BMI (kg/m^2)	22.4±4.0	22.4±3.8	22.4±4.2	22.4±4.5	22.8±4.1	22.4±4.4	21.7±2.4
BMI category *n (%)*	**570 (100)**	**317 (100)**	**253 (100)**	**1**	**2**	**3**	**4**
Underweight or normal weight *	457 (80.2)	260 (82.0)	197 (77.9)	71 (15.5)	148 (32.4)	139 (30.4)	99 (21.7)
Overweight or obese	113 (19.8)	57 (18.0)	56 (22.1)	26 (23.0)	48 (42.5)	25 (22.1)	14 (12.4)
Study specialization *n (%)*	**572 (100)**	**319 (100)**	**253 (100)**	**1**	**2**	**3**	**4**
Vocational	238 (41.7)	108 (33.8)	130 (51.4)	57 (23.9)	107 (45.0)	53 (22.3)	21 (8.8)
General	273 (47.6)	184 (57.7)	89 (35.2)	41 (15.0)	87 (31.9)	99 (36.3)	46 (16.8)
Sports	61 (10.7)	27 (8.5)	34 (13.4)	0	3 (4.9)	12 (19.7)	46 (75.4)
Parents' education *n (%)*	**570 (100)**	**318 (100)**	**252 (100)**	**1**	**2**	**3**	**4**
Do not know	113 (19.8)	52 (16.4)	61 (24.2)	24 (21.2)	39 (34.5)	30 (26.5)	20 (17.7)
Primary/high school	167 (29.3)	89 (28.0)	78 (31.0)	34 (20.4)	65 (38.9)	46 (27.5)	22 (13.2)
University <4 years	115 (20.2)	72 (22.6)	43 (17.0)	11 (9.6)	41 (35.7)	29 (25.2)	34 (29.6)
University ≥4 years	175 (30.7)	105 (33.0)	70 (27.8)	28 (16.0)	51 (29.1)	59 (33.7)	37 (21.1)
Self-perceived health *n (%)*	**569 (100)**	**317 (100)**	**252 (100)**	**1**	**2**	**3**	**4**
Very poor/poor	30 (5.3)	18 (5.7)	12 (4.8)	12 (40.0)	11 (36.7)	5 (16.7)	2 (6.7)
Neither good nor poor	119 (20.9)	61 (19.2)	58 (23.0)	36 (30.3)	55 (46.2)	18 (15.1)	10 (8.4)
Good	276 (48.5)	170 (53.6)	106 (42.1)	40 (14.5)	98 (35.5)	91 (33.0)	47 (17.0)
Excellent	144 (25.3)	68 (21.5)	76 (30.1)	10 (6.9)	31 (21.5)	50 (34.7)	53 (36.8)

Data are mean ± standard deviation. SGPALS=Saltin-Grimby Physical Activity Level Scale (Which description fits best regarding your physical activity level in leisure time during the last year? 1 Almost completely inactive "Sitting by the PC/TV, reading, or other sedentary activity". 2 Moderately active "Walking, cycling or other forms of exercise at least 4 hours per week (here you should also consider transport to/from school, shopping, Sunday strolls etc.". 3 Highly active "Participation in recreational sports, heavy outside activity, shoveling snow etc. at least 4 hours per week". 4 Vigorously active "Participation in hard training or sports competitions regularly several times a week". BMI=Body mass index. *Cut-off value<25.

The distribution of CPM, steps and MVPA is illustrated by box plots in Figure 1. We observed statistically significant increases in all indices of accelerometer measured PA by increasing SGPALS levels (all p<0.001). Mean difference between the lowest and highest SGPALS categories was 163 CPM (278 vs. 441 mean CPM), 2947 steps/day (6509 vs. 9456 steps/day) and 27 min/day MVPA (35 minutes vs 62 minutes) (Table 3).

Include Figure 1 about here.

Table 3. Accelerometer measured physical activity according to the Saltin-Grimby Physical Activity Level Scale (SGPALS). The Fit Futures Study 2010-2011

	SGPALS (n=572)			
	Inactive (n = 98, 17.1%)	*Moderately active (n = 197, 34.4%)*	*Highly active (n = 164, 28.7%)*	*Vigorously active (n = 113, 19.8%)*
Mean CPM per day* (95% CI)	277.9 (256.1-299.7)	307.1 (291.7-322.4)	348.6 (331.8-365.5)	441.4 (421.1-461.7)
Steps per day* (95% CI)	6509 (6046-6971)	7481 (7153-7808)	8060 (7703-8418)	9456 (9023-9889)
MVPA (min/day)* (95% CI)	35.2 (31.3-39.1)	39.8 (37.1-42.6)	44.7 (41.7-47.8)	61.6 (57.9-65.2)
N (%)	98 (100)	197 (100)	164 (100)	113 (100)
Meeting PA guidelines	5 (5.1)	22 (11.2)	34 (20.7)	57 (50.4)

*Statistically significant difference between categories (between-subject difference): p<0.001. Data are unadjusted mean and 95%CI. CPM=counts per minute, Steps=steps per day, MVPA=moderate-to-vigorous physical activity, CI=confidence interval.

The SGPALS was positively correlated with steps/day (ρ=0.35, p<0.01), min/day MVPA (ρ=0.35, p<0.01), and mean CPM (ρ=0.40, p<0.01) (Table 4). We observed no differences in correlations between socio-demographic strata (all p>0.001).

Table 4. Spearman rank correlations between SGPALS ranks and accelerometer-measured physical activity. The Fit Futures Study 2010-2011

	Mean CPM	Steps	MVPA
All (n=572)	**0.40***	**0.35***	**0.35***
Sex			
Boys (n=253)	**0.40***	**0.37***	**0.34***
Girls (n=319)	**0.41***	**0.33***	**0.38***
BMI category			
Underweight or normal weight (n=457)	**0.43***	**0.35***	**0.38***
Overweight or obese (n=113)	**0.27***	**0.32***	**0.20**
Study specialization			
Vocational (n=238)	**0.30***	**0.31***	**0.26***
General (n=273)	**0.33***	**0.23***	**0.23***
Sports (n=61)	0.25	0.20	0.23
Parents' education			
Do not know (n=113)	**0.37***	**0.40***	**0.35***
Primary/high school (n=167)	**0.26***	**0.25***	**0.24***
University <4 years (n=115)	**0.47***	**0.38***	**0.41***
University ≥4 years (n=175)	**0.48***	**0.38***	**0.41***
Self-perceived health			
Very poor/poor (n=30)	**0.40**	**0.39**	0.35
Neither good nor poor (n=119)	**0.30***	**0.28***	**0.24***
Good (n=276)	**0.31***	**0.25***	**0.28***
Excellent (n=144)	**0.47***	**0.42***	**0.43***

SGPALS=Saltin-Grimby Physical Activity Level Scale. BMI=body mass index, CPM=counts per minute, Steps=steps per day, MVPA=moderate-to-vigorous physical activity, bold numbers indicate significant Spearman's rho at p<0.05, *Significant Spearman's rho at p<0.01.

Discussion

In this population-based validation study among Norwegian adolescents, we found positive associations between self-reported PA measured by the SGPALS and accelerometer-measured PA. Although correlations between the SGPALS and accelerometer measured PA in general were weak, the SGPALS was able to correctly rank accelerometer-measured PA, as the findings showed a notable and gradual increase in accelerometry measures for each increase in SGPALS levels.

The SGPALS correlated with accelerometer-measured mean CPM, steps/day and min/day of MVPA. These observations are consistent with previous studies comparing the SGPALS with criterion measures of PA in adults (40-42). In general, the correlations in our study and that of others (40-42) are modest, which highlight the imprecision associated with self-reported PA (43) and shows that the SGPALS is unable to precisely reflect accelerometry estimates of PA. Nevertheless, 95% of those reporting to be inactive (rank 1) in the SGPALS were also physically inactive in accelerometry estimates (<60 minutes of MVPA), indicating that the SGPALS is fairly stable in classifying inactive and active individuals in rank 1 (Table 3). Although the proportion of individuals classified as active by the accelerometer increases by increasing rank, it seems that in the higher ranks, the precision in classifying active and inactive individuals decreases (Table 3).

Although the accuracy of PA volume and intensity is limited when using the SGPALS, crude ranking of self-reported PA at population level is valuable (43). The ranking ability of the SGPALS has been demonstrated against accelerometry (41, 42) and cardiorespiratory fitness measures in adults (40-42, 44). In our study of adolescents, the SGPALS demonstrated similar ranking ability of PA levels. For example, for every increase in SGPALS level, steps per day increased with ~1000 steps and MVPA with ~ 8 minutes per day. This sums up to ~7000 steps and ~60 minutes of MVPA extra per week if individuals increase their PA by one SGPALS level. Such increases would have relevant impact on public health and thus highlights the SGPALS´ ranking ability at the population level. Similar increases in step count by higher SGPALS ranks are found in adults, while increases in MVPA seem to be lower (~2 min by increasing SGPALS rank) (42).

The ranking ability of the SGPALS was similar across various socio-demographic strata. This contrasts with some previous studies comparing other PA questionnaires in adolescents against accelerometry measured PA by sex (18, 26, 27), parental education (24), and categories of BMI (18). However, differences in demography when comparing self-reported and device measured PA are inconsistent in the literature, where some have reported no differences by sex and BMI groups (17, 18).

Inconsistent findings may be explained by differences in the distribution of socio-demographic variables or by measurement properties in the PA questionnaires included. Most PA questionnaires ask participants to report minutes in different intensities (17-21, 24-28), while the SGPALS include four crude groups representing PA in the last year. Considering inconsistent findings between socio-demographic strata in previous studies (17-21, 24-28), larger and more thorough PA questionnaires (multiple item questions) than the SGPALS may inherently influence measurement precision due to adolescents´ recall abilities. Our findings of stable correlations across strata suggest the SGPALS to be fairly robust in ranking PA levels without much influence from socio-demographical characteristics in adolescents.

Strengths and limitations

To our knowledge, this is the first study to assess the validity of the leisure time SGPALS in adolescents, as few other studies have used accelerometry to measure PA in larger samples in this particular age group. Moreover, Fit Futures had a high participation proportion (93%), although missing accelerometer data resulted in a considerably large proportion that did not provide valid accelerometer wear time; thus, our results may be influenced by selection bias. Consequently, one should be cautious when interpreting the results. However, in a recent publication based on the same population from Fit Futures, missing accelerometer data were imputed and a sensitivity analysis showed that the participants with missing accelerometer data did not differ significantly from the participants with valid data (45).

Further, the accelerometer assessment over seven days was not time-aligned with the SGPALS (10, 11, 46); the SGPALS addresses habitual PA (over the last year) and participants completed the instrument at the start of the accelerometer wear period. However, PA instruments are in general designed to capture the habitual PA level (47), with the SGPALS (48, 49) showing acceptable reliability (moderate Kappa ~0.5-0.6), as does four days of ≥10 hours of accelerometer assessment (intraclass correlation: 0.8) (46, 47). As the SGPALS was filled out immediately before wearing the accelerometer, this may have introduced reactivity (33). In an attempt to overcome the potential for reactivity, we excluded the first day of accelerometry recording.

Furthermore, this study validated the leisure time PA part of the SGPALS, including modes of transportation to/from school, while the accelerometer assessment is not limited to leisure time. The occupational time SGPALS (10) was not included in this study of adolescents as it is not relevant for this age group attending high school.

Conclusion

Our study adds to building evidence for satisfactory ranking validity of SGPALS measured against accelerometry in adolescents, and the validity is fairly stable across strata of sex, BMI, and education. However, the validity of SGPALS in providing information on absolute physical activity levels is limited.

Implications for public health and future research

In a public health perspective, increasing PA is more important among those who are inactive. The SGPALS is a short PAQ that can be used as a low cost and time efficient tool to identify the least active adolescents, which are most in need of lifestyle advices and interventions.

Figure Legend

Box plot with median, interquartile range, maximum and minimum with outlies of CPM, steps and MVPA per day by SGPALS ranks. The Fit Futures Study 2010-2011

Abbreviations

BMI: Body Mass Index, CPM: Count per minute, FF1: Fit Futures 1, MVPA: Moderate to vigorous Activity, PA: Physical activity, PAQ: Physical activity questionnaire, QCAT: Quality Control & Analysis Tool, SGPALS: Saltin-Grimby Physical Activity Level Scale, VM: Vector Magnitude, WHO: World Health Organization.

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Declarations

Ethics approval and consents to participate

The participants signed a written informed consent. Participants younger than 16 years of age brought written permission from their guardian and those aged 16 and above signed at the study site. The Regional Committee for Medical and Health Ethics has approved the study (2012/1663/REK nord).

Consent for publication

Not applicable.

Availability of data and material

The data that support the findings of this study are available from The Fit Futures Study. However, confidentiality requirements according to Norwegian law prevents sharing of individual patient level data in public repositories. The legal restriction on data availability are set by the Fit Futures Data and Publication Committee in order to control for data sharing, including publication of datasets with the potential of reverse identification of de-identified sensitive participant information. Data can be made available from the The Fit Futures Study upon application. To apply for data, please contact the Fit Futures at fitfutures@uit.no .

Competing interests

None.

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Author Contributions

SB, AH, NAA and BM designed the study. ASF designed, planned and conducted FF1 cohort study. SB, NAA, EHS and PH performed statistical analyses, all authors interpreted the results. SB and EHS wrote the initial draft of the manuscript. All authors revised and approved the last version of the manuscript draft.

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Supporting information

S1 Tab. Supplementary Table 1 Accelerometry wear time by BMI, study specialization, parental education and self-perceived health. The Fit Futures Study 2010-2011

Supplementary Table 1.
Accelerometry wear time by BMI, study specialization, parental education and self-perceived health. The Fit Futures Study 2010-2011

Wear time (h)	
Sex	**Mean ± SD**
Girls	14.00 ± 1.10
Boys	14.25 ± 1.22
BMI category	**Mean ± SD**
Underweight or normal weight	14.11 ± 1.16
Overweight or obese	14.14 ± 1.09
Study specialization	**Mean ± SD**
Vocational	14.19 ± 1.10
General	14.13 ± 1.18
Sports	14.13 ± 1.18
Parents' education	**Mean ± SD**
Do not know	14.17 ± 1.10
Primary/high school	14.16 ± 1.16
University <4 years	14.21 ± 1.10
University ≥4 years	13.97 ± 1.19
Self-perceived health	**Mean ± SD**
Very poor/poor	13.94 ± 1.07
Neither good nor poor	14.02 ± 1.23
Good	14.19 ± 1.18
Excellent	14.06 ± 1.00

BMI=body mass index, SD=standard deviation.

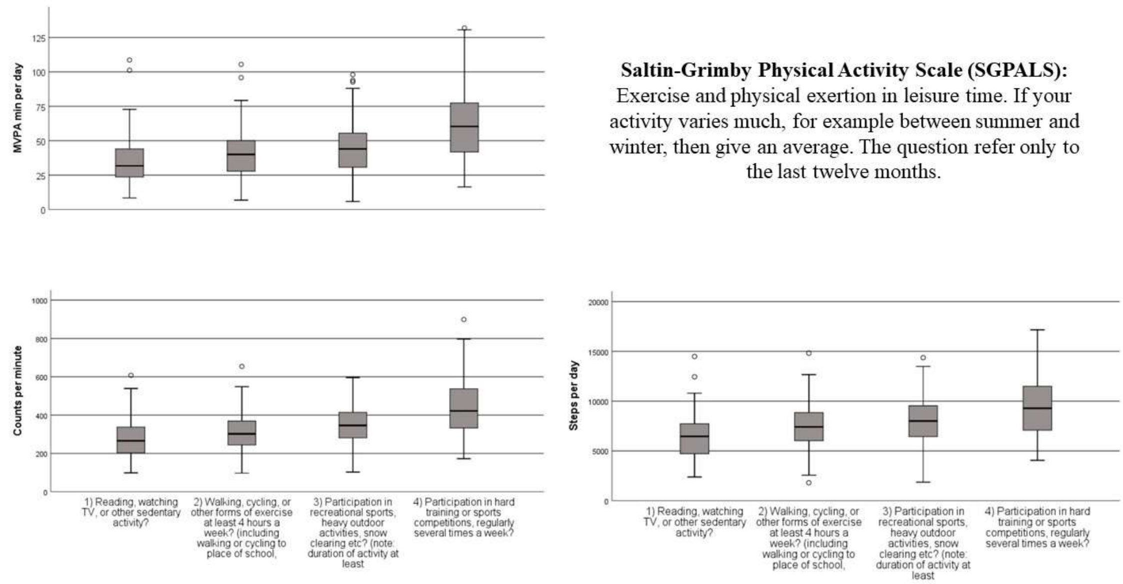

Figure 1: Box plot with median, interquartile range, maximum and minimum with outlies of CPM, steps and MVPA per day by SGPALS ranks. The Fit Futures Study 2010-2011

Paper III

BMJ Open

Association between objectively measured physical activity and longitudinal changes in body composition in adolescents: the Tromsø study fit futures cohort

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ABSTRACT

Objectives Physical activity may be important in deterring the obesity epidemic. This study aimed to determine whether objectively measured physical activity in first year of upper secondary high school predicted changes in body composition over 2 years of follow-up in a cohort of Norwegian adolescents (n=431).

Design A longitudinal study of adolescents (mean age of 16 (SD 0.4) at baseline, 60.3% girls) participating in the Fit Futures studies 1 (2010–2011) and 2 (2012–2013).

Setting All eight upper secondary high schools in two municipalities in Northern Norway.

Participants Students participating in both studies and under the age of 18 at baseline and with valid measurement of physical activity at baseline and body composition in both surveys.

Primary and secondary outcomes Change in objectively measured body mass index and waist circumference and change in dual-energy X-ray absorptiometry measured fat mass index, lean mass index (LMI) and appendicular LMI (aLMI) between baseline and follow-up.

Results At baseline, boys had significantly higher physical activity volume (p=0.01) and spent on average of 6.4 (95% CI 2.1 to 10.6) more minutes in moderate-to-vigorous physical activity (MVPA) than girls (p<0.01). In girls, multivariate regression analyses showed that more sedentary time was negatively associated with changes in LMI (p<0.01) and aLMI (p<0.05), whereas more light activity had opposite effects on these measures (p<0.01 and p<0.05, respectively). No significant associations between measures of baseline physical activity and changes in body composition parameters were observed in boys.

Conclusions In this cohort of Norwegian adolescents, sedentary and light physical activity was associated with changes in LMI and aLMI in girls, but not boys. Minutes spent in MVPA in first year of upper secondary high school was not associated with changes in measures of body composition in neither sex after 2 years.

Strengths and limitations of this study

- This study used objective measures of physical activity.
- The study included objectively measured weight, height and waist circumference and dual-energy X-ray absorptiometry measures of fat and lean mass.
- We were not able to fully adjust for nutrition and not for pubertal development.
- The 431 participants with complete data from both baseline and follow-up represent 41% of those attending Fit Futures 1, indicating a degree of selection.

BACKGROUND

The potential of physical activity to prevent or treat a number of diseases has been highlighted by the WHO,[1] with inactivity accounting for 9% of worldwide premature mortality.[2] Public health guidelines state that adolescents should engage in moderate-to-vigorous physical activity (MVPA) ≥60 min/day,[3] but in 2011, only 50% of Norwegian, 15-year olds, met these recommendations.[4] During adolescence, there is a decline in both total physical activity and MVPA,[5 6] and many quit or reduce participation in organised sports.[7] As of 2013, the prevalence of overweight and obesity (body mass index (BMI) ≥25 kg/m^2) in Norwegians aged <20 years appears to be stabilising at around 20% in boys and 16% in girls—comparable to the Nordic countries.[8] This is lower than in the USA (around 29% in boys and girls),[8] but the health effects for those concerned may still be substantial over the long term.[9]

While physical activity has many positive health effects, its relationship with adiposity is less clear and it has proven difficult to determine causality, direction and magnitude of this relationship.[10] Cross-sectional research typically shows a strong inverse association between physical activity and weight status,[11] but temporality cannot be ascertained using such study designs.[12] Longitudinal studies may ascertain if lower physical activity precedes excess weight gain, but a review found no evidence for a relationship between objectively measured physical activity and body fat gain in adolescents.[12] The lack of congruent results may in part be explained by the diverse and inadequate measures of both exposure and outcome used in research of the association between physical activity and body composition.[10 11]

Although many methods to measure physical activity are available, the most common and most feasible is self-report, which commonly overestimates the total amount of physical activity.[13] Body composition is most commonly assessed using BMI, but BMI does not distinguish between fat and muscle mass.[14] This has the potential to cause misclassification of overweight status and may attenuate a true association between physical activity and fat or muscle mass. Thus, in the current study, we sought to overcome these limitations by applying objective measures of both physical activity and specific measures of body composition. Our aim was to investigate the association between objectively measured physical activity and changes in five different measures of body composition (BMI, waist circumference, fat mass index (FMI), lean mass index (LMI) and appendicular LMI (aLMI)) over 2 years of follow-up in a cohort of Norwegian adolescents.

METHODS AND MATERIALS

We used data from the first and second Fit Futures cohort studies, performed in 2010–2011 and 2012–2013, respectively. In the first study, we invited all students (n=1117) in their first year of upper secondary high school in the neighbouring municipalities of Tromsø and Balsfjord in Northern Norway, and 93% participated. The study was repeated 2 years later, when the students were in their last year of upper secondary high school or had started as apprentices if they studied vocational subjects. The second study included 868 participants, giving an attendance of 77%. All eight upper secondary high schools in the two municipalities participated in both studies. Altogether, 735 adolescents attended both surveys. For the present study, we excluded those aged ≥18 years of age at baseline (n=38). Some participants (n=240) did not have valid measurements of physical activity at baseline and were therefore not included in the study. We also excluded those with missing data on change in body composition parameters or variables included in the model (n=26). Thus, 431 participants were included in the present study (60.3% girls). Online supplemental appendix table 1 includes descriptive characteristics of the boys and girls with a valid baseline measurement of physical activity and variables included in the analyses, but who were missing follow-up data on body composition parameters (n=133).

Students were granted leave of absence from school to attend an examination at the Clinical Research Unit at the University Hospital of Northern Norway in both surveys. The participants attended a clinical examination where they also completed a questionnaire, which included questions on lifestyle, screen time, dietary habits and so on. The participants signed a letter of informed consent, and those under the age of 16 brought a letter of consent signed by their parent or guardian.

All measurements were performed by trained personnel. Height was measured to the nearest centimetre and weight to the nearest 100 g, wearing light clothing and using an automatic electronic scale/stadiometer (Jenix DS 102 stadiometer, Dong Sahn Jenix, Seoul, Korea). BMI was calculated as body weight in kilograms per height in meter square. Waist circumference was measured to the nearest 0.1 centimetre at the height of the umbilicus. Fat and soft tissue lean mass in grams was estimated by whole-body dual-energy X-ray absorptiometry (DXA) (GE Lunar Prodigy, Lunar Corporation, Madison, Wisconsin, USA). Fat mass comprises all fat, while soft tissue lean mass comprises all bodily tissue except fat and skeletal mass. These variables were used to calculate FMI, fat mass in kilograms per height in meter square and LMI, lean mass in kilograms/height in meter square. In addition, we calculated aLMI, which is the sum of soft tissue lean mass in kilograms in all four extremities divided by height in meter square. Although most commonly used in studies of sarcopenia in elderly,[15] this body composition parameter is arguably more specific to skeletal muscle mass than total LMI. The ability of DXA to detect changes in appendicular lean mass in young adolescents is good and has been validated against MRI.[16]

Physical activity was objectively measured using the ActiGraph GT3X accelerometer (ActiGraph, LLC, Pensacola, USA). Participants were instructed to wear the device on their right hip for 7 consecutive days and to remove it only when showering, swimming or sleeping. The ActiLife software was used to initialise the accelerometer and download data, which was imported into the Quality Control & Analysis Tool for data processing. This software was developed by the research group of professor Horsch in Matlab (The MathWorks, Massachusetts, USA) for processing of accelerometer data. The accelerometer was set in raw data mode, with a sampling frequency of 30 Hz and with normal filtering epochs of 10 s. Data collection was initiated at 14:00 hours the first day and concluded at 23:58 on the eighth day of measurement. We excluded data from the first day of measurement to reduce reactivity bias. The criteria for a valid measurement of physical activity was wear time of ≥4 consecutive days, with ≥10 hours wear time per day. This has been demonstrated as representative of activity over a full week.[17] The triaxial algorithm developed by Hecht *et al* was used to calculate wear time.[18] Minutes per day in sedentary (0–99 cpm), light (100–1951 cpm), moderate (1952–5723 cpm) and vigorous (≥5724 cpm) physical activity was determined using the cut-offs developed by Freedson.[19] The choice of these cut-offs enables direct comparisons as the cohort ages, although these cut-offs are not commonly used for adolescents, we consider the bodily proportions of an adolescent to resemble that of an adult in terms of measured acceleration. The device collected data in both uniaxial and triaxial modes, but in the present study, only the uniaxial data had been processed and therefore available. Studies have shown that uniaxial data recorded from the GT3X correlate well with uniaxial data recorded from previous ActiGraph models.[20] Data on objectively measured physical activity were only available from Fit Futures 1.

Baseline characteristics were presented as means with SD or prevalence in percentages with number of subjects (n). Sex-specific difference in body composition between baseline and follow-up was tested using a paired samples t-test. The difference in physical activity between sexes was tested using a two-sample t-test, while sex differences in categories of minutes spent in MVPA was tested using a χ^2 test. Difference in linear trend across categories of minutes spent in MVPA was tested using STATA's non-parametric test for trend, developed by Cuzick.[21] Linear regression was used to determine the effect of baseline physical activity on change in body composition, that is, the change in BMI, waist circumference, FMI, LMI and aLMI from the first to the second Fit Futures Study.

We used three different predictors of change in body composition, performing three sets of analyses, with first; minutes per day spent in sedentary activity second; minutes per day spent in light activity and third; minutes per day spent in MVPA . We divided the continuous variables sedentary and light activity by 30 and the continuous variable MVPA by 15 before inclusion in the models, thus presenting the beta coefficient for change in body composition parameter per 30 minof sedentary or light activity, or per 15 min of MVPA, with 95% CIs and a p value. In model 1, we adjusted for the baseline measurement of the body composition parameter. In the adjusted models (model 2), we also included time between measurements (mean (SD): 730 (74) days) and baseline values of device wear time, age in half years and questionnaire data on screen time on weekdays (how many hours per weekday the students spent in front of a computer or television—answers ranged from none to more than 10 hours per weekday) and regularity of eating breakfast as an indicator of healthy meal patterns (answers ranging from rarely/never to everyday). In the analyses of sedentary and light activity, we also adjusted for minutes spent in MVPA (model 3). In a subset of analyses (online supplemental appendix tables 2–4), we repeated the analyses performed in tables 2 and 3, adjusting also for self-reported pubertal status measured by either pubertal development scale (boys) or age at menarche (girls). These analyses included the 143 boys and 256 girls with valid data on pubertal status. In all the analyses, a p value of <0.05 was considered statistically significant.

All analyses were performed sex specific as decided a priori, using STATA V.14 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, Texas, USA: StataCorp LP.).

Patient and public involvement

Participating schools were consulted and included in the design phase of the study.

RESULTS

Table 1 displays the participants' body composition measurements at baseline and follow-up as well as physical activity measurements at baseline. Boys had a statistically significant increase in all measures of body composition. Girls had a statistically significant increase in body weight, BMI, fat mass in kilogram and FMI, but not in LMI and appendicular lean mass. Boys were statistically significantly more physically active than girls in some aspects, with higher mean counts per minute (p=0.01) and more minutes in MVPA (p<0.01). Time spent in sedentary or light intensities did not differ significantly between sexes. Twenty-seven per cent of boys and 17% of girls complied with the recommendations of 60 min/day MVPA.

Table 2 displays the association between minutes spent in sedentary activity at baseline and changes in body composition between baseline and follow-up. There was no association between sedentary activity and changes in BMI, waist circumference and FMI in neither boys nor girls. In girls, but not in boys, more minutes spent in sedentary activity at baseline was associated with lower LMI (p<0.01) and aLMI (p=0.02). Adjustment for covariates and MVPA slightly attenuated the association with aLMI (p=0.05).

Table 3 displays the association between minutes spent in light activity at baseline and changes in body composition between baseline and follow-up. There was no association between the exposure and either body composition parameter in boys. In girls, there was some evidence to suggest an association with change in waist circumference (p=0.05), but the association was attenuated after adjustments (p=0.17). More minutes spent in light physical activity was associated with higher LMI (p<0.01 (models 2 and 3)) and aLMI (p=0.04 (model 2) and 0.05 (model 3)).

Table 4 displays the association between minutes in MVPA at baseline and changes in body composition between baseline and follow-up. There was no association between time spent in MVPA and changes in either measure of body composition for either sex.

Online supplemental appendix table 1 shows the descriptive characteristics of the participants with valid baseline measurements of physical activity and adjustment variables, but who were lost to follow-up. Both boys and girls lost to follow-up had significantly higher mean BMI, waist circumference, fat mass and FMI at baseline as well as significantly less minutes per day spent in light-to-vigorous and moderate-to-vigorous (girls only) physical activities. In online supplemental appendix tables 2–4, we present subanalyses restricted to those with complete data on pubertal development, confirming the results displayed in tables 2–4 also after adjustments for pubertal development. Overall, adjustment for pubertal

Table 1 Characteristics of the longitudinal cohort of the Tromsø study; Fit Futures 2010–2011 and 2012–2013*

	Boys (n=171)		Girls (n=260)	
	FF1	FF2	FF1	FF2
Age (years)	16.0 (0.4)	18.2 (0.4)	16.1 (0.4)	18.1 (0.4)
Height (cm)	177.1 (6.6)	179.0 (6.5)*	165.4 (6.6)	166.1 (6.6)*
Body weight (kg)	69.0 (12.3)	74.3 (13.0)*	60.8 (10.8)	63.4 (11.6)*
Body mass index (BMI kg/m2)	22.0 (3.5)	23.2 (3.7)*	22.2 (3.7)	23.0 (4.0)*
Waist circumference (cm)	81.0 (10.3)	83.9 (10.9)*	76.7 (9.8)	78.0 (10.8)*
Total body fat mass (kg)	13.3 (9.4)	15.6 (10.4)*	19.9 (8.3)	21.7 (9.1)*
FMI (kg/m^2)	4.2 (3.0)	4.9 (3.2)*	7.3 (3.0)	7.9 (3.3)*
Total body lean mass (kg)	54.0 (6.5)	56.4 (6.9)*	38.9 (4.5)	39.3 (4.7)*
LMI (kg/m^2)	17.2 (1.6)	17.6 (1.8)*	14.2 (1.3)	14.2 (1.4)
Appendicular lean mass (kg)	25.3 (3.4)	26.2 (3.6)*	17.4 (2.3)	17.4 (2.3)
aLMI (kg/m^2)	8.1 (0.9)	8.2 (0.9)*	6.4 (0.7)	6.3 (0.7)*
Accelerometer variables				
Wear time per valid day	14.2 (1.2)		14.1 (1.1)	
Counts per minute	362.9 (137.5)		334.0 (111.9)‡	
Minutes per day in different intensities				
Sedentary (cpm 0–99)	573.3 (77.3)		565.3 (63.2)	
Light (cpm 100–1951)	230.5 (58.8)		236.2 (48.4)	
Moderate (cpm 1952–5723)	45.8 (20.6)		40.2 (17.7)‡	
Vigorous (cpm ≥5724)	3.7 (5.8)		2.9 (4.1)‡	
MVPA§ (cpm ≥1952)	49.5 (23.4)		43.1 (19.6)‡	
Meeting MVPA guidelines per day				
0–29 min	35 (20.5)		69 (26.5)	
30–59 min	90 (52.6)		146 (56.2)	
≥60 min	46 (26.9)		45 (17.3)¶	

*Values are means with SD or n (prevalence in percentages). BMI: body weight in kg/height in meters^2, FMI: fat mass in kg/height in meters^2, LMI: lean mass in kg/height in meters^2, aLMI: appendicular lean mass in kg/height in meters^2. Data on physical activity in FF2 was not available.
†Significantly different from baseline measurement (p<0.05).
‡Significantly different from boys (mean).
§MVPA: moderate to vigorous physical activity, using cut-offs suggested by Freedson.[19]
¶Significantly different linear trend from boys (p<0.05).

development had no substantial impact on an association between sedentary, light and MVPA and changes in body composition for either sex in complete case analyses. However, the association between minutes spent in sedentary activity and light activity and changes in aLMI were no longer significant for girls in model 3. The point estimates did not differ from those from analyses without adjustments for pubertal development, however.

DISCUSSION

In this longitudinal population-based study of Norwegian adolescents, there were in both boys and girls no associations between objectively measured physical activity at baseline and 2-year changes in BMI, waist circumference and FMI. Both boys and girls had statistically significant increases in the measures of body composition (except LMI and appendicular lean mass in girls). Objectively measured physical activity did not predict changes in boys. In girls, there was a significant association between minutes spent in sedentary and light physical activity and changes in indices of lean mass.

Although the magnitude of change differed, both sexes experienced increases in measures of body composition. In boys, FMI increased by 0.7 units (+16.7%), whereas LMI increased by 0.4 units (+2.3 %) from baseline. Similar relative changes were observed in girls, (FMI+8.2 %) and (LMI+0.7%), indicating that FMI increases relatively more than LMI during late adolescence. We observed statistically significant differences in minutes spent in moderate (p<0.01) and vigorous (p=0.04) intensity between boys and girls, but time spent in other intensity levels did not differ. Differences in physical activity by sex are consistent

Table 2 Association between minutes per day spent in sedentary activity (cpm 0–99) at baseline and changes in body composition*

	Boys (n=171)			Girls (n=260)		
	Beta	95% CI	P value	Beta	95% CI	P value
Δ BMI						
Model 1	–0.02	–0.13 to 0.09	0.76	–0.05	–0.15 to 0.05	0.33
Model 2	–0.02	–0.17 to 0.12	0.75	–0.11	–0.24 to 0.03	0.12
Model 3	0.01	–0.17 to 0.20	0.88	–0.11	–0.27 to 0.05	0.16
Δ waist circumference						
Model 1	0.17	–0.21 to 0.56	0.37	–0.01	–0.41 to 0.40	0.96
Model 2	0.27	–0.24 to 0.78	0.30	–0.33	–0.87 to 0.20	0.22
Model 3	0.42	–0.23 to 1.07	0.20	–0.44	–1.06 to 0.18	0.17
Δ FMI						
Model 1	0.00	–0.10 to 0.10	0.99	–0.01	–0.11 to 0.08	0.83
Model 2	–0.02	–0.16 to 0.11	0.74	–0.06	–0.18 to 0.07	0.36
Model 3	0.00	–0.17 to 0.17	0.98	–0.05	–0.20 to 0.09	0.48
Δ LMI						
Model 1	0.00	–0.05 to 0.05	0.88	–0.06	-0.09, to 0.02	<0.01
Model 2	0.01	–0.06 to 0.07	0.77	–0.07	-0.12, to 0.02	<0.01
Model 3	0.02	–0.06 to 0.10	0.63	–0.08	-0.13, to 0.03	<0.01
Δ aLMI						
Model 1	0.00	–0.03 to 0.03	0.84	–0.02	-0.04, to 0.00	0.02
Model 2	0.00	–0.03 to 0.04	0.81	–0.03	-0.05, to 0.01	0.02
Model 3	0.01	–0.04 to 0.05	0.71	–0.03	–0.06 to 0.00	0.05

*The table displays the association between minutes spent in sedentary activity and difference in BMI (kg/m^2), waist circumference, FMI (fat mass in kg/m^2), LMI (lean mass in kg/m^2) and aLMI (appendicular lean mass in kg/m^2) between Fit Futures 1 (2010–2011) and Fit Futures 2 (2012–2013). The models give the beta coefficient for 30 min increase in sedentary activity. All models were adjusted for baseline values of the body composition parameter. In model 2 also adjusted for time between measurements and baseline values of screen time on weekdays, study specialisation, age in half-years, regularity of eating breakfast and device wear time. In model 3 adjusted also for minutes spent in moderate-to-vigorous physical activity (cpm≥1952).
aLMI, appendicular LMI; BMI, body mass index; FMI, fat mass index; LMI, lean mass index .

with the previous research.[22 23] Differences in changes in body composition by sex are biologically determined during adolescence, with sex hormones resulting in fat mass accrual in girls and lean mass accrual in boys.[24 25] The observation that sedentary and light activity-predicted changes in indices of lean mass in girls, but not boys, may be explained by these expected biological differences. Physical activity may have somewhat greater potential to influence lean mass accrual in girls than in boys during this period, as fat-free mass is relatively stable in girls in late adolescence, whereas it increases up to 18 years of age in boys.[26]

In the present study, sedentary and light activity had opposing effects on lean mass in girls. In a study using isotemporal substitution models, positive prospective effects on fat mass were found when substituting 30 min of sedentary activity with MVPA, but not when substituted with light activity.[27] It is reasonable that sedentary and light physical activity has opposing effects on lean mass.[28] In the present study, sedentary and light activity was inversely correlated (r=–0.39), but minutes spent in different intensity levels is not directly a function of each other as wear time in the participants varies between individuals. Based on wear time inclusion criteria, the theoretical time span for wear time lies between 10 and 24 hours. Thus, minutes spent in sedentary activity may not be deduced from the sum of minutes spent in other intensities and vice versa, but it is plausible that higher wear time results in more sedentary time. This was evident in an exploratory analyses on the same cohort (not included in the present study), where higher wear time was significantly associated with more sedentary activity and less light activity (p<0.01). Adjusting for wear time (model 2) did not change the associations substantially for sedentary activity (table 2), but had some effect on the associations with light physical activity (table 3). Because of the inverse relationship between minutes spent sedentary and in light activity, it is not possible to determine whether it is sedentary time or light activity time that is associated with change in LMI. The practical consequences are nevertheless that being active increases lean mass in girls.

Table 3 Association between minutes per day spent in light activity (cpm 100–1951) at baseline and changes in body composition*

	Boys (n=171)			Girls (n=260)		
	Beta	95% CI	P value	Beta	95% CI	P value
Δ BMI						
Model 1	0.04	−0.11 to 0.18	0.60	0.05	−0.09 to 0.19	0.47
Model 2	0.01	−0.17 to 0.18	0.93	0.12	−0.04 to 0.27	0.13
Model 3	−0.01	−0.20 to 0.17	0.88	0.11	−0.05 to 0.27	0.16
Δ waist circumference						
Model 1	−0.11	−0.62 to 0.40	0.68	0.54	0.01 to 1.07	0.05
Model 2	−0.38	−1.00 to 0.23	0.22	0.43	−0.19 to 1.05	0.17
Model 3	−0.42	−1.07 to 0.23	0.20	0.44	−0.19 to 1.06	0.17
Δ FMI						
Model 1	0.03	−0.10 to 0.16	0.67	0.02	−0.10 to 0.15	0.71
Model 2	0.01	−0.15 to 0.18	0.87	0.06	−0.09 to 0.20	0.43
Model 3	−0.00	−0.17 to 0.17	0.98	0.05	−0.09 to 0.20	0.49
Δ LMI						
Model 1	−0.01	−0.07 to 0.06	0.84	0.04	−0.01 to 0.09	0.08
Model 2	−0.02	−0.09 to 0.06	0.67	0.08	0.03 to 0.13	<0.01
Model 3	−0.02	−0.10 to 0.06	0.63	0.08	0.03 to 0.13	<0.01
Δ aLMI						
Model 1	0.00	−0.03 to 0.04	0.87	0.02	−0.01 to 0.04	0.16
Model 2	−0.01	−0.05 to 0.04	0.73	0.03	0.00 to 0.06	0.04
Model 3	−0.01	−0.05 to 0.04	0.70	0.03	−0.00 to 0.06	0.05

*The table displays the association between minutes spent in light activity and difference in BMI (kg/m^2), waist circumference, FMI (fat mass in kg/m^2), LMI (lean mass in kg/m^2) and aLMI (appendicular lean mass in kg/m^2) between Fit Futures 1 (2010–2011) and Fit Futures 2 (2012–2013). The models give the beta coefficient for 30 min increase in light activity. All models were adjusted for baseline values of the body composition parameter. In model 2 also adjusted for time between measurements and baseline values of screen time on weekdays, study specialisation, age in half-years, regularity of eating breakfast and device wear time. In Model 3 adjusted also for minutes spent in moderate-to-vigorous physical activity (cpm≥1952).
aLMI, appendicular LMI; BMI, body weight index; FMI, fat mass index; LMI, lean mass index.

When interpreting results, we must acknowledge the limitations of DXA in the estimation of lean mass, which can be affected by both biological factors and measurement error.[29] Because the relative increase in lean mass was small, only slight differences in, for instance, individual hydration status at the two time points may influence estimates and thus the association.

There were no associations between objectively measured physical activity and change in BMI, waist circumference and FMI for either sex. It may be that the negative effects of less physical activity have not yet had time to manifest themselves in a population still undergoing physiological changes as a result of natural growth, especially considering the relatively short 2-year follow-up. Our results are in line with a systematic review suggesting that objectively measured physical activity (PA) is not an important predictor of change in adiposity in children, adolescents and adults.[12] In contrast, another systematic review found a protective effect of physical activity on adiposity in adolescents.[10] There were however several methodological weaknesses in the studies included in this review, particularly regarding the validity of the measurement of both physical activity and body composition. In contrast, our study employed robust measures of both these exposures and outcomes, a combination of which is lacking in much past research on the association between the two.[10–12]

In adolescents, physical activity is influenced by friends, family and other social support[30] and is less stable than in adults.[31–33] Follow-up data on objectively measured physical activity were not available in the present study, but some evidence suggest that the decline in physical activity is steeper prior to the onset of adolescence.[34] Reductions in level of physical activity during the transition from adolescence to young adulthood nevertheless often occur.[35] Prior observations from the same cohort showed that change in self-reported physical activity between baseline and follow-up was a stronger predictor of change in body composition than self-reported baseline physical activity.[36] Other studies have suggested that change in activity during follow-up might obscure an association with body composition.[37 38] In a subanalyses,

Table 4 Association between minutes per day spent in MVPA (cpm≥1952) at baseline and changes in body composition*

	Boys (n=171)			Girls (n=260)		
	Beta	95% CI	P value	Beta	95% CI	P value
Δ BMI						
Model 1	0.11	–0.07 to 0.30	0.22	–0.00	–0.17 to 0.16	0.97
Model 2	0.08	–0.13 to 0.29	0.47	0.07	–0.11 to 0.25	0.47
Δ waist circumference						
Model 1	0.25	–0.39 to 0.89	0.44	–0.03	–0.68 to 0.63	0.94
Model 2	–0.02	–0.75 to 0.71	0.95	0.02	–0.70 to 0.74	0.96
Δ FMI						
Model 1	0.02	–0.15 to 0.19	0.83	–0.01	–0.17 to 0.14	0.86
Model 2	0.06	–0.14 to 0.25	0.57	0.05	–0.12 to 0.22	0.54
Δ LMI						
Model 1	0.07	–0.02 to 0.15	0.11	0.03	–0.03 to 0.09	0.33
Model 2	0.01	–0.08 to 0.10	0.86	0.02	–0.04 to 0.09	0.44
Δ aLMI						
Model 1	0.03	–0.02 to 0.08	0.19	0.02	–0.01 to 0.05	0.13
Model 2	0.00	–0.05 to 0.05	0.92	0.02	–0.01 to 0.05	0.18

*The table displays the association between minutes spent in moderate-to-vigorous physical activity (MVPA) and difference in BMI (kg/m^2), waist circumference, FMI (fat mass in kg/m^2), LMI (lean mass in kg/m^2) and aLMI (appendicular lean mass in kg/m^2) between Fit Futures 1 (2010–2011) and Fit Futures 2 (2012–2013). The models give the beta coefficient for 15 min increase in MVPA. Both models were adjusted for baseline values of the body composition parameter. In model 2 also adjusted for time between measurements and baseline values of screen time on weekdays, study specialisation, age in half-years, regularity of eating breakfast and device wear time.
aLMI, appendicular LMI ; BMI, body mass index; FMI, fat mass index ; LMI, lean mass index .

one of four in both the highest and lowest categories of MVPA at baseline reported decreased (high MVPA at baseline) and increased (low MVPA at baseline) self-reported physical activity at follow-up, thus indicating that physical activity in adolescents is fluctuant. These two observations, assuming that measurement of both MVPA and self-reported hours per week of physical activity, are representative of actual physical activity behaviour at the time, work in opposing directions with regards to the effect of physical activity on changes in adiposity. This phenomenon is known as regression dilution bias and may flatten the regression slope and cause an underestimate of the actual association.[39] With an annual decline in total physical activity of 7% in adolescents, researchers must consider the possibility that measured physical activity has a ‘best before-date’. It remains questionable whether baseline measurements of a fluctuant behaviour such as physical activity is representative of actual habits during the period of follow-up. It may be that the measurement represents current, but not future (or even prior) habits.[12 40] This has implications for longitudinal studies of the relationship between physical activity and body composition.[38]

Strengths and limitations

The primary strength of this study is objective measures of both physical activity and body composition parameters and the inclusion of tissue-specific measures of body composition. Some limitations have to be considered. As the Fit Futures study did not include a validated food frequency questionnaire or similar instrument for nutritional assessment, we were not able to fully adjust for the potential confounding effects of nutrition and changes in food habits of adolescents on changes in body composition. Accelerometer-measured physical activity has limitations. A hip worn accelerometer such as the ActiGraph GT3X is not able to correctly measure cycling and swimming.[41] Furthermore, accelerometers are dependent on user compliance, and non-wear time therefore affects the amount of activity that is actually measured. Subjective judgement determines data management and analyses, for example, the decision to exclude participants with wear time <10 hours and <4 consecutive days is a trade-off between quality of data and the number of participants with valid data. We lacked complete data on physical activity and adjustment variables in 212 participants, but changes in BMI, waist circumference, FMI, LMI (except in girls, p=0.04) and aLMI were not significantly different between those with and without complete exposure data. Furthermore, of those with valid data concerning both physical activity and body composition parameters at baseline, close to 25% did not attend the follow-up (online supplemental appendix table 1). This group differed significantly from those included in the main analyses with respect to both physical activity and body composition parameters. The prospective associations between physical activity and changes in body composition parameters in this group (n=133) may be different from those observed in the group of participants included in the main analyses (n=431), and the associations in all the 564 participants with valid baseline data may therefore be different from what we find in the main analyses. This is however not possible to determine given the lack of follow-up data.

Although longitudinal observational studies are superior to cross-sectional studies to examine causation, they are also susceptible to directional bias, since participants may avoid physical activity because they are overweight, and not be overweight because they are inactive.[42–44] Finally, as the participants were 16 years old, much may already have happened both to the level of physical activity and the different measures of body composition prior to participation. In light of this, 2 years of follow-up may be a short time frame to determine the potential effects of physical activity on changes in the different body composition parameters.

CONCLUSION

Objectively measured physical activity was not significantly associated with change in objectively measured BMI, waist circumference or FMI after 2 years in this cohort of Norwegian adolescents. There was evidence to suggest that sedentary and light activity affected indices of lean mass in girls, but not boys.

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Contributors NAA wrote the draft of the manuscript, which was revised and edited by all authors several times during the process. SB produced the accelerometer variables in close collaboration with AH, who wrote the software which converted raw accelerometer data to variables. BKJ contributed to the statistical analyses, and BM specifically contributed to the discussion of physical activity. NE and A-SF were among the principal investigators in FF1 and FF2 and contributed significantly to the acquisition of data. SG formulated the research question and conceived the study. All authors have substantially contributed to the study, and have read and approved the final manuscript.

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Supplementary file

Appendix Table 1. Descriptive characteristics of participants lost to follow-up (n = 133), with p-value for difference from sample in Table 1*.

	Boys (n = 79)	P for difference	Girls (n = 54)	P for difference
Age (years)	16.1 (0.4)	0.26	16.1 (0.4)	0.42
Height (cm)	176.7 (13.8)	0.31	164.5 (5.9)	0.18
Body weight (kg)	73.3 (18.0)	0.01	63.5 (1.9)	0.06
Body mass index (BMI kg/m2)	23.4 (5.2)	0.01	23.4 (4.4)	0.02
Waist circumference (cm)	85.1 (13.9)	<0.01	80.0 (12.4)	0.02
Total Body Fat Mass (kg)	17.6 (12.8)	<0.01	22.8 (10.3)	0.01
Fat Mass Index (FMI kg/m2)	5.6 (4.0)	<0.01	8.4 (3.5)	0.01
Total Body Lean Mass (kg)	53.9 (7.8)	0.46	38.6 (4.6)	0.33
Lean Mass Index (LMI kg/m2)	17.2 (1.9)	0.43	14.2 (1.4)	0.42
Appendicular Lean Mass (kg)	25.3 (4.1)	0.49	17.4 (2.5)	0.48
Appendicular Lean Mass Index (aLMI kg/m2)	8.1 (1.0)	0.41	6.4 (0.76)	0.29
Accelerometer variables				
Wear time per valid day	14.3 (1.2)	0.26	13.7 (1.0)	<0.01
Counts per minute	338.4 (112.1)	0.08	300.5 (121.5)	0.03
Minutes per day in different intensities				
Sedentary (cpm 0 – 99)	570.1 (82.6)	0.38	562.6 (68.9)	0.39
Light (cpm 100 – 1951)	244.3 (64.7)	0.05	223.4 (46.3)	0.04
Moderate (cpm 1952 – 5723)	42.9 (19.6)	0.15	33.0 (17.6)	<0.01
Vigorous (cpm ≥ 5724)	2.3 (2.9)	0.03	2.7 (5.1)	0.40
MVPA# (cpm ≥ 1952)	45.2 (21.0)	0.08	35.6 (20.0)	0.01
Meeting MVPA guidelines per day				
0 – 29 minutes	21 (26.6)		24 (44.4)	
30 – 59 minutes	41 (51.9)		23 (42.6)	
≥ 60 minutes	17 (21.5)		7 (13.0)*	

*: Statistically significantly different linear trend from sample included in manuscript (Table 1).

Appendix Table 2. Association between minutes per day spent in sedentary activity (CPM 0 – 99) at baseline and changes in body composition, adjusted for puberty#.

	Boys (n = 143)			Girls (n = 258)		
	Beta	95% CI	p value	Beta	95% CI	p value
Δ BMI						
Model 1	-0.02	-0.14, 0.09	0.70	-0.05	-0.15, 0.05	0.32
Model 2	-0.01	-0.17, 0.14	0.85	-0.11	-0.24, 0.03	0.12
Model 3	0.03	-0.17, 0.23	0.76	-0.11	-0.27, 0.05	0.19
Δ waist circumference						
Model 1	0.12	-0.27, 0.51	0.55	-0.01	-0.42, 0.39	0.95
Model 2	0.24	-0.28, 0.77	0.36	-0.38	-0.91, 0.15	0.16
Model 3	0.37	-0.32, 1.06	0.29	-0.52	-1.14, 0.10	0.10
Δ FMI						
Model 1	-0.01	-0.12, 0.09	0.84	-0.01	-0.11, 0.08	0.81
Model 2	-0.01	-0.15, 0.13	0.85	-0.06	-0.18, 0.07	0.35
Model 3	0.01	-0.17, 0.20	0.90	-0.05	-0.20, 0.10	0.49
Δ LMI						
Model 1	0.00	-0.05, 0.06	0.90	-0.06	-0.09, -0.02	< 0.01
Model 2	0.01	-0.07, 0.08	0.89	-0.07	-0.12, -0.02	< 0.01
Model 3	0.02	-0.08, 0.11	0.74	-0.08	-0.13, -0.02	< 0.01
Δ aLMI						
Model 1	-0.00	-0.03, 0.03	0.91	-0.02	-0.04, -0.00	0.02
Model 2	0.00	-0.04, 0.04	0.92	-0.03	-0.05, -0.00	0.02
Model 3	0.01	-0.04, 0.07	0.59	-0.03	-0.06, 0.00	0.06

#: The table displays the association between minutes spent in sedentary activity and difference in BMI (kg/m^2), waist circumference, FMI (fat mass in kg/m^2), LMI (lean mass in kg/m^2) and aLMI (appendicular lean mass in kg/m^2) between Fit Futures 1 (2010-2011) and Fit Futures 2 (2012-2013). The models give the beta coefficient for 30 minutes increase in sedentary activity. All models were adjusted for baseline values of the outcome. In model 2 also adjusted for time between measurements and baseline values of pubertal development (pds (boys) and age at menarche (girls)), screen time on weekdays, study specialisation, age in half-years, regularity of eating breakfast and device wear time. In Model 3 adjusted also for minutes spent in Moderate-to-vigorous physical activity (CPM ≥ 1952).

Appendix Table 3. Association between minutes per day spent in light activity (CPM 100 – 1951) at baseline and changes in body composition, adjusted for puberty#.

	Boys (n = 143)			Girls (n = 258)		
	Beta	95% CI	p value	Beta	95% CI	p value
Δ BMI						
Model 1	0.05	-0.10, 0.20	0.53	0.04	-0.09, 0.18	0.54
Model 2	-0.00	-0.19, 0.18	0.97	0.11	-0.04, 0.27	0.15
Model 3	-0.03	-0.23, 0.17	0.76	0.11	-0.05, 0.27	0.19
Δ waist circumference						
Model 1	-0.01	-0.53, 0.51	0.97	0.53	-0.00, 1.07	0.05
Model 2	-0.34	-0.98, 0.30	0.30	0.50	-0.11, 1.11	0.11
Model 3	-0.37	-1.06, 0.32	0.29	0.51	-0.11, 1.13	0.10
Δ FMI						
Model 1	0.05	-0.09, 0.18	0.51	0.02	-0.11, 0.14	0.78
Model 2	0.00	-0.17, 0.18	0.97	0.06	-0.09, 0.20	0.43
Model 3	-0.01	-0.20, 0.17	0.90	0.05	-0.10, 0.20	0.49
Δ LMI						
Model 1	-0.01	-0.08, 0.06	0.84	0.04	-0.01, 0.09	0.08
Model 2	-0.01	-0.10, 0.07	0.80	0.08	0.02, 0.13	< 0.01
Model 3	-0.02	-0.11, 0.07	0.74	0.08	0.02, 0.13	< 0.01
Δ aLMI						
Model 1	0.00	-0.04, 0.04	0.93	0.02	-0.01, 0.04	0.17
Model 2	-0.01	-0.06, 0.04	0.73	0.03	0.00, 0.06	0.04
Model 3	-0.01	-0.07, 0.04	0.59	0.03	-0.00, 0.06	0.06

#: The table displays the association between minutes spent in light activity and difference in BMI (kg/m^2), waist circumference, FMI (fat mass in kg/m^2), LMI (lean mass in kg/m^2) and aLMI (appendicular lean mass in kg/m^2) between Fit Futures 1 (2010-2011) and Fit Futures 2 (2012-2013). The models give the beta coefficient for 30 minutes increase in light activity. All models were adjusted for baseline values of the outcome. In model 2 also adjusted for time between measurements and baseline values of pubertal development (pds (boys) and age at menarche (girls)), screen time on weekdays, study specialisation, age in half-years, regularity of eating breakfast and device wear time. In Model 3 adjusted also for minutes spent in Moderate-to-vigorous physical activity (CPM ≥ 1952).

Appendix Table 4. Association between minutes per day spent in MVPA (CPM ≥ 1952) at baseline and changes in body composition, adjusted for puberty#.						
	Boys (n = 143)			Girls (n = 258)		
	Beta	95% CI	p value	Beta	95% CI	p value
Δ BMI						
Model 1	0.11	-0.08, 0.31	0.24	-0.00	-0.17, 0.16	0.97
Model 2	0.07	-0.15, 0.29	0.51	0.07	-0.11, 0.25	0.43
Δ waist circumference						
Model 1	0.28	-0.38, 0.95	0.40	-0.02	-0.68, 0.64	0.95
Model 2	-0.06	-0.82, 0.70	0.88	0.02	-0.69, 0.72	0.97
Δ FMI						
Model 1	0.02	-0.16, 0.20	0.80	-0.01	-0.17, 0.14	0.88
Model 2	0.05	-0.16, 0.25	0.66	0.06	-0.11, 0.22	0.52
Δ LMI						
Model 1	0.08	-0.02, 0.17	0.11	0.03	-0.03, 0.09	0.34
Model 2	0.01	-0.09, 0.11	0.84	0.03	-0.04, 0.09	0.42
Δ aLMI						
Model 1	0.05	-0.01, 0.10	0.09	0.02	-0.01, 0.05	0.13
Model 2	0.02	-0.04, 0.07	0.60	0.02	-0.01, 0.06	0.15

#: The table displays the association between minutes spent in moderate-to-vigorous physical activity (MVPA) and difference in BMI (kg/m^2), waist circumference, FMI (fat mass in kg/m^2), LMI (lean mass in kg/m^2) and aLMI (appendicular lean mass in kg/m^2) between Fit Futures 1 (2010-2011) and Fit Futures 2 (2012-2013). The models give the beta coefficient for 15 minutes increase in MVPA. Both models were adjusted for baseline values of the outcome. In model 2 also adjusted for time between measurements and baseline values of pubertal development (pds (boys) and age at menarche (girls)), screen time on weekdays, study specialisation, age in half-years, regularity of eating breakfast and device wear time.

Appendices

1. Interview guide Fit Futures 1
2. General questionnaire Fit Futures 1
3. General questionnaire Fit Futures 2
4. Fit Futures pamphlet of information
5. Fit Futures consent of participation
6. Ethical approval 2012 / 1663 REK Nord (dated 09.11.12)
7. Updated ethical approval 2012 / 1663 REK Nord (dated 29.08.14)

Fit futures

- en del av Tromsøundersøkelsen

Intervju og Spørreskjema

Versjon: 12.04.2010

Intervju

Skriftlig samtykke:

☐ Ja ☐ Nei

Hvis nei, avbrytes undersøkelsen.

Foreldresamtykke (for de som er under 16 år)

☐ Ja ☐ Nei

Dersom de har glemt å ta med dette ber man om lov til å tas kontakt med foreldre for å innhente samtykke per telefon. To teknikere signerer på at dette er gjort.

Dersom det mangler samtykke for de under 16 år, avbrytes undersøkelsen.

Dagens dato registreres automatisk. Genererer:

[Alder i hele år]

Føler du deg frisk i dag?

☐ Ja ☐ Nei

Hvis nei:

Hva er det som feiler deg?

☐ Feber ☐ Forkjølet ☐ Hodepine ☐ Magesmerter ☐ Andre smerter

☐ Kvalme ☐ Annet

Tekstfelt for annet: ___________________________________

Har du noen form for infeksjon?

☐ Ja ☐ Nei

Hvis ja:

Beskriv: ________________________

Har du noen form for kroniske eller vedvarende sykdommer?

Hvor gammel var du da du fikk denne sykdommen første gang?

Diagnose 1: [ICD10 kode] Alder sykdom 1:

Diagnose 2: [ICD10 kode] Alder sykdom 2:

Diagnose 3: [ICD10 kode] Alder sykdom 3:

Diagnose 4: [ICD10 kode] Alder sykdom 4:

Diagnose 5: [ICD10 kode] Alder sykdom 5:

Tekstfelt for annet: ___________________________________

Tar du noen form for medisiner fast?

☐ Ja ☐ Nei

Hvis ja:

Medisin 1: [ATC kode]

Medisin 2: [ATC kode]

Medisin 3: [ATC kode]

Medisin 4: [ATC kode]

Medisin 5: [ATC kode]

Har du tatt noen form for smertestillende medisiner i løpet av de siste 24 timene, for eksempel Paracet, Ibux, Parlagin forte?

☐ Ja ☐ Nei

Hvis ja:

Medisin 1:	[ATC kode]	[Timer siden]	[Antall tabletter]
Medisin 2:	[ATC kode]	[Timer siden]	[Antall tabletter]
Medisin 3:	[ATC kode]	[Timer siden]	[Antall tabletter]

Har du tatt noen form for antibiotika i løpet av de siste 24 timene, for eksempel Penicillin, mot infeksjon eller kviser?

☐ Ja ☐ Nei

Hvis ja:

Medisin 1: [ATC kode]
Medisin 2: [ATC kode]
Medisin 3: [ATC kode]

Når spiste du sist?

[ ] klokkeslett – omkodes automatisk til timer siden siste måltid

Sosialt nettverkskartlegging (se redegjørelse i protokoll)

[Løpenummer venn 1]
[Løpenummer venn 2]
[Løpenummer venn 3]
[Løpenummer venn 4]
[Løpenummer venn 5]

<u>Jenter</u>

Har du fått menstruasjon?

☐ Ja ☐ Nei

Hvis ja (har fått menstruasjon):

Hvor regelmessig er menstruasjonene dine?

☐ Alltid regelmessig ☐ Oftest regelmessig ☐ Uregelmessig

Hvor mange dager er det mellom start av hver menstruasjon?

[Antall dager]

Hvilken dag startet siste menstruasjon? ***Dato registreres, genererer:***

[Dager siden siste menstruasjon]

Bruker du noen form for hormonell prevensjon, for eksempel p-piller?

(følges eventuelt opp med spørsmål om type prevensjon om dette ikke sies spontant)

☐ Nei ☐ P-piller ☐ P-sprøyte ☐ Annet

Er det noen mulighet for at du kan være gravid nå?
☐ Ja ☐ Nei

Hvis ja:
Er det greit for deg at vi tar en gravitest?
☐ Ja ☐ Nei
(resultat av prøven formidles ikke til foreldre)

Hvis ja:
Resultat av gravitest:
☐ Negativ ☐ Positiv ☐ Ikke utført

Klarert for DEXA (genereres automatisk)
☐ Ja ☐ Nei

Følgende personer er ikke klarert:
Kvinner som sier det er mulighet for at de er gravide som ikke vil gjøre gravitest
Kvinner som har positiv gravitest.

Alle: ved innsamling av aktigraf

Hvor mange timer totalt var du utendørs i dagslys i løpet av de siste 7 dagene?
[ ] [ ] timer

FF - Generelt spørreskjema - Uke 1

Vi ønsker å vite mer om livsstil og helse.

Bruk den tiden du trenger til å svare så presist du kan.

Alle svarene dine blir behandlet med taushetsplikt.

Bruk "neste >>" og "<< tilbake" - knappene i skjema for å bla deg fremover og bakover.

Lykke til og tusen takk for hjelpen!

DEG OG DIN FAMILIE

1) Er du:

○ Jente ○ Gutt

2) Hvem bor du sammen med nå? (sett ett eller flere kryss)

- ☐ Mor
- ☐ Far
- ☐ 1-2 søsken
- ☐ 3 eller flere søsken
- ☐ Mors nye mann/samboer
- ☐ Fars nye kone/samboer
- ☐ Fosterforeldre
- ☐ Adoptivforeldre
- ☐ Besteforeldre
- ☐ Venner
- ☐ Alene/på hybel
- ☐ Institusjon
- ☐ Annet

3) Hvor lenge er det siden du flyttet hjemmefra?

- ○ Mindre enn 6 måneder
- ○ 6 - 11 måneder
- ○ 1 - 2 år
- ○ Mer enn 2 år

4) Er moren din i arbeid? (sett ett eller flere kryss)

- ☐ Ja, heltid
- ☐ Ja, deltid
- ☐ Arbeidsledig
- ☐ Uførerygdet
- ☐ Hjemmeværende
- ☐ Går på skole, kurs, e.l.
- ☐ Pensjonist
- ☐ Mor er død
- ☐ Vet ikke
- ☐ Annet

5) Er faren din i arbeid? (sett ett eller flere kryss)

- ☐ Ja, heltid
- ☐ Ja, deltid
- ☐ Arbeidsledig
- ☐ Uførerygdet
- ☐ Hjemmeværende
- ☐ Går på skole, kurs, e.l.
- ☐ Pensjonist
- ☐ Far er død
- ☐ Vet ikke
- ☐ Annet

6) Hva er den høyeste fullførte utdanningen til dine foreldre? (sett kryss for alle utdanningene du vet om for mor og far)

	Grunnskole	Yrkesfaglig videregående, yrkesskole	Allmennfaglig videregående skole eller gymnas	Høyskole eller universitet, mindre enn 4 år	Høyskole eller universitet, 4 år eller mer	Vet ikke
Mors utdanning	○	○	○	○	○	○
Fars utdanning	○	○	○	○	○	○

7) Hva regner du deg selv som: (kryss av for ett eller flere alternativ)

- ☐ Norsk
- ☐ Samisk
- ☐ Kvensk/Finsk
- ☐ Annet, spesifiser her ________

8) I hvilken kommune bodde du da du var 5-6 år (førskolealder/1.klasse)?

Velg kommune [▼]

9) Er du født i Norge?

- ○ Ja
- ○ Nei, spesifiser hvilket land ________

10) Er din biologiske mor født i Norge?

- ○ Ja
- ○ Nei, spesifiser hvilket land ________

11) Er din biologiske far født i Norge?

- ○ Ja
- ○ Nei, spesifiser hvilket land ________

12) Har du noen gang oppholdt deg 4 uker eller mer sammenhengende i Australia, USA, Argentina eller Sør-Afrika?

- Ja
- Nei

Hvis det har vært flere opphold, oppgi varighet av siste opphold.

13) Hvor lenge varte oppholdet?

- Mindre enn 2 måneder
- 2-6 måneder
- Mer enn 6 måneder

Hvis det har vært flere opphold, oppgi når du hadde siste opphold.

14) Når var oppholdet? (Oppgi årstall når oppholdet sluttet - 4 siffer)

VENNER OG SKOLE

15) Har du vurdert å avbryte eller ta pause fra den videregående opplæringen du er i gang med?

- Ja
- Nei

16) Hvor sannsynlig er det at du fullfører den utdanningen du er i gang med?

- Liten - kommer til å slutte
- God - kommer sannsynligvis til å fullføre
- Stor - Kommer helt sikkert til å fullføre
- Vet ikke

17) Hvor mange tekstmeldinger (SMS/MMS) sendte du med mobiltelefon i går?

- Ingen
- 1-5 meldinger
- 6-10 meldinger
- 11-20 meldinger
- 21-50 meldinger
- Mer enn 50 meldinger

18) Nedenfor er det noen spørsmål om hvordan du synes du selv er. Kryss av for det som passer best for deg.

	Stemmer svært godt	Stemmer nokså godt	Stemmer nokså dårlig	Stemmer svært dårlig
Jeg synes det er ganske vanskelig å få venner				
Jeg har mange venner				
Andre ungdommer har vanskelig for å like meg				
Jeg er populær blant jevnaldrende				
Jeg føler at jevnaldrende godtar meg				

19) Hvilke avgangskarakterer fikk du fra ungdomsskolen? (sett ett kryss for hvert fag)

	1	2	3	4	5	6	Husker ikke
Norsk skriftlig							
Matematikk							
Engelsk							

HELSE

20) Hvordan vurderer du din egen helse sånn i alminnelighet?

- Meget god
- God
- Verken god eller dårlig
- Dårlig
- Meget dårlig

21) Hvor ofte har du i løpet av de siste 4 ukene brukt følgende medisiner?

	Ikke brukt siste 4 uker	Sjeldnere enn hver uke	Hver uke, men ikke daglig	Daglig
Smertestillende på resept (f. eks. Paralgin forte, Pinex forte)				
Smertestillende uten resept (f. eks. Paracet, Pinex, Ibux)				
Sovemidler				
Medisin mot depresjon				
Medisiner mot ADHD				
Beroligende medisiner				

22) Har du diabetes?

Ja Nei

23) Har din biologiske mor diabetes?

Ja Nei Vet ikke

24) Har din biologiske far diabetes?

Ja Nei Vet ikke

25) Bruker mor insulin? (Penn eller pumpe)

- Ja
- Nei
- Vet ikke

26) Hvor gammel var mor da hun fikk diabetes?

- < 20 år
- 20 - 40 år
- > 40 år

27) Bruker far insulin? (Penn eller pumpe)

- Ja
- Nei
- Vet ikke

28) Hvor gammel var far da han fikk diabetes?

- < 20 år
- 20 - 40 år
- > 40 år

PSYKISKE VANSKER

29) Har du gått i behandling hos psykolog, psykiater eller PP-tjenesten det siste året?

- Ja
- Nei

30) Under finner du en liste over ulike problemer. Har du opplevd noe av dette den siste uken (til og med i dag)?

	Ikke plaget	Litt plaget	Ganske mye	Veldig mye
Plutselig frykt uten grunn	○	○	○	○
Føler deg redd eller engstelig	○	○	○	○
Matthet eller svimmelhet	○	○	○	○
Føler deg anspent eller oppjaget	○	○	○	○
Lett for å klandre deg selv	○	○	○	○
Søvnproblemer	○	○	○	○
Nedtrykt, tungsindig	○	○	○	○
Følelse av å være unyttig, lite verdt	○	○	○	○
Følelse av at alt er et slit	○	○	○	○
Følelse av håpløshet med hensyn til framtida	○	○	○	○

31) De følgende spørsmålene handler om hva du følte og gjorde de siste to ukene.

	Riktig	Noen ganger riktig	Ikke riktig
Jeg var lei meg eller ulykkelig	○	○	○
Jeg følte meg så trøtt at jeg bare ble sittende uten å gjøre noen ting	○	○	○
Jeg var veldig rastløs	○	○	○
Jeg var ikke glad for noe	○	○	○
Jeg følte meg lite verdt	○	○	○
Jeg gråt mye	○	○	○
Jeg hatet meg selv	○	○	○
Jeg tenkte at jeg aldri kunne bli så god som andre ungdommer	○	○	○
Jeg følte meg ensom	○	○	○
Jeg tenkte at ingen egentlig var glad i meg	○	○	○
Jeg følte meg som et dårlig menneske	○	○	○
Jeg gjorde alt galt	○	○	○
Jeg syntes det var vanskelig å tenke klart eller å konsentrere meg	○	○	○

PUBERTET

Her har vi noen spørsmål om kroppslige forandringer som skjer gjennom ungdomstiden:

32) Har du fått menstruasjon?

Ja Nei

Hvor gammel var du da du fikk menstruasjon første gang?

33) År

Velg...

34) Måneder

Velg...

35) Har du fått eller begynt å få kjønnshår?

Ja Nei

36) Har du fått eller begynt å få bryster?

Ja Nei

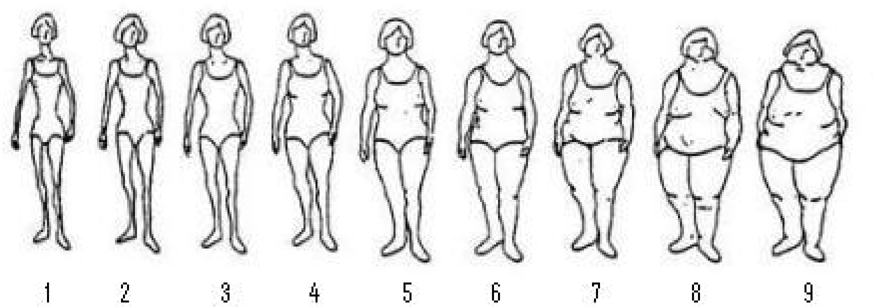
37) Har du fått eller begynt å få kjønnshår?

Ja Nei

38) Hvor gammel var du da du begynte å få kjønnshår?

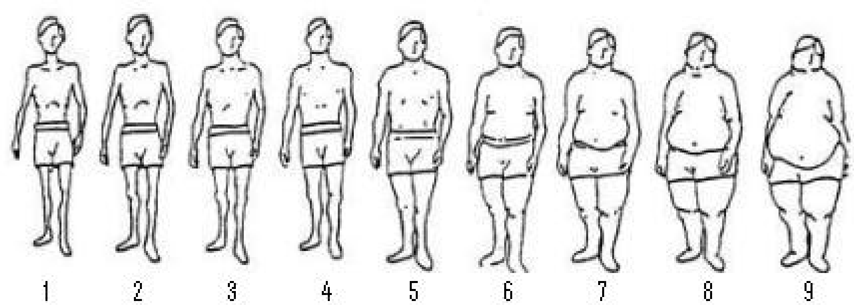
Velg...

KROPP OG VEKT



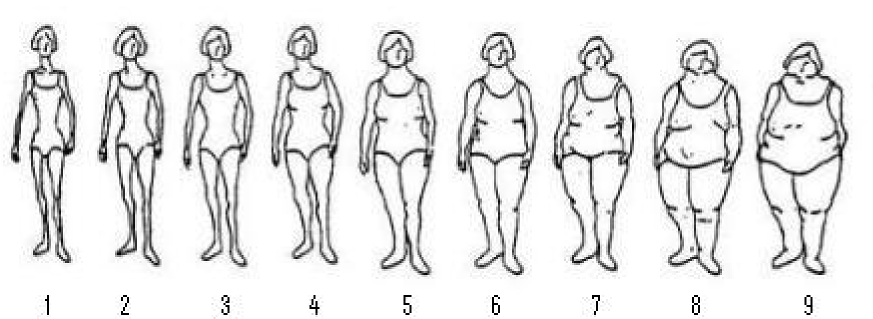
39) Hvilken av disse kroppsfasongene likner mest på kroppen til moren din?

○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9



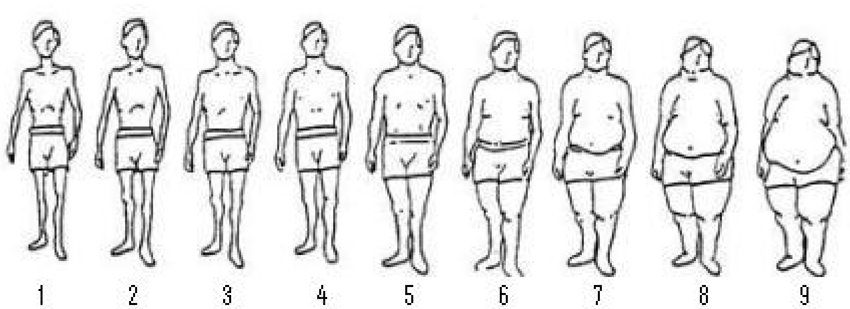
40) Hvilken av disse kroppsfasongene likner mest på kroppen til faren din?

○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9



41) Hvilken av disse kroppsfasongene likner mest på din kropp slik du er i dag?

1 2 3 4 5 6 7 8 9



42) Hvilken av disse kroppsfasongene likner mest på din kropp slik du er i dag?

1 2 3 4 5 6 7 8 9

RØYK, SNUS OG ALKOHOL

43) Røyker du?

Nei, aldri Av og til Daglig

44) Bruker du snus eller skrå?

Nei, aldri Av og til Daglig

45) Hvor mange sigaretter røyker du vanligvis i løpet av en uke?

- 1 eller færre
- 2-3
- 4-6
- 7-10
- Mer enn 10

46) Hvor mange sigaretter røyker du vanligvis per dag?

- 1
- 2-3
- 4-6
- 7-10
- Mer enn 10

47) Hvor mange priser snus/skrå bruker du vanligvis i løpet av en uke?

- 1 eller færre
- 2-3
- 4-6
- 7-10
- Mer enn 10

48) Hvor mange priser snus/skrå bruker du per dag?

- 1
- 2-3
- 4-6
- 7-10
- Mer enn 10

49) Hvor ofte drikker du alkohol?

- Aldri
- 1 gang per måned eller sjeldnere
- 2-4 ganger per måned
- 2-3 ganger per uke
- 4 eller flere ganger per uke

50) Hvor mange enheter alkohol (en øl, ett glass vin eller en drink) tar du vanligvis når du drikker?

- 1-2
- 3-4
- 5-6
- 7-9
- 10 eller flere

51) Hvor ofte drikker du 6 eller flere enheter alkohol ved en anledning?

- Aldri
- Sjeldnere enn 1 gang per måned
- 1 gang per måned
- 1 gang per uke
- Daglig eller nesten daglig

FYSISK AKTIVITET

52) Hvilken beskrivelse passer best når det gjelder din fysiske aktivitet på fritiden det siste året?

- Sitter ved PC/TV, leser eller annen stillesittende aktivitet.
- Går, sykler eller beveger deg på annen måte minst 4 timer i uken (her skal du også regne med tur til/fra skolen, shopping, søndagsturer med mer).
- Driver med idrett/trening, tyngre utearbeid, snømåking eller liknende minst 4 timer i uka.
- Trener hardt eller driver konkurranseidrett regelmessig og flere ganger i uka.

53) Hvordan kommer du deg vanligvis til og fra skolen i sommerhalvåret?

- Med bil, motorsykkel/moped
- Med buss
- Med sykkel
- Går

54) Hvor lang tid bruker du vanligvis til og fra skolen (en vei) i sommerhalvåret?

- Mindre enn 5 minutter
- 6 til 15 minutter
- 16 til 30 minutter
- 1/2 til 1 time
- Mer enn 1 time

55) Hvordan kommer du deg vanligvis til og fra skolen i vinterhalvåret?

- Med bil, motorsykkel/moped
- Med buss
- Med sykkel
- Går

56) Hvor lang tid bruker du vanligvis til og fra skolen (en vei) i vinterhalvåret?

- Mindre enn 5 minutter
- 6 til 15 minutter
- 16 til 30 minutter
- 1/2 til 1 time
- Mer enn 1 time

57) Driver du med idrett eller fysisk aktivitet (f.eks. skateboard, fotball, dans, løping) utenom skoletid?

- Ja
- Nei

58) Hvor mange dager i uken driver du med idrett/fysisk aktivitet utenom skoletid?

- Aldri
- Sjeldnere enn 1 dag i uka
- 1 dag i uka
- 2-3 dager i uka
- 4-6 dager i uka
- Omtrent hver dag

59) Omtrent hvor mange timer per uke bruker du til sammen på idrett/fysisk aktivitet utenom skoletid?

- Ingen
- Omtrent 1/2 time
- Omtrent 1 - 1 1/2 time
- Omtrent 2 - 3 timer
- Omtrent 4 - 6 timer
- 7 timer eller mer

60) Hvor slitsom er vanligvis idretten/aktiviteten du driver med utenom skoletid?

- Ikke anstrengende
- Litt anstrengende
- Ganske anstrengende
- Meget anstrengende
- Svært anstrengende

Utenom skoletid: Hvor mange timer per dag ser du på PC, TV, DVD og liknende?

61) Hverdager, antall timer per dag:

- Ingen
- Omtrent 1/2 time
- Omtrent 1 - 1 1/2 time
- Omtrent 2 - 3 timer
- Omtrent 4 - 6 timer
- Omtrent 7 - 9 timer
- 10 timer eller mer

62) Fridager (helg, helligdager, ferie), antall timer per dag:

- Ingen
- Omtrent 1/2 time
- Omtrent 1 - 1 1/2 time
- Omtrent 2 - 3 timer
- Omtrent 4 - 6 timer
- Omtrent 7 - 9 timer
- 10 timer eller mer

Svar på en skala fra 1 til 5, der 1 tilsvarer svært sjelden eller aldri og 5 tilsvarer svært ofte.

63) I hvilken grad har andre oppmuntret deg til å være fysisk aktiv

	1	2	3	4	5
Foreldre/foresatte					
Søsken					
Venner					
Trenere					
Gymlærere					
Nabolaget					

Svar på en skala fra 1 til 5, der 1 tilsvarer helt enig og 5 tilsvarer helt uenig.

64) Hvordan passer disse utsagnene for deg?

	1	2	3	4	5
Det er morsommere å drive med trening eller fysisk aktivitet enn å gjøre andre ting...					
Jeg skulle ønske jeg kunne drive mer med trening eller fysisk aktivitet enn det jeg har anledning til å gjøre...					
Jeg føler at jeg er bedre enn de fleste på min alder i idrett/fysisk aktivitet...					
Jeg føler at jeg lett kan holde følge med de andre på min alder når vi driver med idrett/fysisk aktivitet...					

Svar på en skala fra 1 til 5, der 1 tilsvarer helt enig og 5 tilsvarer helt uenig.

65) Hvordan passer disse utsagnene for deg?

	1	2	3	4	5
Jeg liker ikke å trene mens noen står å ser på...					
Tilgang til egen garderobe hadde gjort det lettere å trene...					
Jeg blir ubehagelig andpusten, svett eller får vondt i kroppen ved trening...					
Gymtimene er organisert slik at jeg ikke henger med...					
Jeg har ingen å trene sammen med...					
Jeg mangler utstyr for å drive med den aktiviteten jeg har lyst til...					
Jeg har for mange andre oppgaver som gjør at jeg ikke får tid til å trene (f.eks lekser, hjemmeoppgaver)...					
Det mangler egnede haller eller gode uteområder for å drive fysisk aktivitet der jeg bor...					

MATVANER OG KOSTHOLD

66) Hvor ofte pleier du å spise følgende i løpet av en uke?

	Hver dag	4-6 dager i uka	1-3 dager i uka	Sjelden eller aldri
Frokost	○	○	○	○
Middag	○	○	○	○

67) Hvor ofte spiser du matpakke hjemmefra på skolen?

- ○ Hver dag
- ○ 3-4 ganger per uke
- ○ 1-2 ganger per uke
- ○ Sjelden eller aldri

68) Hvor ofte spiser du vanligvis disse matvarene?

	Sjelden/ aldri	1-3 ganger per måned	1-3 ganger per uke	4-6 ganger per uke	Hver dag
Ost (alle typer)	○	○	○	○	○
Fet fisk (f.eks. laks, ørret, makrell, sild)	○	○	○	○	○
Mager fisk (f.eks. torsk, sei, hyse)	○	○	○	○	○
Pizza, hamburger eller pølser	○	○	○	○	○
Hermetisert mat (fra metallbokser)	○	○	○	○	○
Godteri (f.eks. sjokolade, drops)	○	○	○	○	○
Snacks og søtsaker (f.eks. potetgull, kake, kjeks, bolle)	○	○	○	○	○
Sukkerfri tyggegummi	○	○	○	○	○

69) Hvor ofte spiser du vanligvis

	Sjelden/ aldri	1-3 ganger per mnd	1-3 ganger per uke	4-6 ganger per uke	1-2 ganger per dag	3-4 ganger per dag	5 eller flere ganger per dag
Frukt	○	○	○	○	○	○	○
Grønnsaker	○	○	○	○	○	○	○

70) Hvor mange ganger i året spiser du vanligvis disse matvarene?

	0	1-3	4-5	6-9	10 eller flere
Mølje med fiskelever	○	○	○	○	○
Måsegg	○	○	○	○	○
Reinsdyrkjøtt	○	○	○	○	○
Selvplukket sopp	○	○	○	○	○

71) Hvor mye drikker du vanligvis av følgende?

	Sjelden/ aldri	1-6 glass per uke	1 glass per dag	2-3 glass per dag	4 glass eller mer per dag
Helmelk, kefir, yoghurt	○	○	○	○	○
Lettmelk, cultura, lettyoghurt	○	○	○	○	○
Skummet melk (sur/søt)	○	○	○	○	○
Ekstra lett melk	○	○	○	○	○
Juice	○	○	○	○	○
Saft med sukker	○	○	○	○	○
Lettsaft, kunstig søtet	○	○	○	○	○
Brus med sukker (1/2 liters flaske = 2 glass)	○	○	○	○	○
Lettbrus, kunstig søtet (1/2 liters flaske = 2 glass)	○	○	○	○	○
Vann	○	○	○	○	○

72) Bruker du følgende kosttilskudd?

	Ja, daglig	Iblant	Nei
Tran, trankapsler, fiskeoljekapsler	○	○	○
Vitamin- og/eller mineraltilskudd	○	○	○

SØVN OG SØVNVANER

73) Når pleier du å legge deg for å sove på ukedagene?

Velg... ▼

74) Når pleier du å legge deg for å sove i helgen?

Velg... ▼

75) Hvor lenge pleier du å ligge våken før du får sove på ukedagene?

Velg... ▼

76) Hvor lenge pleier du å ligge våken før du får sove i helgen?

Velg... ▼

77) Når pleier du å våkne på ukedagene (endelig oppvåkning)?

Velg... ▼

78) Når pleier du å våkne i helgen (endelig oppvåkning)?

Velg... ▼

79) Hvor mange timer sover du vanligvis pr. natt?

Velg... ▼

80) Hvor mange timer søvn trenger du pr. natt for å føle deg uthvilt?

Velg... ▼

81) Synes du at du får tilstrekkelig med søvn?

- Ja, absolutt tilstrekkelig
- Ja, stort sett tilstrekkelig
- Nei, noe utilstrekkelig
- Nei, klart utilstrekkelig
- Nei, langt fra tilstrekkelig

HUD

Her har vi noen spørsmål om vanlige hudplager/hudsykdommer.

82) Har du hatt kløende utslett i løpet av de siste 12 månedene?

Ja Nei Vet ikke

83) Har dette utslettet sittet på noen av de følgende stedene: rundt hals, ører eller øyne, i albuebøyene (på innsiden), under baken, bak knærne eller foran på anklene?

Ja Nei

84) Hvor gammel var du første gang du fikk denne typen utslett?

Velg... ▼

Hvor mye plaget er du av dette utslettet i dag?
Svar på en skala fra 0-10, der 0 tilsvarer ingen plager og 10 tilsvarer verst tenkelige plager.

0 1 2 3 4 5 6 7 8 9 10

86) Har du hatt håndeksem flere ganger?

○ Ja ○ Nei ○ Vet ikke

Hvor mye plaget er du av håndeksem i dag?
Svar på en skala fra 0-10, der 0 tilsvarer ingen plager og 10 tilsvarer verst tenkelige plager.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

88) Har du noen gang vært plaget av kviser?

○ Ja ○ Nei ○ Vet ikke

Hvor mye plaget er du av kviser i dag?
Svar på en skala fra 0-10, der 0 tilsvarer ingen plager og 10 tilsvarer verst tenkelige plager.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

90) Har du noen gang oppsøkt lege på grunn av kviser?

○ Ja ○ Nei

91) Har du fått noen av disse behandlingene av lege?

	Ja	Nei	Vet ikke
Lokalbehandling (f.eks. kremer eller oppløsninger)	○	○	○
Antibiotika tabletter (f.eks. Tetracyclin)	○	○	○
Roaccutan tabletter	○	○	○

92) Har du eller har du noen gang hatt psoriasis?

○ Ja ○ Nei ○ Vet ikke

Hvor mye plaget er du av psoriasis i dag?
Svar på en skala fra 0-10, der 0 tilsvarer ingen plager og 10 tilsvarer verst tenkelige plager.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Verkebyller er svært store kviser som er ømme/smertefulle og som ofte gir arr.

94) Har du noen gang hatt verkebyller under armene/armhulene?

○ Ja
○ Nei
○ Vet ikke

95) Har du noen gang oppsøkt lege pga verkebyllene?

○ Ja ○ Nei

96) Har du noen gang hatt verkebyller i lyskene/nært skrittet?

○ Ja
○ Nei
○ Vet ikke

97) Har du noen gang oppsøkt lege på grunn av verkebyllene?

- Ja
- Nei

98) Har en lege noen gang sagt at du har...

	Ja	Nei	Vet ikke
høysnue eller neseallergi?			
astma?			
barneeksem eller atopisk eksem?			

SMERTER

99) Har du langvarige eller stadig tilbakevendende smerter som har vart i 3 måneder eller mer?

- Ja
- Nei

100) Hvor lenge har du hatt disse smertene? (Dersom du har flere typer smerte, svar for den som har vart lengst)

- 3 - 6 måneder
- 6 - 12 måneder
- 1-2 år
- 3-6 år
- Mer enn 6 år

101) Hvor ofte har du vanligvis disse smertene?

- Hele tiden, uten opphør
- Hver dag, men ikke hele tiden
- Hver uke, men ikke hver dag
- Sjeldnere enn hver uke

Hvor er det vondt?
(kryss av på alle aktuelle steder)

	Venstre side	Høyre side
Skulder	☐	☐
Arm/albue	☐	☐
Hånd	☐	☐
Hofte	☐	☐
Lår/kne/legg	☐	☐
Ankel/fot	☐	☐

	Midten
Hode/ansikt	☐
Kjeve/kjeveledd	☐
Nakke	☐
Øvre del av ryggen	☐
Korsryggen	☐
Bryst	☐
Mage	☐
Underliv/kjønnsorganer	☐

104) Hva mener du er årsaken til smertene? (flere svar mulig)

- ☐ PC-bruk, dataspill og lignende
- ☐ Idrettsskade
- ☐ Ulykke/skade
- ☐ Kirurgisk inngrep/operasjon
- ☐ Migrene/hodepine
- ☐ Medfødt sykdom
- ☐ Tannproblemer
- ☐ Whiplash
- ☐ Prolaps (skiveutglidning i ryggen)
- ☐ Annet ryggproblem
- ☐ Nerveskade
- ☐ Mage- eller tarmsykdom
- ☐ Annet, spesifiser her ________
- ☐ Vet ikke

Hvis du har langvarige smerter flere steder i kroppen, gjelder de 4 neste spørsmålene smerten som plager deg mest.

Hvor sterke vil du si at smertene vanligvis er?
Svar på en skala fra 0-10, der 0 tilsvarer ingen smerte og 10 tilsvarer verst tenkelig smerte.

Dersom du har flere typer smerte, svar den som plager deg mest.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Hvor sterke er smertene når de er på sitt sterkeste?
Svar på en skala fra 0-10, der 0 tilsvarer ingen smerte og 10 tilsvarer verst tenkelig smerte.

Dersom du har flere typer smerte, svar den som plager deg mest.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I hvor stor grad påvirker smertene søvnen din?
Svar på en skala fra 0-10, der 0 tilsvarer ingen smerte og 10 tilsvarer verst tenkelig smerte.

Dersom du har flere typer smerte, svar den som plager deg mest.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

I hvor stor grad hindrer smertene deg i å utføre vanlige aktiviteter hjemme og på skolen?
Svar på en skala fra 0-10, der 0 tilsvarer ingen smerte og 10 tilsvarer verst tenkelig smerte.

Dersom du har flere typer smerte, svar den som plager deg mest.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

MAGE- OG TARMPROBLEMER

109) I løpet av de siste 2 månedene: Hvor ofte har du hatt smerte eller ubehag i magen?

- ○ Aldri
- ○ 1-3 ganger i måneden
- ○ En gang i uka
- ○ Flere ganger i uka
- ○ Hver dag

110) Hvor lenge har du vært plaget av smerte eller ubehag i magen?

- ○ Mindre enn 1 måned
- ○ 2 måneder
- ○ 3 måneder
- ○ 4-11 måneder
- ○ Ett år eller mer

111) I hvilken del av magen er det du har hatt smerte eller ubehag? (kryss av for alt som passer)

- ☐ Over navlen
- ☐ Rundt navlen
- ☐ Nedenfor navlen

112) Når du har smerter eller ubehag i magen, hvor lenge varer det vanligvis?

- ○ Mindre enn 1 time
- ○ 1-2 timer
- ○ 3-4 timer
- ○ Mesteparten av dagen
- ○ Hele døgnet

Når du har smerte eller ubehag i magen, hvor sterke smerter har du vanligvis?
Svar på en skala fra 0-10, der 0 tilsvarer ingen smerte og 10 tilsvarer verst tenkelig smerte.

Dersom du har flere typer smerte, svar den som plager deg mest.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

114) Når du har smerter eller ubehag i magen, hvor ofte blir det bedre etter at du har hatt avføring?

- ○ Sjelden eller aldri
- ○ En del ganger
- ○ For det meste/hver gang

115) Når du har smerter eller ubehag i magen, hvor ofte skjer det i forbindelse med at du..

	Sjelden eller aldri	En del ganger	For det meste
har fastere eller mer klumpete avføring enn vanlig?	○	○	○
har løsere eller mer vannaktig avføring enn vanlig?	○	○	○
hadde avføring oftere enn vanlig?	○	○	○
hadde avføring sjeldnere enn vanlig?	○	○	○

HODEPINE

116) Har du vært plaget av hodepine det siste året?

○ Ja ○ Nei

117) Hva slags hodepine er du plaget av? (Du kan sette flere kryss)

☐ Migrene ☐ Annen hodepine ☐ Vet ikke

118) Omtrent hvor mange dager per måned har du hodepine?

- ○ Mindre enn 1 dag
- ○ 1-6 dager
- ○ 7-14 dager
- ○ Mer enn 14 dager

119) Er hodepinen vanligvis:

	Ja	Nei
Bankende/dunkende smerte	○	○
Pressende smerte	○	○
Ensidig smerte (høyre eller venstre)	○	○

120) Hvor lenge varer hodepinen vanligvis?

- Mindre enn 4 timer
- 4 timer - 1 døgn
- 1-3 døgn
- Mer enn 3 døgn

121) Før eller under hodepinen, kan du da ha forbigående:

	Ja	Nei
Synsforstyrrelse? (takkede linjer, flimring, tåkesyn, lysglimt)		
Nummenhet i halve ansiktet eller i hånden?		
Forverring ved moderat fysisk aktivitet?		
Kvalme og/eller oppkast?		

122) Hvor ofte pusser du vanligvis tennene dine? (sett ett kryss)

- Sjeldnere enn 1 gang per uke
- 1 gang per uke
- 2-3 ganger per uke
- 4-6 ganger per uke
- 1 gang daglig
- 2 eller flere ganger daglig

Hvor smertefullt, jevnt over, synes du det er å gå til tannlegen?
Svar på en skala fra 0-10, der 0 tilsvarer ingen smerte og 10 tilsvarer verst tenkelig smerte.

0 1 2 3 4 5 6 7 8 9 10

Nedenfor er det fire spørsmål om hvordan du opplever det er å gå til tannlege. Les hvert spørsmål og velg det svaralternativet som du synes passer best for deg.

124) Dersom du skulle gå til tannlegen i morgen, hva ville du føle?

- Jeg ville se frem til det som en ganske hyggelig opplevelse
- Det ville være det samme for meg, ikke bety noe
- Det ville gjøre meg litt urolig
- Jeg ville bli redd for at det skulle bli ubehagelig og vondt
- Jeg ville bli svært redd med tanke på hva tannlegen kanskje skulle gjøre

125) Når du venter på tannlegens venteværelse, hvordan føler du deg da?

- Avslappet
- Litt urolig
- Anspent, nervøs
- Redd, engstelig
- Så redd at jeg av og til begynner å svette eller nesten føler meg syk

126) Når du sitter i tannlegestolen og venter på at tannlegen skal begynne behandlingen, hvordan føler du deg da?

- Avslappet
- Litt urolig
- Anspent, nervøs
- Redd, engstelig
- Så redd at jeg av og til begynner å svette eller nesten føler meg syk

Tenk at du sitter i tannlegestolen og skal få tennene renset og pusset. Mens du sitter og venter på at tannlege skal finne frem instrumentene som brukes til å skrape og pusse med,

127) hvordan føler du deg da?

- Avslappet
- Litt urolig
- Anspent, nervøs
- Redd, engstelig
- Så redd at jeg av og til begynner å svette eller nesten føler meg syk

128) Har du øresus?

○ Aldri ○ Sjelden ○ Ofte

129) Hvor ofte har du øresus?

○ Hele tiden, uten opphør
○ Hver dag, men ikke hele tiden
○ Hver uke, men ikke hver dag
○ Sjeldnere enn hver uke

130) Hvor lenge varer vanligvis periodene med øresus?

○ Mindre enn 10 minutter ○ 10 minutter - 1 time ○ Mer enn 1 time

131) Når får du vanligvis øresus?

☐ Etter sterke lyder ☐ Når det er stille ☐ Vet aldri når

Noen bryr seg ikke om lyden, for andre oppleves det svært plagsomt å ha øresus. Angi hvor plaget du er av øresusen.
Svar på en skala fra 0 til 10, der 0 tilsvarer ingen plager og 10 tilsvarer verst tenkelige plager.

○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

133) På hvilket øre har du vanligvis øresus?

○ Bare høyre
○ Bare venstre
○ Begge, men mest høyre
○ Begge, men mest venstre
○ Like mye på begge

134) Omtrent hvor gammel var du når du begynte å ha øresus ofte?

Velg... ▼

FF2 Generelt spørreskjema - UKE 1

Vi ønsker å vite mer om livsstil og helse.

Bruk den tiden du trenger til å svare så presist du kan.

Alle svarene dine blir behandlet med taushetsplikt.

Bruk "neste >>" og "<< tilbake" - knappene i skjema for å bla deg fremover og bakover.

Lykke til og tusen takk for hjelpen!

DEG OG DIN FAMILIE

1) Er du:

○ Jente ○ Gutt

2) Hvem bor du sammen med nå? (sett ett eller flere kryss)

- ☐ Mor
- ☐ Far
- ☐ 1-2 søsken
- ☐ 3 eller flere søsken
- ☐ Mors nye mann/samboer
- ☐ Fars nye kone/samboer
- ☐ Fosterforeldre
- ☐ Adoptivforeldre
- ☐ Besteforeldre
- ☐ Venner
- ☐ Alene/på hybel
- ☐ Institusjon
- ☐ Samboer/gift
- ☐ Annet

3) Hvor lenge er det siden du flyttet hjemmefra?

- ○ Mindre enn 6 måneder
- ○ 6 - 11 måneder
- ○ 1 - 2 år
- ○ Mer enn 2 år

4) Er moren din i arbeid? (sett ett eller flere kryss)

- ☐ Ja, heltid
- ☐ Ja, deltid
- ☐ Arbeidsledig
- ☐ Uførerygdet
- ☐ Hjemmeværende
- ☐ Går på skole, kurs, e.l.
- ☐ Pensjonist
- ☐ Mor er død
- ☐ Vet ikke
- ☐ Annet

5) Er faren din i arbeid? (sett ett eller flere kryss)

- ☐ Ja, heltid
- ☐ Ja, deltid
- ☐ Arbeidsledig
- ☐ Uførerygdet
- ☐ Hjemmeværende
- ☐ Går på skole, kurs, e.l.
- ☐ Pensjonist
- ☐ Far er død
- ☐ Vet ikke
- ☐ Annet

6) Har du noen gang oppholdt deg 4 uker eller mer sammenhengende i Australia, USA, Argentina eller Sør-Afrika?

○ Ja ○ Nei

Hvis det har vært flere opphold, oppgi varighet av siste opphold.

7) Hvor lenge varte det siste oppholdet?

- Mindre enn 2 måneder
- 2-6 måneder
- Mer enn 6 måneder

Hvis det har vært flere opphold, oppgi når du hadde siste opphold.

8) Når var det siste oppholdet?

Velg... Velg... ▼

9) Er du i dag?

- Elev i videregående skole
- Lærling/elev i bedrift
- Ikke i videregående opplæring

VENNER OG SKOLE

10) Har du vurdert å avbryte eller ta pause fra den videregående opplæringen du er i gang med?

- Ja
- Nei

11) Hvor sannsynlig er det at du fullfører den utdanningen du er i gang med?

- Liten - kommer til å slutte
- God - kommer sannsynligvis til å fullføre
- Stor - Kommer helt sikkert til å fullføre
- Vet ikke

12) Hvor mange tekstmeldinger (SMS/MMS) sendte du med mobiltelefon i går?

- Ingen
- 1-5 meldinger
- 6-10 meldinger
- 11-20 meldinger
- 21-50 meldinger
- Mer enn 50 meldinger

13) Nedenfor er det noen spørsmål om hvordan du synes du selv er. Kryss av for det som passer best for deg.

	Stemmer svært dårlig	Stemmer nokså dårlig	Stemmer nokså godt	Stemmer svært godt
Jeg synes det er ganske vanskelig å få venner				
Jeg har mange venner				
Andre ungdommer har vanskelig for å like meg				
Jeg er populær blant jevnaldrende				
Jeg føler at jevnaldrende godtar meg				

HELSE

14) Hvordan vurderer du din egen helse sånn i alminnelighet?

- Meget god
- God
- Verken god eller dårlig
- Dårlig
- Meget dårlig

15) Hvor ofte har du i løpet av de siste 4 ukene brukt følgende medisiner?

	Ikke brukt siste 4 uker	Sjeldnere enn hver uke	Hver uke, men ikke daglig	Daglig
Smertestillende på resept (f. eks. Paralgin forte, Pinex forte)	○	○	○	○
Smertestillende uten resept (f. eks. Paracet, Pinex, Ibux)	○	○	○	○
Sovemidler	○	○	○	○
Medisin mot depresjon	○	○	○	○
Medisiner mot ADHD	○	○	○	○
Beroligende medisiner	○	○	○	○

16) Har en lege noen gang sagt at du har...

	Ja	Nei	Vet ikke
høysnue eller neseallergi?	○	○	○
astma?	○	○	○
barneeksem eller atopisk eksem?	○	○	○
psoriasis?	○	○	○

PSYKISKE VANSKER

17) Har du gått i behandling hos psykolog, psykiater eller PP-tjenesten det siste året?

○ Ja ○ Nei

18) Under finner du en liste over ulike problemer. Har du opplevd noe av dette den siste uken (til og med i dag)?

	Ikke plaget	Litt plaget	Ganske mye	Veldig mye
Plutselig frykt uten grunn	○	○	○	○
Føler deg redd eller engstelig	○	○	○	○
Matthet eller svimmelhet	○	○	○	○
Føler deg anspent eller oppjaget	○	○	○	○
Lett for å klandre deg selv	○	○	○	○
Søvnproblemer	○	○	○	○
Nedtrykt, tungsindig	○	○	○	○
Følelse av å være unyttig, lite verdt	○	○	○	○
Følelse av at alt er et slit	○	○	○	○
Følelse av håpløshet med hensyn til framtida	○	○	○	○

19) De følgende spørsmålene handler om hva du følte og gjorde de siste to ukene.

	Ikke riktig	Noen ganger riktig	Riktig
Jeg var lei meg eller ulykkelig	○	○	○
Jeg følte meg så trøtt at jeg bare ble sittende uten å gjøre noen ting	○	○	○
Jeg var veldig rastløs	○	○	○
Jeg var ikke glad for noe	○	○	○
Jeg følte meg lite verdt	○	○	○
Jeg gråt mye	○	○	○
Jeg hatet meg selv	○	○	○
Jeg tenkte at jeg aldri kunne bli så god som andre ungdommer	○	○	○
Jeg følte meg ensom	○	○	○
Jeg tenkte at ingen egentlig var glad i meg	○	○	○
Jeg følte meg som et dårlig menneske	○	○	○
Jeg gjorde alt galt	○	○	○
Jeg syntes det var vanskelig å tenke klart eller å konsentrere meg	○	○	○

De følgende spørmålene handler om hvordan du ser på deg selv.

20) Jeg ser på meg selv som en som...

	Svært uenig 1	2	3	4	5	Svært enig 6
Er pratsom						
Har en tendens til å finne feil med andre						
Gjør en grundig jobb						
Er deprimert, nedstemt						
Er orginal, kommer med nye ideer						
Er reservert						
Er hjelpsom og uegoistisk ovenfor andre						
Kan være uforsiktig						
Er avslappet, takler stress godt						
Er nysgjerrig på mange ting						
Er full av energi						
Er en kranglefant						
Er pålitelig i arbeidet mitt						
Kan være anspent						
Er skarpsindig, tenker dypt						
Skaper mye entusiasme						
Er tilgivende av natur						
Har en tendens til å være ustrukturert						
Bekymrer meg mye						
Har livlig fantasi						
Har en tendens til å være stillferdig						
Er tillitsfull						

De følgende spørmålene handler om hvordan du ser på deg selv.

21) Jeg ser på meg selv som en som...

	Svært uenig 1	2	3	4	5	Svært enig 6
Har en tendens til å være lat	○	○	○	○	○	○
Er følelsesmessig stabil	○	○	○	○	○	○
Er oppfinnsom	○	○	○	○	○	○
Er selvhevdende	○	○	○	○	○	○
Kan være kald og fjern	○	○	○	○	○	○
Står på til oppgaven er gjennomført	○	○	○	○	○	○
Kan være humørsyk	○	○	○	○	○	○
Setter pris på skjønnhet og kunst	○	○	○	○	○	○
Kan være sjenert og hemmet	○	○	○	○	○	○
Er hensynsfull og vennlig ovenfor de fleste	○	○	○	○	○	○
Gjør ting effektivt	○	○	○	○	○	○
Beholder roen i spente situasjoner	○	○	○	○	○	○
Foretrekker rutinearbeid	○	○	○	○	○	○
Er utadvendt og sosial	○	○	○	○	○	○
Kan noen ganger være uhøflig	○	○	○	○	○	○
Legger planer og gjennomfører dem	○	○	○	○	○	○
Blir lett nervøs	○	○	○	○	○	○
Liker å tenke, leke med ideer	○	○	○	○	○	○
Har få kunstneriske interesser	○	○	○	○	○	○
Liker å samarbeide	○	○	○	○	○	○
Blir lett distrahert	○	○	○	○	○	○
Har kunnskaper om kunst, musikk, litteratur	○	○	○	○	○	○

PUBERTET

Her har vi noen spørsmål om kroppslige forandringer som skjer gjennom ungdomstiden:

22) Har du fått menstruasjon?

○ Ja ○ Nei

Hvor gammel var du da du fikk menstruasjon første gang?

23) År

Velg... Velg... ▼

24) Måneder

Velg... Velg... ▼

25) Hvis du ser bort fra svangerskap, har du noen gang vært blødningsfri i minst 6 måneder?

- Ja
- Nei

26) Hvor mange ganger har du vært blødningsfri i mer enn 6 måneder?

Velg... Velg... ▼

27) Hvordan er blødningene dine nå?

- Jeg har regelmessige blødninger
- Jeg har uregelmessige blødninger
- Jeg har ikke hatt blødninger det siste året

PUBERTET

28) Når man er tenåring, er det perioder da man vokser raskt. Har du merket at kroppen din har vokst fort (blitt høyere)?

- Nei, den har ikke begynt å vokse
- Ja, den har såvidt begynt å vokse
- Ja, den har helt tydelig begynt å vokse
- Ja, det virker som om jeg er ferdig med å vokse raskt

29) Og hva med hår på kroppen (under armene og i skrittet)? Vil du si at håret på kroppen din har:

- Ikke begynt å vokse enda
- Såvidt begynt å vokse
- Helt tydelig begynt å vokse
- Det virker som om håret på kroppen er utvokst

30) Hvor gammel var du da du begynte å få hår i skrittet (kjønnshår)?

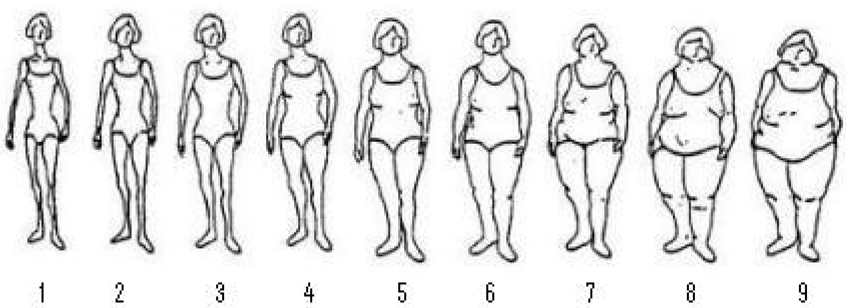
Velg... Velg... ▼

31) Har du begynt å komme i stemmeskifte?

- Nei, har ikke begynt ennå
- Ja, har såvidt begynt
- Ja, har helt tydelig begynt
- Det virker som om stemmeskifte er ferdig

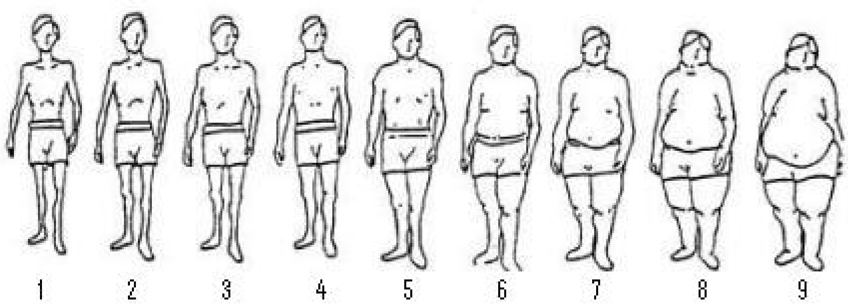
32) Har du begynt å få bart eller skjegg?

- Nei, har ikke begynt ennå
- Ja, har såvidt begynt
- Ja, har helt tydelig begynt
- ja, har fått en god del skjeggvekst



33) Hvilken av disse kroppsfasongene likner mest på din kropp slik du er idag?

◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9



34) Hvilken av disse kroppsfasongene likner mest på din kropp slik du er idag?

◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7 ◯ 8 ◯ 9

35) Gjør du for tiden noe forsøk på å endre kroppsvekten din?

◯ Nei

◯ Ja, jeg forsøker å legge på meg

◯ Ja, jeg forsøker å slanke meg

36) Hvilken vekt vil du være fornøyd med (din trivselsvekt i hele kilo)?

LIVSSTIL

37) Røyker du?

◯ Nei, aldri ◯ Før, men ikke nå ◯ Av og til ◯ Daglig

38) Hvor gammel var du da du først begynte å røyke?

Velg... Velg... ▼

39) Hvor mange sigaretter røyker/røkte du vanligvis i løpet av en uke?

- 1 eller færre
- 2-3
- 4-6
- 7-10
- Mer enn 10

40) Hvor mange sigaretter røyker/røkte du vanligvis i løpet av en dag?

- 1 eller færre
- 2-3
- 4-6
- 7-10
- Mer enn 10

41) Bruker du snus eller skrå?

- Nei, aldri
- Før, men ikke nå
- Av og til
- Daglig

42) Hvor gammel var du da du først begynte å bruke snus eller skrå?

Velg... Velg... ▼

43) Hvor mange priser snus/skrå bruker du vanligvis i løpet av en uke?

- 1 eller færre
- 2-3
- 4-6
- 7-10
- Mer enn 10

44) Hvor mange priser snus/skrå bruker du per dag?

- 1
- 2-3
- 4-6
- 7-10
- Mer enn 10

45) Hvor ofte drikker du alkohol?

- Aldri
- 1 gang per måned eller sjeldnere
- 2-4 ganger per måned
- 2-3 ganger per uke
- 4 eller flere ganger per uke

46) Hvor mange enheter alkohol (en øl, ett glass vin eller en drink) tar du vanligvis når du drikker?

- 1-2
- 3-4
- 5-6
- 7-9
- 10 eller flere

47) Hvor ofte drikker du 6 eller flere enheter alkohol ved en anledning?

- Aldri
- Sjeldnere enn 1 gang per måned
- 1 gang per måned
- 1 gang per uke
- Daglig eller nesten daglig

FYSISK AKTIVITET

48) Hvilken beskrivelse passer best når det gjelder din fysiske aktivitet på fritiden det siste året?

- Sitter ved PC/TV, leser eller annen stillesittende aktivitet.
- Går, sykler eller beveger deg på annen måte minst 4 timer i uken (her skal du også regne med tur til/fra skolen, shopping, søndagsturer med mer).
- Driver med idrett/trening, tyngre utearbeid, snømåking eller liknende minst 4 timer i uka.
- Trener hardt eller driver konkurranseidrett regelmessig og flere ganger i uka.

49) Hvordan kommer du deg vanligvis til og fra skolen eller arbeid i sommerhalvåret?

- Med bil, motorsykkel/moped
- Med buss
- Med sykkel
- Går
- Ikke i skole eller arbeid

50) Hvor lang tid bruker du vanligvis til og fra skolen eller arbeid (en vei) i sommerhalvåret?

- Mindre enn 5 minutter
- 6 til 15 minutter
- 16 til 30 minutter
- 1/2 til 1 time
- Mer enn 1 time

51) Hvordan kommer du deg vanligvis til og fra skolen eller arbeid i vinterhalvåret?

- Med bil, motorsykkel/moped
- Med buss
- Med sykkel
- Går (til fots eller på ski)

52) Hvor lang tid bruker du vanligvis til og fra skolen eller arbeid (en vei) i vinterhalvåret?

- Mindre enn 5 minutter
- 6 til 15 minutter
- 16 til 30 minutter
- 1/2 til 1 time
- Mer enn 1 time

53) Driver du med idrett eller fysisk aktivitet (f.eks. fotball, dans, løping, sykling, skateboard) utenom skoletid?

- Ja
- Nei

54) Hvor mange dager i uken driver du med idrett/fysisk aktivitet utenom skoletid?

- Sjeldnere enn 1 dag i uka
- 1 dag i uka
- 2-3 dager i uka
- 4-6 dager i uka
- Omtrent hver dag

55) Omtrent hvor mange timer per uke bruker du til sammen på idrett/fysisk aktivitet utenom skoletid?

- Omtrent 1/2 time
- Omtrent 1 - 1 1/2 time
- Omtrent 2 - 3 timer
- Omtrent 4 - 6 timer
- 7 timer eller mer

56) Hvor slitsom er vanligvis idretten/aktiviteten du driver med utenom skoletid?

- Ikke anstrengende
- Litt anstrengende
- Ganske anstrengende
- Meget anstrengende
- Svært anstrengende

Utenom skoletid: Hvor mange timer per dag ser du på PC, TV, DVD og liknende?

57) Hverdager, antall timer per dag:

- Ingen
- Omtrent 1/2 time
- Omtrent 1 - 1 1/2 time
- Omtrent 2 - 3 timer
- Omtrent 4 - 6 timer
- Omtrent 7 - 9 timer
- 10 timer eller mer

58) Fridager (helg, helligdager, ferie), antall timer per dag:

- Ingen
- Omtrent 1/2 time
- Omtrent 1 - 1 1/2 time
- Omtrent 2 - 3 timer
- Omtrent 4 - 6 timer
- Omtrent 7 - 9 timer
- 10 timer eller mer

59) I hvilken grad har andre oppmuntret deg til å være fysisk aktiv

	Svært sjelden/aldri 1	2	3	4	Svært ofte 5
Foreldre/foresatte	○	○	○	○	○
Søsken	○	○	○	○	○
Venner	○	○	○	○	○
Trenere	○	○	○	○	○
Gymlærere	○	○	○	○	○
Nabolaget	○	○	○	○	○

60) Hvordan passer disse utsagnene for deg?

	Helt uenig 1	2	3	4	Helt enig 5
Det er morsommere å drive med trening eller fysisk aktivitet enn å gjøre andre ting...	○	○	○	○	○
Jeg skulle ønske jeg kunne drive mer med trening eller fysisk aktivitet enn det jeg har anledning til å gjøre...	○	○	○	○	○
Jeg føler at jeg er bedre enn de fleste på min alder i idrett/fysisk aktivitet...	○	○	○	○	○
Jeg føler at jeg lett kan holde følge med de andre på min alder når vi driver med idrett/fysisk aktivitet...	○	○	○	○	○

61) Hvordan passer disse utsagnene for deg?

	Helt uenig 1	2	3	4	Helt enig 5
Jeg liker ikke å trene mens noen står å ser på...	○	○	○	○	○
Tilgang til egen garderobe hadde gjort det lettere å trene...	○	○	○	○	○
Jeg blir ubehagelig andpusten, svett eller får vondt i kroppen ved trening...	○	○	○	○	○
Gymtimene er organisert slik at jeg ikke henger med...	○	○	○	○	○
Jeg har ingen å trene sammen med...	○	○	○	○	○
Jeg mangler utstyr for å drive med den aktiviteten jeg har lyst til...	○	○	○	○	○
Jeg har for mange andre oppgaver som gjør at jeg ikke får tid til å trene (f.eks lekser, hjemmeoppgaver)...	○	○	○	○	○
Det mangler egnede haller eller gode uteområder for å drive fysisk aktivitet der jeg bor...	○	○	○	○	○

MATVANER OG KOSTHOLD

62) Hvor ofte pleier du å spise følgende i løpet av en uke?

	Hver dag	4-6 dager i uka	1-3 dager i uka	Sjelden eller aldri
Frokost	○	○	○	○
Middag	○	○	○	○

63) Hvor ofte spiser du matpakke hjemmefra på skole eller arbeid?

- ○ Hver dag
- ○ 3-4 ganger per uke
- ○ 1-2 ganger per uke
- ○ Sjelden eller aldri

64) Hvor ofte spiser du vanligvis disse matvarene?

	Sjelden/ aldri	1-3 ganger per måned	1-3 ganger per uke	4-6 ganger per uke	Hver dag
Ost (alle typer)	○	○	○	○	○
Fet fisk (f.eks. laks, ørret, makrell, sild)	○	○	○	○	○
Mager fisk (f.eks. torsk, sei, hyse)	○	○	○	○	○
Pizza, hamburger eller pølser	○	○	○	○	○
Hermetisert mat (fra metallbokser)	○	○	○	○	○
Godteri (f.eks. sjokolade, drops)	○	○	○	○	○
Snacks og søtsaker (f.eks. potetgull, kake, kjeks, bolle)	○	○	○	○	○
Sukkerfri tyggegummi	○	○	○	○	○

65) Hvor ofte spiser du vanligvis

	Sjelden/ aldri	1-3 ganger per mnd	1-3 ganger per uke	4-6 ganger per uke	1-2 ganger per dag	3-4 ganger per dag	5 eller flere ganger per dag
Frukt	○	○	○	○	○	○	○
Grønnsaker	○	○	○	○	○	○	○

66) Hvor mye drikker du vanligvis av følgende?

	Sjelden/ aldri	1-6 glass per uke	1 glass per dag	2-3 glass per dag	4 glass eller mer per dag
Helmelk, kefir, yoghurt	○	○	○	○	○
Lettmelk, cultura, lettyoghurt	○	○	○	○	○
Skummet melk (sur/søt)	○	○	○	○	○
Ekstra lett melk	○	○	○	○	○
Juice	○	○	○	○	○
Saft med sukker	○	○	○	○	○
Lettsaft, kunstig søtet	○	○	○	○	○
Brus med sukker (1/2 liters flaske = 2 glass)	○	○	○	○	○
Lettbrus, kunstig søtet (1/2 liters flaske = 2 glass)	○	○	○	○	○
Vann	○	○	○	○	○

67) Bruker du følgende kosttilskudd?

	Ja, daglig	Av og til	Nei
Tran, trankapsler, fiskeoljekapsler	○	○	○
Vitamin- og/eller mineraltilskudd	○	○	○

SØVN OG SØVNVANER

68) Når pleier du å legge deg for å sove på ukedagene?

Velg... [Velg... ▼]

69) Når pleier du å legge deg for å sove i helgen?

Velg... [Velg... ▼]

70) Hvor lenge pleier du å ligge våken før du får sove på ukedagene?

Velg... [Velg... ▼]

71) Hvor lenge pleier du å ligge våken før du får sove i helgen?

Velg... | Velg... ▼

72) Når pleier du å våkne på ukedagene (endelig oppvåkning)?

Velg... | Velg... ▼

73) Når pleier du å våkne i helgen (endelig oppvåkning)?

Velg... | Velg... ▼

74) Hvor mange timer sover du vanligvis pr. natt?

Velg... | Velg... ▼

75) Hvor mange timer søvn trenger du pr. natt for å føle deg uthvilt?

Velg... | Velg... ▼

76) Synes du at du får tilstrekkelig med søvn?

- Ja, absolutt tilstrekkelig
- Ja, stort sett tilstrekkelig
- Nei, noe utilstrekkelig
- Nei, klart utilstrekkelig
- Nei, langt fra tilstrekkelig

77) I løpet av den siste måneden, hvor mange dager pr. uke har du

	0 dager	1 dag	2 dager	3 dager	4 dager	5 dager	6 dager	7 dager
brukt mer enn 30 minutter for å sovne etter at lysene ble slukket?								
vært våken mer enn 30 minutter innimellom søvnen?								
våknet mer enn 30 mintter tidligere enn du ønsket å gjøre uten å få sove igjen?								
følt deg for lite uthvilt etter å ha sovet?								
vært så søvnig/trett at det har gått ut over skole/jobb eller privatlivet?								
vært misfornøyd med søvnen din?								
hatt vansker med å sovne før kl 02:00?								
hatt vansker med å våkne om morgenen?								
har du forsovet deg til skolen, arbeid eller avtaler?								

Følsomhet for støy

78) Hvor enig eller uenig er du i utsagnene? Sett kryss for det svaralternativet som passer best for hvert utsagn

	Helt uenig	Ganske uenig	Litt uenig	Litt enig	Ganske enig	Helt enig
Jeg vekkes lett av støy						
Jeg venner meg til de fleste lyder uten store problemer						
Det er vanskelig for meg å slappe av på et sted med mye støy						
Jeg er flink til å konsentrere meg uansett hva som skjer rundt meg						
Jeg blir sint på folk som lager støy som hindrer meg i å sovne eller å få gjort jobben min						
Jeg er følsom for støy						

SOLING

79) Hva skjer med huden din hvis du soler deg om sommeren?

- Alltid rød, aldri brun
- Nesten alltid rød, av og til brun
- Nesten alltid brun, av og til rød
- Alltid brun, aldri rød

80) Har du vært i Syden-/solingsferie de siste 2 måneder?

- Ja
- Nei

81) Har du tatt solarium i løpet av de siste 4 ukene?

- Nei
- Ja, en gang
- Ja, flere ganger

SMERTER

82) Har du langvarige eller stadig tilbakevendende smerter som har vart i 3 måneder eller mer?

- Ja
- Nei

83) Hvor ofte har du vanligvis disse smertene?

- Hele tiden, uten opphør
- Hver dag, men ikke hele tiden
- Hver uke, men ikke hver dag
- Sjeldnere enn hver uke

84) Hvor lenge har du hatt disse smertene? (Dersom du har flere typer smerte, svar for den som har vart lengst)

- 3 - 6 måneder
- 6 - 12 måneder
- 1-2 år
- 3-6 år
- Mer enn 6 år

Hvor er det vondt?

(Kryss av på alle aktuelle steder)

	Venstre side	Høyre side
Skulder	☐	☐
Arm/albue	☐	☐
Hånd	☐	☐
Hofte	☐	☐
Lår/kne/legg	☐	☐
Ankel/fot	☐	☐

Hode/ansikt	☐
Kjeve/kjeveledd	☐
Nakke	☐
Øvre del av ryggen	☐
Korsryggen	☐
Bryst	☐
Mage	☐
Underliv/kjønnsorganer	☐

87) Hva mener du er årsaken til smertene? (flere svar mulig)

- ☐ PC-bruk, dataspill og lignende
- ☐ Idrettsskade
- ☐ Ulykke/skade
- ☐ Kirurgisk inngrep/operasjon
- ☐ Migrene/hodepine
- ☐ Medfødt sykdom
- ☐ Tannproblemer
- ☐ Whiplash
- ☐ Prolaps (skiveutglidning i ryggen)
- ☐ Annet ryggproblem
- ☐ Nerveskade
- ☐ Mage- eller tarmsykdom
- ☐ Annet, spesifiser her ______
- ☐ Vet ikke

Hvis du har langvarige smerter flere steder i kroppen, gjelder de 4 neste spørsmålene smerten som plager deg mest.

Dersom du har flere typer smerte, svar den som plager deg mest.

88) Hvor sterke vil du si at smertene vanligvis er?

- ○ 0 Ingen smerte
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10 Verst tenkelige smerte

89) Hvor sterke er smertene når de er på sitt sterkeste?

- 0 Ingen smerte
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Verst tenkelige smerte

90) I hvor stor grad påvirker smertene søvnen din?

- 0 Ingen påvirkning
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Umulig å få sove på grunn av smertene

91) I hvor stor grad hindrer smertene deg i å utføre vanlige aktiviteter hjemme og på skolen?

- 0 Påvirker ikke vanlige aktiviteter
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Kan ikke gjøre noe på grunn av smertene

92) Får du smerter i muskler og ledd når du har feber?

- Ja
- Nei

93) Hvor sterke er febersmertene vanligvis?

- 0 Ingen smerte
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Verst tenkelige smerte

MAGE- OG TARMPROBLEMER

94) I løpet av de siste 2 månedene: Hvor ofte har du hatt smerte eller ubehag i magen?

- Aldri
- 1-3 ganger i måneden
- En gang i uka
- Flere ganger i uka
- Hver dag

95) Hvor lenge har du vært plaget av smerte eller ubehag i magen?

- Mindre enn 1 måned
- 2 måneder
- 3 måneder
- 4-11 måneder
- Ett år eller mer

96) I hvilken del av magen er det du har hatt smerte eller ubehag? (kryss av for alt som passer)

- Over navlen
- Rundt navlen
- Nedenfor navlen

97) Når du har smerter eller ubehag i magen, hvor lenge varer det vanligvis?

- Mindre enn 1 time
- 1-2 timer
- 3-4 timer
- Mesteparten av dagen
- Hele døgnet

98) Når du har smerte eller ubehag i magen, hvor sterke smerter har du vanligvis?

- 0 Ingen smerte
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Verst tenkelige smerte

99) Når du har smerter eller ubehag i magen, hvor ofte blir det bedre etter at du har hatt avføring?

- Sjelden eller aldri
- En del ganger
- For det meste/hver gang

100) Når du har smerter eller ubehag i magen, hvor ofte skjer det i forbindelse med at du..

	Sjelden eller aldri	En del ganger	For det meste
har fastere eller mer klumpete avføring enn vanlig?			
har løsere eller mer vannaktig avføring enn vanlig?			
hadde avføring oftere enn vanlig?			
hadde avføring sjeldnere enn vanlig?			

HODEPINE

101) Har du vært plaget av hodepine det siste året?

- Ja
- Nei

102) Hva slags hodepine er du plaget av? (Du kan sette flere kryss)

- Migrene
- Annen hodepine
- Vet ikke

103) Omtrent hvor mange dager per måned har du hodepine?

- Mindre enn 1 dag
- 1-6 dager
- 7-14 dager
- Mer enn 14 dager

104) Er hodepinen vanligvis:

	Ja	Nei
Bankende/dunkende smerte		
Pressende smerte		
Ensidig smerte (høyre eller venstre)		

105) Hvor lenge varer hodepinen vanligvis?

- Mindre enn 4 timer
- 4 timer - 1 døgn
- 1-3 døgn
- Mer enn 3 døgn

106) Før eller under hodepinen, kan du da ha forbigående:

	Ja	Nei
Synsforstyrrelse? (takkede linjer, flimring, tåkesyn, lysglimt)		
Nummenhet i halve ansiktet eller i hånden?		
Forverring ved moderat fysisk aktivitet?		
Kvalme og/eller oppkast?		

Nedenfor er det fire spørsmål om hvordan du opplever det er å gå til tannlege. Les hvert spørsmål og velg det svaralternativet som du synes passer best for deg.

107) Dersom du skulle gå til tannlegen i morgen, hva ville du føle?

- Jeg ville se frem til det som en ganske hyggelig opplevelse
- Det ville være det samme for meg, ikke bety noe
- Det ville gjøre meg litt urolig
- Jeg ville bli redd for at det skulle bli ubehagelig og vondt
- Jeg ville bli svært redd med tanke på hva tannlegen kanskje skulle gjøre

108) Når du venter på tannlegens venteværelse, hvordan føler du deg da?

- Avslappet
- Litt urolig
- Anspent, nervøs
- Redd, engstelig
- Så redd at jeg av og til begynner å svette eller nesten føler meg syk

109) Når du sitter i tannlegestolen og venter på at tannlegen skal begynne behandlingen, hvordan føler du deg da?

- Avslappet
- Litt urolig
- Anspent, nervøs
- Redd, engstelig
- Så redd at jeg av og til begynner å svette eller nesten føler meg syk

110) Tenk at du sitter i tannlegestolen og skal få tennene renset og pusset. Mens du sitter og venter på at tannlege skal finne frem instrumentene som brukes til å skrape og pusse med, hvordan føler du deg da?

- Avslappet
- Litt urolig
- Anspent, nervøs
- Redd, engstelig
- Så redd at jeg av og til begynner å svette eller nesten føler meg syk

HØRSEL

111) Har du et hørseltap som du vet om?

- Nei
- Ja
- Kanskje

112) Er hørseltapet bekreftet av lege eller annet helsepersonell?

- Nei
- Ja

113) Bruker du høreapparat?

- Nei
- Ja

114) Har du øresus?

- Aldri
- Sjelden
- Ofte

115) Hvor ofte har du øresus?

- Hele tiden, uten opphør
- Hver dag, men ikke hele tiden
- Hver uke, men ikke hver dag
- Sjeldnere enn hver uke

116) Hvor lenge varer vanligvis periodene med øresus?

- Mindre enn 10 minutter
- 10 minutter - 1 time
- Mer enn 1 time

117) Når får du vanligvis øresus?

- Etter sterke lyder
- Når det er stille
- Vet aldri når

118) Noen bryr seg ikke om lyden, for andre oppleves det svært plagsomt å ha øresus. Angi hvor plaget du er av øresusen.

- 0 Ingen plager
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Verst tenkelige plager

119) På hvilket øre har du vanligvis øresus?

- Bare høyre
- Bare venstre
- Begge, men mest høyre
- Begge, men mest venstre
- Like mye på begge

120) Omtrent hvor gammel var du når du begynte å ha øresus?

Velg... Velg... ▼

121) Omtrent hvor gammel var du når du begynte å ha øresus ofte?

Velg... Velg... ▼

SYKEHUS OG INFEKSJONER

122) Har du vært innlagt som pasient på sykehus i løpet av de siste 12 månedene?

- Ja
- Nei

123) Arbeider noen du bor sammen med i helsevesenet (sykehus, sykehjem, hjemmetjenesten, legekontor, helsestasjon)?

- Ja
- Nei

124) Har du tidligere fått fjernet mandlene?

- Ja
- Nei
- Vet ikke

125) Jeg fikk fjernet mandlene fordi jeg hadde

- halsbetennelse som kom og gikk
- halsbetennelse og vondt i halsen og/eller dårlig ånde hele tiden
- store mandler og trang hals (dette kan gi svelgproblemer, snorking, pustestopp)
- både halsbetennelse og store mandler
- vet ikke

126) Jeg har nå

- ingen plager fra halsen
- plaget med halsbetennelse som kommer og går
- konstante plager med halsbetennelse og vondt i halsen og/eller dårlig ånde
- store mandler og trang hals (dette kan gi svelgproblemer, snorking, pustestopp)
- plaget med både halsbetennelse og store mandler

TANNHELSE

127) Hvor ofte pusser du vanligvis tennene dine?

- Sjeldnere enn 1 gang per uke
- 1 gang per uke
- 2-3 ganger per uke
- 4-6 ganger per uke
- 1 gang daglig
- 2 eller flere ganger daglig

128) Hvor ofte bruker du noen av følgende hjelpemidler?

	Daglig	Noen ganger i uka	Noen ganger i måneden	Sjelden/aldri
Fluor tannkrem				
Tanntråd				
Tannstikker				
Fluortabletter				
Fluor skyllevæske				

129) Hvor ofte kontrollerte foreldrene dine eller dine foresatte at du hadde pusset tennene dine da du var yngre?

- Ofte
- Omtrent daglig
- Av og til
- Sjelden/aldri

130) Hvordan vurderer du din egen tannhelse?

- Meget god
- God
- Verken god eller dårlig
- Dårlig
- Meget dårlig

131) Hvorfor er fluor tilsatt i tannkrem?

- Behagelig smak
- Gir god ånde
- Hindrer hull i tennene
- Gir hvite tenner

132) Har du følt at tannlegen/tannpleieren ikke tar seg tid til å forklare eller svare på spørsmål?

- Ja, ofte
- Ja, av og til
- Nei

133) Er du fornøyd med tannstillingen din i fronten?

- Veldig fornøyd
- Fornøyd
- Ganske fornøyd
- Verken fornøyd eller misfornøyd
- Ganske misfornøyd
- Misfornøyd
- Veldig misfornøyd

134) Prøver du å unngå å smile på grunn av dine tenners utseende?

- Aldri
- Veldig sjelden
- Sjelden
- Vanskelig å si
- Av og til
- Ganske ofte
- Ofte

135) Ønsker du tannregulering for å få rettet opp tennene dine?

- Ja, absolutt
- Ja
- Ja, kanskje
- Verken ja eller nei
- Tror ikke det
- Nei
- Absolutt ikke

136) Har du hatt fast tannregulering/streng?

- Ja
- Nei

137) Har du hatt avtagbar plate?

- Ja
- Nei

138) Har du hatt tannregulering siden forrige gang du deltok i Fit Futures undersøkelsen?

- Nei
- Ja
- Har ikke deltatt tidligere

139) Hadde du allergiske reaksjoner i forbindelse med tannreguleringen?

- Ja
- Nei

140) Hvor smertefullt, jevnt over, synes du det er å gå til tannlegen?

- 0 Ingen smerte
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Verst tenkelige smerte

141) Har du latt være å møte opp til en tannlegetime pga frykt for tannbehandling?

Ja Nei

Ta stilling til følgende påstander:

142) Tannpuss er svært viktig for meg når jeg skal

	Helt uenig	Uenig	Enig	Helt enig
ut med venner på ungdomsklubb, diskotek osv.				
møte en kjæreste				
på skolen				
møte min beste venn/venninne				
delta i sport eller drive med hobbyer				
til tannlegen				

143) Tannpuss er svært viktig for at jeg skal

	Helt uenig	Uenig	Enig	Helt enig
føle meg frisk	○	○	○	○
unngå hull i tennene	○	○	○	○
unngå at tennene får en stygg farge	○	○	○	○
få frisk pust	○	○	○	○
beholde sunt tannkjøtt	○	○	○	○
få bedre utseende	○	○	○	○

144) jeg synes det ville være pinlig dersom det ble hull i

	Helt uenig	Uenig	Enig	Helt enig
mine egne tenner	○	○	○	○
min mors tenner	○	○	○	○
min fars tenner	○	○	○	○
min venn/venninnes tenner	○	○	○	○

145) Tannpuss er svært viktig for at jeg skal få

	Helt uenig	Uenig	Enig	Helt enig
mine foreldres anerkjennelse	○	○	○	○
mine venners anerkjennelse	○	○	○	○

Ta stilling til følgende utsagn

146) Hvor sikker er du på at du vil pusse tennene 2 ganger om dagen i 2 minutter med fluortannkrem i følgende situasjoner

	Svært sikker	Ganske sikker	Noe usikker	Ganske usikker
Når du er trøtt om kvelden	○	○	○	○
Når du har mye å gjøre (mye lekser, eksamener)	○	○	○	○
Når du har skoleferie	○	○	○	○
Når du er trøtt på morgenen	○	○	○	○
Når du føler deg syk (hodepine)	○	○	○	○

147) Hvor sikker er du på at du er villig til avstå fra sukkerholdige drikker som brus, juice og saft til andre tider enn ved lunsj eller middag?

- ○ Svært sikker
- ○ Ganske sikker
- ○ Noe usikker
- ○ Svært usikker

148) Jeg har til hensikt å pusse tennene 2 ganger om dagen i minst 2 minutter med fluortannkrem hver dag

- ○ Helt enig
- ○ Enig
- ○ Uenig
- ○ Helt uenig

149) Hvor fornøyd er du med din tannhelse?

- ○ Svært misfornøyd
- ○ Misfornøyd
- ○ Verken eller
- ○ Fornøyd
- ○ Svært fornøyd

150) Har du vært, eller er du, plaget med sur smak i munnen eller sure oppstøt?

- Nei
- Ja

151) Hvor ofte har du vært, eller er du, plaget med sur smak i munnen eller sure oppstøt?

- Daglig
- Noen ganger i uken
- Månedlig
- Sjelden eller aldri

152) Hvor lenge har det vart?

- Uker
- Måneder
- Flere år

153) Har du vært, eller er du, plaget med oppkast?

- Nei
- Ja

154) Hvor ofte har du vært, eller er du, plaget med oppkast?

- Daglig
- Noen ganger i uken
- Månedlig
- Sjelden eller aldri

155) Hvor lenge har det vart?

- Uker
- Måneder
- Flere år

ASTMA OG PUSTEBESVÆR

156) Har du - de siste 12 månedene - hatt pipende eller hvesende pust?

- Nei
- Ja

157) Hvor mange ganger har du hatt disse plagene de siste 12 månedene ?

- 1-3 ganger
- 4-12 ganger
- Mer enn 12 ganger

158) Har du - de siste 12 månedene - unnlatt å gjøre ting du vil gjøre pga pipende eller hvesende pust?

- Nei
- Ja

159) Hvor mye har pipende eller hvesende pust hindret deg fra å gjøre ting du har villet gjøre de siste 12 månedene?

- Lite
- Moderat
- Ganske mye
- Mye

160) Har du - de siste 12 månedene - hatt vanskelig for å sove, eller våknet pga pipende eller hvesende pust?

- Nei
- Mindre enn en gang i uken
- 1 eller flere ganger i uken

161) Har du - de siste 12 månedene - vært borte fra skolen pga pipende eller hvesende pust?

- Nei
- Ja

162) Hvor mange dager har du vært borte fra skolen pga pipende eller hvesende pust de siste 12 månedene?

- Mindre enn 5 dager
- 5-10 dager
- Mer enn 10 dager

163) Har du - de siste 12 månedene - hatt så store plager med pipende eller hvesende pust, at du har hatt behov for å ta nye åndedrag midt i en setning?

- Nei
- Ja

164) Har du - de siste 12 månedene - hatt pustebesvær (hatt tungt for å puste, kjent deg tett i brystet, hatt pipende eller hvesende pust)?

- Nei
- Ja

165) Dersom du har hatt pustebesvær eller pipende eller hvesende pust de siste 12 månedene, hvor tungt opplevde du at det var å puste? (Marker med et kryss på linjen)

- 0 Ikke tungt i det hele tatt
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Verst tenkbar

166) Har du - de siste 12 månedene - hatt pipende eller hvesende pust, tungt for å puste, eller besværlig hoste, i forbindelse med noe av det nedenstående?

- Nei, har ikke hatt besvær ved noe av dette
- Kald luft eller tåke
- Katt
- Hund
- Hest
- Bjørkepollen
- Gresspollen
- Burotpollen
- Psykisk belastning eller stress
- Tobakksrøyk
- Luftforurensninger
- Sterke dufter
- Mat eller matos
- Kald drikke
- Annet

167) Har du - de siste 12 månedene - hatt pipende eller hvesende pust, tungt for å puste, eller besværlig hoste i forbindelse med anstrengelse?

- Nei
- Ja

168) Har du - de siste 12 månedene - brukt noen medisiner for astma eller pustebesvær?

- Nei
- Ja

169) Hvilke medisiner for astma eller pustebesvær har du brukt de siste 12 månedene?

	Ved behov, eller for en kortere periode, noen uker av gangen	Over en lengre periode, minst 2 mnd
Bricanyl, Ventoline, Airomir, Buventol, Salbutamol Arrow		
Pulmicort, Flutide, Becotide, Giona Easyhaler, Beklomet, AeroBec autohaler, Budesonid Arrow, Alvesco		
Symbicort, Seretide		
Oxis, Serevent, Onbrez Breezehaler		
Atrovent, Ipraxa, Ipratropiumbromid		
Singulair tabelett		

170) Dersom du bruker luftrørsutvidende medisin (Bricanyl, Ventoline, Airomir, buventol...), hvor ofte bruker du dem i løpet av en vanlig uke?

- Mindre enn 2 ganger pr uke
- 2 ganger eller mer pr uke

171) Har du - de siste 12 månedene - tatt kortisontabletter oppløst i vann (f.eks Betapred) mot astma eller pustebesvær?

- Nei
- Ja

172) Har du tatt kortisontabletter oppløst i vann 3 dager i strekk eller mer de siste 12 månedene?

- Nei
- Ja

173) Har du brukt medisiner for astma eller pustebesvær som er skrevet ut til andre?

- Nei
- Ja, delvis
- Ja, helt

174) Har noen andre brukt dine medisiner for astma eller pustebesvær?

- Nei
- Ja, delvis
- Ja, helt

175) Hvor mange inhalatorer av samme merke bruker du å ha samtidig? (men kanskje på ulike steder)

- 1 inhalator
- 2 inhalatorer
- 3 inhalatorer
- Mer enn 3 inhalatorer

176) Hvor ofte hender det at du bruker din inhalator til den er tom?

- Aldri
- Sjelden
- Ofte
- Alltid

177) Har du fått undervisning om din astmasykdom av sykepleier eller lege? (f.eks hva astma er slags sykdom, hvordan medisinene fungerer og hva du skal gjøre ved forverring)

○ Nei ○ Ja

178) Har du - de siste 12 månedene - hatt tørrhoste om natten uten samtidig å være forkjølet?

○ Nei ○ Ja

179) Har du vært plaget av hoste mesteparten av tiden, i minst 3 måneder pr år?

○ Nei

○ Ja

180) Hvor mange år har du vært plaget med hoste mesteparten av tiden, i minst 3 måneder pr år?

Velg... [Velg... ▼]

181) Har du vært plaget av slim fra brystet mesteparten av tiden, i minst 3 måneder pr år?

○ Nei

○ Ja

182) Hvor mange år har du vært plaget med slim fra brystet mesteparten av tiden, i minst 3 måneder pr år?

Velg... [Velg... ▼]

183) Om du har pustebesvær eller astma, har det...

	Ikke i det hele tatt	Litt	En del	Ganske mye	Mye
hindret deg i skolearbeidet	○	○	○	○	○
hindret deg i fritidsaktiviteter	○	○	○	○	○
uroet deg de siste 4 ukene	○	○	○	○	○

HUDPLAGER OG EKSEM

184) Har du noen gang vært plaget av kviser?

- Ja
- Nei
- Vet ikke

185) Hvor mye plaget er du av kviser idag?

- 0 Ingen plager
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Verst tenkelige plager

186) Har du noen gang oppsøkt lege på grunn av kviser?

- Ja
- Nei

187) Har du fått noen av disse behandlingene av lege?

	Ja	Nei	Vet ikke
Lokalbehandling (f.eks. kremer eller oppløsninger)	○	○	○
Antibiotika tabletter (f.eks. Tetracyclin)	○	○	○
Roaccutan tabletter	○	○	○

188) Har du eller har du noen gang hatt psoriasis?

○ Ja ○ Nei ○ Vet ikke

189) Hvor gammel var du første gang du fikk psoriasis?

Velg... Velg... ▼

190) Hvor mye plaget er du av psoriasis idag?

○ 0 Ingen plager
○ 1
○ 2
○ 3
○ 4
○ 5
○ 6
○ 7
○ 8
○ 9
○ 10 Verst tenkelige plager

Verkebyller er svært store kviser som er ømme/smertefulle og som ofte gir arr.

191) Har du noen gang hatt verkebyller under armene/armhulene?

- Ja
- Nei
- Vet ikke

192) Har du noen gang oppsøkt lege på grunn av verkebyllene?

Ja Nei

193) Har du noen gang hatt verkebyller i lyskene/nært skrittet?

- Ja
- Nei
- Vet ikke

194) Har du noen gang oppsøkt lege på grunn av verkebyllene?

- Ja
- Nei

195) Har du - de siste 12 månedene - hatt plager med tørr hud?

Nei Ja

196) Har du - de siste 12 månedene - smurt deg med mykgjørende krem/lotion på grunn av tørr hud?

- Nei
- Ja, mindre enn 1 måned
- Ja, 1-6 måneder
- Ja, mer enn 6 måneder

197) Har du - de siste 12 månedene - hatt kløende utslett?

- ○ Nei
- ○ Ja

198) Hvor lenge pleier det kløende utslettet å vare?

- ○ Mindre enn 1 uke
- ○ 1-2 uker
- ○ Mer enn 2 uker

199) Hvor har du de kløende utslettene? (Flere alternativer kan krysses av)

- ☐ I hodebunnen
- ☐ I ansiktet
- ☐ I ørene
- ☐ På halsen eller i nakken
- ☐ På håndledd eller fotledd
- ☐ På hendene
- ☐ På eller under rumpeballene
- ☐ På lårenes innsider
- ☐ På brystkasse, mage, rygg eller skuldre
- ☐ I armhulene
- ☐ På armenes eller benas utsider
- ☐ I albuebøyer eller knehaser
- ☐ I lysken eller underlivet
- ☐ På føttene
- ☐ Andre steder

200) Hvor gammel var du første gang du fikk denne typen utslett?

Velg... [Velg... ▼]

201) I hvilken periode i løpet av året har du hatt kløende utslett de siste 12 månedene?

- ☐ Januar
- ☐ Februar
- ☐ Mars
- ☐ April
- ☐ Mai
- ☐ Juni
- ☐ Juli
- ☐ August
- ☐ September
- ☐ Oktober
- ☐ November
- ☐ Desember

202) Har det kløende utslettet forsvunnet helt ved noe tidspunkt de siste 12 månedene?

○ Nei ○ Ja

203) Har du - de siste 12 månedene - hatt vanskelig for å få sove, eller våknet pga kløende utslett?

- ○ Nei
- ○ Mindre enn 1 gang pr uke
- ○ 1 eller flere ganger pr uke

204) Har du - den siste uken - hatt kløende utslett?

○ Nei ○ Ja

205) I løpet av den siste uken, hvor mye har huden din klødd eller føltes smertefull?

- ○ Veldig mye
- ○ Ganske mye
- ○ Litt
- ○ Ikke i det hele tatt

206) I løpet av den siste uken, hvor plaget, trist eller lei deg, har du vært pga huden?

- Veldig mye
- Ganske mye
- Litt
- Ikke i det hele tatt

207) I løpet av den siste uken, har huden din påvirket hvordan det har vært å være sammen med dine venner?

- Veldig mye
- Ganske mye
- Litt
- Ikke i det hele tatt

208) I løpet av den siste uken, har du byttet eller hatt på deg andre eller spesielle klær/sko på grunn av din hud?

- Veldig mye
- Ganske mye
- Litt
- Ikke i det hele tatt

209) I løpet av den siste uken, har dine hudplager påvirket deg når det gjelder å gå ut eller holde på med dine hobbyer?

- Veldig mye
- Ganske mye
- Litt
- Ikke i det hele tatt

210) I løpet av den siste uken, har du unngått svømming eller annen trening pga dine hudplager?

- Veldig mye
- Ganske mye
- Litt
- Ikke i det hele tatt

211) I løpet av den siste uken, har huden din påvirket ditt skolearbeid?

- Veldig mye
- Ganske mye
- Litt
- Ikke i det hele tatt

212) Dersom du har hatt ferie: I løpet av den siste uken, har dine hudplager hindret deg i å nyte ferien?

- Veldig mye
- Ganske mye
- Litt
- Ikke i det hele tatt

213) I løpet av den siste uken, hvor mye plager har du hatt pga din hud fordi andre personer har gitt deg tilnavn, ertet deg, mobbet deg, stilt spørsmål eller unngått deg?

- Veldig mye
- Ganske mye
- Litt
- Ikke i det hele tatt

214) I løpet av den siste uken, hvor mye har din søvn blitt påvirket av dine hudplager?

- Veldig mye
- Ganske mye
- Litt
- Ikke i det hele tatt

215) I løpet av den siste uken, hvor mye problem har du hatt med behandlingen av huden din?

- Veldig mye
- Ganske mye
- Litt
- Ikke i det hele tatt

216) Har du - de siste 12 månedene - hatt eksem?

- Nei
- Ja

217) Hvor lenge har du tilsammen hatt eksem de siste 12 månedene?

- Mindre enn 1 måned
- 1-3 måneder
- 4-6 måneder
- Mer enn 6 måneder

218) Har du smurt deg med kortison pga eksem de siste 12 månedene?

- Nei
- Ja, mindre enn 1 måned
- Ja, 1-6 måneder
- Ja, mer enn 6 måneder

219) Har du noen gang hatt håndeksem? (Kløende forandring i huden, blemmer eller kløende utslett)

- Nei
- Ja

220) Hvor gammel var du da håndeksemet begynte?

Velg... [Velg... ▼]

221) Har du - de siste 12 månedene - ved noen anledning hatt håndeksem?

- Nei
- Ja

222) Hvor mye plaget er du av håndeksem i dag?

- 0 Ingen plager
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Verst tenkelige plager

223) Hvor mange ganger kommer hendene dine i kontakt med vann i løpet av en dag? (ikke tell med den tiden du beskytter hendene med hansker)

- Ingen ganger pr dag
- 1-10 ganger pr dag
- 11-20 ganger pr dag
- 21-30 ganger pr dag
- Mer enn 30 ganger pr dag

224) Har du - noen gang - fått kløende utslett eller eksem (rødhet, blemmer eller flassing) av sminke eller hygieneprodukter?

- Nei
- Ja

225) Av hva har du fått plager?

- ☐ Sminke eller parfyme
- ☐ Deodorant
- ☐ Shampo eller balsam
- ☐ Såpe eller dusjkrem
- ☐ Annet

226) Har du - noen gang - farget håret? (farget, tonet, bleket eller stripet håret ditt, hjemme eller hos frisør)

○ Nei ○ Ja

227) Har du noen gang fått plager ved hårfarging?

○ Nei ○ Ja

228) På hvilken måte har du reagert når du har farget håret?

- ☐ Reaksjon i ansiktet, hodebunn, på ørene eller halsen (rødhet, flassing, kløe)
- ☐ Kraftig reaskjon i ansiktet, hodebunn, på ørene eller halsen (hevelse, væskende utslett)
- ☐ Reaksjon på hendene (rødhet, flassing, kløe)
- ☐ Annet

229) Har du - noen gang - fått kløende utslett eller eksem (rødhet, blemmer eller flassing) av latex eller gummi (ballonger, gummihansker, kondomer...)?

○ Nei ○ Ja

230) Av hvilke latex-/gummiprodukter har du fått plager?

- ☐ Ballonger ved ballongblåsing
- ☐ Gummihansker
- ☐ Kondomer
- ☐ Annet

231) Har du - noen gang - tatt hull i ørene eller laget hull for smykker noen andre steder på kroppen?

○ Nei ○ Ja

232) Har du noen tatovering?

○ Nei ○ Ja

233) Har du noen gang fått kløende utslett eller eksem (rødhet, blemmer eller flassing) av din tatovering?

○ Nei ○ Ja

234) Har du - noen gang - fått kløende utslett eller eksem (rødhet, blemmer eller flassing) av metallgjenstander?

○ Nei ○ Ja

235) Av hva har du fått kløende utslett eller eksem?

- ☐ Armbånd, halsbånd, fingerring eller annet
- ☐ Smykke (unntatt smykker for hull)
- ☐ Smykker for hull
- ☐ Knapp, nål, spenne, glidelås eller liknende i sko eller støvler
- ☐ Klokke eller klokkereim
- ☐ Briller eller solbriller
- ☐ Hårspenner eller liknende
- ☐ Mobiltelefon
- ☐ Øretelefon
- ☐ Annet

236) Dersom du har hudbesvær eller eksem, har det...

	Ikke i det hele tatt	Litt	En del	Ganske mye	Mye
Hindret deg i skolearbeidet	○	○	○	○	○
Hindret deg i fritidsaktiviteter	○	○	○	○	○
Bekymret (Uroet) deg de siste fire ukene	○	○	○	○	○

NESE- ELLER ØYEPLAGER

237) Har du - de siste 12 månedene - hatt nysing, kløende nese, rennende nese eller tett nese uten at du samtidig har vært forkjølet?

○ Nei ○ Ja

238) Har du hatt nysing, kløende nese, rennende nese eller tett nese i mer en 4 dager uten at du samtidig har vært forkjølet i de siste 12 månedene?

○ Nei ○ Ja

239) Skjedde dette over 4 uker i strekk de siste 12 månedene?

- Nei
- Ja

240) Hvor lenge har du hatt disse plagene uten samtidig å være forkjølet de siste 12 månedene?

- Mindre enn 1 måned
- 1-3 måneder
- 3-6 måneder
- Mer enn 6 måneder

241) Har disse neseplagene - de siste 12 månedene - forekommet samtidig med kløende, rennende øyne?

- Nei
- Ja

242) I løpet av hvilken periode har du hatt plager med nysing, kløende nese, rennende nese eller tett nese de siste 12 månedene?

- Januar
- Februar
- Mars
- April
- Mai
- Juni
- Juli
- August
- September
- Oktober
- November
- Desember

243) Har du hatt nese- eller øyeplager, uten å være forkjølet, ved kontakt med noe av det nedenstående de siste 12 månedene?

- ☐ Nei, har ikke hatt besvær med noen av disse
- ☐ Katt
- ☐ Hund
- ☐ Hest
- ☐ Kanin, marsvin eller andre gnagere
- ☐ Bjørkepollen
- ☐ Gresspollen
- ☐ Burotpollen
- ☐ Tobakksrøyk
- ☐ Luftforurensninger
- ☐ Sterke dufter
- ☐ Annet

244) Har du unnlatt å gjøre ting du har villet gjøre pga neseplager de siste 12 månedene?

○ Nei ○ Ja

245) Hvor mye har neseplagene påvirket at du har unnlatt å gjøre ting du har villet gjøre de siste 12 månedene?

- ○ Litt
- ○ Moderat
- ○ Ganske mye
- ○ Mye

246) Har du hatt vanskelig for å sove pga neseplager de siste 12 månedene?

○ Nei ○ Ja

247) Har du - de siste 12 månedene - tatt noen medisiner for allergisnue/høysnue?

○ Nei ○ Ja

248) Hvilke medisiner for allergisnue/høysnue har du brukt de siste 12 månedene?

- ☐ Øyedråper
- ☐ Nesespray
- ☐ Allergitabletter
- ☐ Andre

249) Dersom du har hatt neseplager, allergisnue/høysnue, hvor plagsomt opplevde du at det var de siste 12 månedene?

- ○ 0 Ingen plager
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10 Verst tenkelige plager

250) Har du - de siste 12 månedene - vært tett i nesen?

- ○ Nei
- ○ Mindre enn 10 dager
- ○ 10 dager - 12 uker
- ○ 12 uker eller mer

251) Har du - de siste 12 månedene - hatt gulgrønt slim eller snørr bak i halsen?

- Nei
- Mindre enn 10 dager
- 10 dager - 12 uker
- 12 uker eller mer

252) Har du - de siste 12 månedene - hatt nedsatt luktesans?

- Nei
- Mindre enn 10 dager
- 10 dager - 12 uker
- 12 uker eller mer

253) Har du - de siste 12 månedene - opplevd smerter eller trykk ved eller omkring pannen, nesen eller øynene?

- Nei
- Mindre enn 10 dager
- 10 dager - 12 uker
- 12 uker eller mer

254) Dersom du har hatt nesetetthet, snue, nedsatt luktesans eller smerter i ansiktet, hvor plagsomt synes du det var de siste 12 månedene?

- 0 Ikke plagsomt i det hele tatt
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 Verst tenkelig

255) Dersom du har hatt nese- eller øyeplager, har det...

	Ikke i det hele tatt	Litt	En del	Ganske mye	Mye
Hindret deg i skolearbeid	○	○	○	○	○
Hindret deg i fritidsaktiviteter	○	○	○	○	○
Bekymret deg de siste 4 uker	○	○	○	○	○

Reaksjoner på mat

256) Har du - de siste 12 månedene - reagert på noe i maten?

○ Nei ○ Ja

257) Har du reagert på noen av de nedenstående matvarene de siste 12 månedene?

- ☐ Melk - protein
- ☐ Melk - laktose
- ☐ Egg
- ☐ Fisk
- ☐ Skalldyr
- ☐ Hvete, andre kornslag
- ☐ Soya
- ☐ Sesam
- ☐ Eple, pære
- ☐ Fersken, nektarin, plommer, kirsebær
- ☐ Kiwi
- ☐ Banan
- ☐ Rå gulrot
- ☐ Peanøtter
- ☐ Hasselnøtter
- ☐ Mandel
- ☐ Valnøtt, pekannøtt
- ☐ Cashewnøtt, pistasjnøtt
- ☐ Paranøtt
- ☐ Annet

258) Dersom du reagerer på fisk, hvilke(n) reaksjon(er) får du?

- ☐ Kløende utslett
- ☐ Hevelse i og rundt munnen
- ☐ Hevelse i ansiktet
- ☐ Slim i halsen
- ☐ Oppkast
- ☐ Diare
- ☐ Tungpust
- ☐ Svimmelhet
- ☐ Besvimelse/allergisjokk

259) Dersom du reagerer på fisk, reagerer du ved å...

- ☐ Spise fisk
- ☐ Ta på fisk
- ☐ Puste inn damp fra fisk som kokes eller stekes

260) Dersom du ikke reagerer på fisk nå, har du:

- ○ Reagert på fisk tidligere
- ○ Aldri reagert på fisk

261) Dersom du tidligere har reagert på fisk, hvilke(n) reaksjon(er) fikk du da?

- ☐ Kløende utslett
- ☐ Hevelse i og rundt munnen
- ☐ Hevelse i ansiktet
- ☐ Slim i halsen
- ☐ Oppkast
- ☐ Diare
- ☐ Tungpust
- ☐ Svimmelhet
- ☐ Besvimelse/allergisjokk

262) Har du en adrenalinsprøyte (Epipen, Anapen, Jext) som du kan ta, dersom du reagerer på noe i maten?

○ Nei ○ Ja

263) Har du - noen gang - brukt sprøyten?

○ Nei ○ Ja

264) Har du - de siste 12 månedene - brukt sprøyten?

○ Nei ○ Ja

265) Dersom du får plager av matvarer, har det...

	Ikke i det hele tatt	Litt	En del	Ganske mye	Mye
Hindret deg i skolearbeid	○	○	○	○	○
Hindret deg i fritidsaktiviteter	○	○	○	○	○
Bekymret deg de siste 4 ukene	○	○	○	○	○

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Tromsøundersøkelsen gjennomfører Fit futures i samarbeid med Universitetssykehuset Nord-Norge og Nasjonalt folkehelseinstitutt. Data som samles inn på sykehuset, overføres til Universitetet i Tromsø når datainnsamlingen er avsluttet. Ingen av opplysningene som framkommer i undersøkelsen, lagres i journalsystemet på sykehuset. Databehandlingsansvarlig er Universitetet i Tromsø. Tromsøundersøkelsen administrerer utlevering av data til forskningsprosjekter. Hvem som er ansvarlig for forskningsprosjektene, finner du her http://www.tromsoundersokelsen.no. Fit futures er godkjent av Datatilsynet og Regional komité for medisinsk og helsefaglig forskningsetikk, Nord-Norge. Deltakere er forsikret gjennom Norsk Pasientskadeerstatningsordning.

FRIVILLIG DELTAKELSE

Det er frivillig å delta i studien. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke til å delta i undersøkelsen, og dette vil ikke få noen konsekvenser for deg. Dersom du senere ønsker å trekke deg eller har spørsmål til studien, kan du kontakte Tromsøundersøkelsen, Institutt for samfunnsmedisin, Universitetet i Tromsø, 9037 Tromsø, telefon 77644816, e-post: tromsous@uit.no.

RETT TIL INNSYN OG SLETTING AV PRØVER OG OPPLYSNINGER OM DEG

Hvis du sier ja til å delta i studien, har du rett til å få innsyn i hvilke opplysninger som er registrert om deg. Du har også rett til å få korrigert eventuelle feil i de opplysningene vi har registrert. Dersom du trekker deg fra studien, kan du kreve å få slettet innsamlede prøver og opplysninger, med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner.

ENERGI

VIL DU DELTA?

Hvis du er fylt 16 år, gir du selv ditt samtykke til å delta. Du kan da signere vedlagte skjema (hvitt ark) og ta det med til undersøkelsen. Det er også mulig å undertegne skjemaet når du kommer til Forskningsposten.

Hvis du ikke er fylt 16 år, må du be dine foreldre/foresatte om lov til å delta. Da må både du og dine foreldre/foresatte signere vedlagte skjema (hvitt ark) som du tar med deg til undersøkelsen.

ANSVARLIGE FOR GJENNOMFØRING AV FIT FUTURES UNDERSØKELSEN

Fit futures ledes av en styringsgruppe, og følgende forskere er ansvarlige for gjennomføringen:

Anne-Sofie Furberg
prosjektleder, lege, Universitetssykehuset Nord-Norge
e-post: anne-sofie.furberg@unn.no, telefon 77 75 58 24

Christopher Sivert Nielsen
psykolog, Nasjonalt folkehelseinstitutt
e-post: Christopher.Sivert.Nielsen@fhi.no, telefon 21 07 82 77

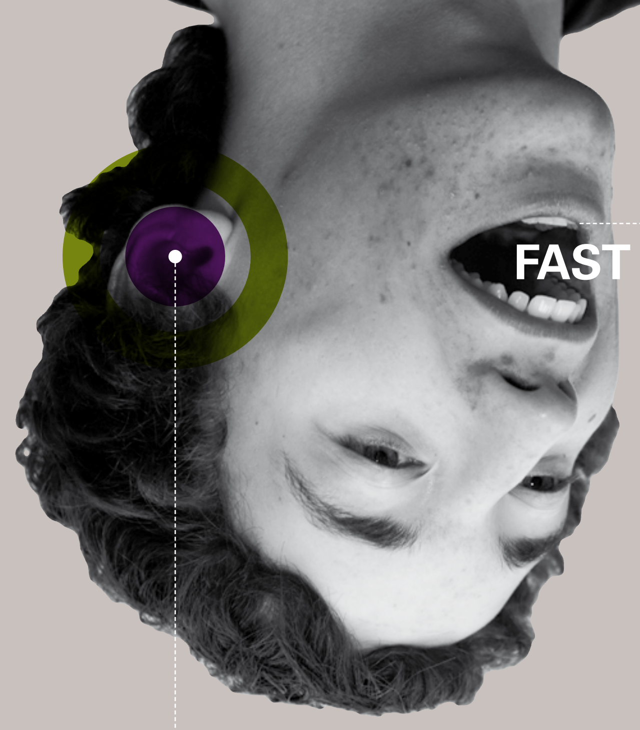
Guri Grimnes
lege, Universitetssykehuset Nord-Norge og Universitetet i Tromsø
e-post: guri.grimnes@unn.no, telefon 77 66 94 83

SPØRSMÅL?

Dersom du/dere har spørsmål om undersøkelsen, kontakt Forskningsposten UNN på telefon 77 62 69 09 eller prosjektadministrator for Fit futures på telefon 930 03 925.

www.fitfutures.no

folkehelseinstituttet



FAST FOOD

SOSIALT NETTVERK

FitFutures

EN DEL AV TROMSØUNDERSØKELSEN

DIN HELSE DIN FREMTID

INVITASJON TIL Å DELTA I HELSEUNDERSØKELSE BLANT UNGDOM

HVA ER FIT FUTURES?

Fit futures er et forskningsprosjekt der vi undersøker ungdommers fysiske helse og livsstil.

HVORFOR ER DETTE VIKTIG?

Voksnes helse undersøkes i mange studier, men man har mindre kunnskap om helse blant ungdom. Selv om få ungdommer har alvorlige sykdommer, legges mye av grunnlaget for fremtidig helse i ungdomsårene. Denne undersøkelsen kan bidra til at vi får økt kunnskap om hvordan man kan forebygge sykdom og om hvordan diagnoser kan stilles på et tidligere tidspunkt.

HVA FORSKES DET PÅ?

Hovedområdene det forskes på er:

- Eksem og kviser
- Infeksjoner
- Fysisk aktivitet og overvekt
- D-vitamin
- Jernmangel
- Genmodifisert mat
- Miljøgifter
- Smerte
- Beintetthet
- Diabetes
- Øresus
- Medisinbruk
- Frafall fra skole
- Tannhelse

Informasjonen fra undersøkelsen vil også bli brukt til forskning om de store folkehelseproblemene generelt, slik som hjerte-karsykdommer, lungesykdommer, kreft, nedsatt fruktbarhet og smerte. Det vil også bli forsket på arbeidsførhet i skole og yrke i forhold til sykdom, helse og livsstil. En del av prosjektene vil studere samspillet mellom arv, miljø og sykdom og helse; til slike prosjekter vil det bli hentet ut genetisk arvestoff fra blodprøvene. I framtiden kan data bli brukt i forskningsprosjekter som i dag ikke er planlagt. For alle slike nye prosjekter kreves det at prosjektet er godkjent av Regional komité for medisinsk og helsefaglig forskningsetikk. En oversikt over godkjente prosjekter finner du her (www.tromsoundersokelsen.no). Nettsiden holdes løpende oppdatert. Her kan du også lese om våre forskningsresultater.

HVEM KAN DELTA?

Alle ungdommer på VG1 blir invitert til å delta. Hvis du er 16 år eller mer, kan du selv bestemme om du vil delta. Er du under 16 år, må du ha samtykke fra dine foreldre eller foresatte.

AKTIVITET

SMERTE

MILJØGIFTER

SLIK FOREGÅR UNDERSØKELSEN

Undersøkelsen gjennomføres i skoletiden. Selve undersøkelsen tar 2-3 timer, og du må påregne å være borte fra skolen en halv dag. Skolen anser dette som gyldig skolefravær. Du blir undersøkt på Forskningsposten, Universitetssykehuset Nord-Norge, av erfarne forskningssykepleiere og tannleger/tannhelsesekretærer. Undersøkelsen består av følgende deler:

- *Spørreskjema* der vi spør om livsstil, trivsel, sykdommer og helseplager gjennom livet, og familieforhold.
- *Intervju* der vi spør om hvilke medisiner du bruker, om du har noen sykdom i dag og litt om sosialt nettverk. Kvinner spørres også om menstruasjon og graviditet.
- *Generell helseundersøkelse* der vi måler høyde, vekt, livvidde og hoftevidde, blodtrykk og puls, samt tar blodprøve, en hårprøve fra nakken, og en bakterieprøve fra nesebor og hals med en fuktet vattpinne.
- Måling av *smertefølsomhet* der vi måler følsomhet for trykk, kulde og varme. Smerten kommer gradvis, og du kan selv avbryte når som helst.
- *Kroppsscan* (DEXA) der vi måler beintetthet og forholdet mellom fett- og muskelvev. Dette skjer ved at du ligger rolig i ca. 10 minutter mens kroppen scannes.
- *Tannundersøkelse* som blir din årlige undersøkelse ved den offentlige tannhelsetjenesten og omfatter klinisk undersøkelse, tannrøntgen, kliniske foto og avtrykk for studiemodeller.

Etter undersøkelsen vil du få utlevert en liten *aktivitetsmåler* som er festet i et smalt strikkbelte til å ha under klærne. Denne måler hvor mye du beveger deg i løpet av dagen. Apparatet leveres på skolen etter en ukes bruk. Da vil det samtidig tas ny bakterieprøve fra nesebor og hals.

Noen deltakere vil bli forespurt om å undersøkes en gang til. Det vil da være aktuelt å gjenta noen av undersøkelsene og gjøre enkelte utvidede undersøkelser.

HVA SKJER MED DE BIOLOGISKE PRØVENE?

Med blodprøven gjøres analyser av bl.a. hormonnivåer, fettstoffer, blodsukker, vitaminer, miljøgifter og markører på betennelse og sykdommer. Det blir også hentet ut arvestoff (DNA og RNA) for genetiske analyser. Bakterieprøvene brukes til å måle forekomst av gule stafylokokker. Hårprøven analyseres for å se på nivå av kvikksølv. Prøvene lagres i Forskningsbiobanken for Tromsøundersøkelsen ved Universitetet i Tromsø. Hvis du sier ja til å delta, gir du også samtykke til at de biologiske prøvene og analyseresultatene inngår i biobanken.

TEKNOLOGI

INFORMASJON FRA ANDRE KILDER OG BRUK AV DATA I FRAMTIDEN

Opplysninger og prøver som du gir, blir oppbevart på ubestemt tid til bruk i forskning omkring helse og sykdom som omtalt i denne brosjyren. Det kan også hende at vi tar kontakt med deg igjen for å spørre om du vil være med på en ny undersøkelse. For spesielle forskningsprosjekter kan det være aktuelt å sammenstille informasjon fra Fit futures med nasjonale helseregistre som Reseptregisteret, Medisinsk fødselsregistrer, Kreftregisteret, Norsk pasientregister, Dødsårsaksregisteret og andre nasjonale registre over sykdommer som det forskes på i Tromsøundersøkelsen. I tillegg kan det være aktuelt å innhente helseopplysninger fra spesialist- og primærhelsetjenesten, for eksempel informasjon om beinbrudd og høyde- og vektdata fra helsestasjon, til bruk i forskning på sykdommer og helseproblemer som det forskes på i Tromsøundersøkelsen. Det kan også bli innehentet data fra registre i Statistisk sentralbyrå slik som miljø, befolkning, utdanning, inntekt, offentlige ytelser, arbeidsdeltakelse og andre forhold som kan ha betydning for helsa. For å undersøke om sykdommer går i arv, kan opplysninger om deg sammenstilles med opplysninger om dine slektninger, dersom disse har deltatt i deler av Tromsøundersøkelsen. Dette blir gjort ved å innhente opplysninger om slektskap fra Familieregisteret. Fra skolen vil vi innhente dine opplysninger om studieprogram, klasse, kjønn, antall fraværsdager, om du fullfører skoleåret og om karakterer i fagene norsk, matematikk og engelsk.

Sammenstillinger av informasjon krever noen ganger nytt samtykke og/eller annen type godkjenning slik som dispensasjon fra taushetsplikten eller godkjenning av offentlige instanser, for eksempel Regional komité for medisinsk og helsefaglig forskningsetikk, Datatilsynet eller NAV.

MULIGE ULEMPER OG FORDELER

Deltakelse innebærer at du må bruke noe tid. Deler av undersøkelsen kan også innebære ubehag. Dette gjelder særlig blodprøven. Dersom du vet at du har problemer med å ta blodprøve, kan du kontakte Forskningsposten på telefon 77 62 69 09 eller snakke med sykepleier når du kommer til undersøkelsen for å finne en løsning på dette.

Dersom resultatet av prøvene dine viser at det er nødvendig med oppfølging av tannlege, lege eller henvisning til spesialist, vil du bli orientert om det. Ved behov for henvisning til spesialist, vil vi sørge for henvisning og tilbud om oppfølging ved sykehuset.

Deltakere får et gavekort til en verdi av kr. 200 ved oppmøte som kan brukes i de fleste butikker i Tromsø.

RØYK OG SNUS

FitFutures
EN DEL AV TROMSØUNDERSØKELSEN

VIL DU DELTA?

Samtykke til å delta i studien Fit futures

Jeg er villig til å delta i studien

____

(DITT FULLE NAVN I BLOKKBOKSTAVER)

Sted ____________________ Dato ____________________

____

(DIN SIGNATUR)

VIL DU DELTA OG ER UNDER 16 ÅR?

Foreldre/foresatte sitt samtykke til deltakelse i Fit futures

Jeg samtykker herved i at mitt/vårt barn kan delta i undersøkelsen

____

(BARNETS FULLE NAVN I BLOKKBOKSTAVER)

Sted ____________________ Dato ____________________

____

(SIGNATUR FORELDER/FORESATT 1)

____

(SIGNATUR FORELDER/FORESATT 2)

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK nord			09.11.2012	2012/1663/REK nord
			Deres dato:	**Deres referanse:**
			25.09.2012	

Vår referanse må oppgis ved alle henvendelser

Bente Morseth
Regionalt kompetansesenter for idrett og helse - Nord

2012/1663 Fysisk aktivitet blant ungdom i Troms – aktivitetsnivå, mønstre og validering av målinger

Forskningsansvarlig institusjon: Universitetet i Tromsø ved Bjørn Straume
Prosjektleder: Bente Morseth

Vi viser til søknad om forhåndsgodkjenning av ovennevnte forskningsprosjekt. Søknaden ble behandlet av Regional komité for medisinsk og helsefaglig forskningsetikk (REK nord) i møtet 25.10.2012.

Prosjektleders prosjektomtale
Det er behov for mer kunnskap om fysisk aktivitet blant ungdom, dette aktualiseres gjennom viktigheten av fysisk aktivitet i et folkehelseperspektiv, forskning som viser at ungdom er for lite aktive og økt fokus på tiltak som kan bidra til økt fysisk aktivitet blant barn og unge. Prosjektet vil beskrive fysisk aktivitetsvaner hos deltakere i ungdomsundersøkelsen Fit Futures og analysere sammenhengen mellom selvrapporterte og objektive aktivitetsmålinger, samt i hvilken grad ungdommens aktivitetsnivå tilfredsstiller nasjonale retningslinjer. I en senere fase kan det være aktuelt å utvide prosjektet med analyser av sammenhenger mellom fysisk aktivitet og overvekt, blodvariabler og/eller sykdomsvariabler. Studiepopulasjon er deltakere i Fit Futures, elever ved 1. år videregående skole. Data inkluderer selvrapportert informasjon om familie, livsstil, helse og sykdom, kliniske målinger og blodprøvetaking, og måling av fysisk aktivitet med akselerometer (bevegelsessensor).

Samtykke
Komiteen har vurdert og kommet til at det brede samtykket fra Fit Futures er dekkende for studien, og at det ikke er forhold som tilsier at nytt samtykke må innhentes, eller at det bør stilles andre vilkår for bruken av samtykket.

Vedtak
Med hjemmel i helseforskningsloven § 10 og forskningsetikkloven § 4 godkjennes prosjektet.

Sluttmelding og søknad om prosjektendring
Prosjektleder skal sende sluttmelding til REK nord på eget skjema senest 15.11.2013, jf. hfl. § 12. Prosjektleder skal sende søknad om prosjektendring til REK nord dersom det skal gjøres vesentlige endringer i forhold til de opplysninger som er gitt i søknaden, jf. hfl. § 11.

Klageadgang
Du kan klage på komiteens vedtak, jf. forvaltningslovens § 28 flg. Klagen sendes til REK nord. Klagefristen er tre uker fra du mottar dette brevet. Dersom vedtaket opprettholdes av REK nord, sendes klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag for endelig vurdering.

Med vennlig hilsen

May Britt Rossvoll
Sekretariatsleder

Kopi til: bjorn.straume@uit.no

REK
REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSKNINGSETIKK

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK nord	Monika Rydland Gaare	77620756	29.08.2014	2012/1663/REK nord
			Deres dato:	Deres referanse:
			26.08.2014	

Vår referanse må oppgis ved alle henvendelser

Bente Morseth
Institutt for idrettsfag/Institutt for samfunnsmedisin

2012/1663 Fysisk aktivitet blant ungdom i Troms – aktivitetsnivå, mønstre og validering av målinger

Forskningsansvarlig: Institutt for samfunnsmedisin
Prosjektleder: Bente Morseth

Vi viser til søknad om prosjektendring av 26.08.2014 vedlagt ny protokoll. Prosjektet utvides til også å omfatte analyser av data fra Fit Futures 2, endring i medarbeidere og forlengelse av studien til 31.08.2018.

Etter fullmakt er det fattet slikt

vedtak
Med hjemmel i helseforskningsloven § 10 og forskningsetikkloven § 4 godkjennes prosjektet slik det nå foreligger.

Endringen godkjennes under forutsetning av at prosjektet gjennomføres slik det er beskrevet i søknaden, endringssøknaden, oppdatert protokoll og de bestemmelser som følger av helseforskningsloven med forskrifter.

For øvrig gjelder de vilkår som er satt i forbindelse med tidligere godkjenning av prosjektet.

Sluttmelding og søknad om prosjektendring
Prosjektleder skal sende sluttmelding på eget skjema senest et halvt år etter prosjektslutt, jf. helseforskningslovens § 12. Dersom det skal gjøres vesentlige endringer i forhold til de opplysninger som er gitt i søknaden må prosjektleder sende søknad om prosjektendring til REK, jf. helseforskningslovens § 11.

Klageadgang
Du kan klage på komiteens vedtak, jf. forvaltningslovens § 28 flg. Klagen sendes til REK nord. Klagefristen er tre uker fra du mottar dette brevet. Dersom vedtaket opprettholdes av REK nord, sendes klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag for endelig vurdering.

Med vennlig hilsen

May Britt Rossvoll
sekretariatsleder

Monika Rydland Gaare
seniorkonsulent

Kopi til: *magritt.brustad@uit.no*