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Adolescent physical activity patterns and subsequent health risk in a public health perspective

The HUNT Study

Thesis for the degree of Philosophiae Doctor

Trondheim, June 2013

Norwegian University of Science and Technology
Faculty of Medicine
Department of Public Health and General Practice

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ISBN 978-82-471-4487-9 (printed ver.)
ISBN 978-82-471-4488-6 (electronic ver.)
ISSN 1503-8181

Doctoral theses at NTNU, 2013:187

Printed by NTNU-trykk

Fysisk aktivitetsadferd blant ungdom og påfølgende helserisiko sett i et folkehelseperspektiv. *Helseundersøkelsen i Nord-Trøndelag (HUNT).*

Fysisk aktivitet er henger sammen med både fysisk form og fysisk, sosial og psykisk helse, både i ungdomsårene og senere i livet. Fysisk inaktivitet er en kjent risikofaktor for hjerte-og karsykdommer, type 2-diabetes og kreft. Representative data på fysisk aktivitet og inaktivitet i befolkningen er avgjørende for å studere forekomst og utvikling og sammenhengen mellom fysisk aktivitet og helse.

Formålet med doktorgradsavhandlingen var å studere pålitelighet og gyldighet av selvrapportert fysisk aktivitet blant ungdom, og å undersøke fysisk aktivitetsadferd i ungdomstiden og i overgangen fra ungdom til ung voksen alder. Videre å studere fysisk aktivitetsadferd og dens sammenheng med helse og risikofaktorer for sykdom i en norsk befolkning.

Data fra 71 tilfeldig utvalgte ungdommer i alderen 13-18 år ble samlet inn for å studere pålitelighet og gyldighet av mye brukte spørreskjemaer om fysisk aktivitet ; fysisk aktivitets-spørsmål i ungdomsdelen av HUNT (Ung-HUNT) og International Physical Activity Questionnaire (IPAQ), kort versjon. Data fra to påfølgende studier i HUNT ble brukt til å studere hva som førte til endringer i fysisk aktivitet i løpet av ungdomsårene (artikkel 2) og hvilken sammenheng det var mellom slike endringer og senere målbar helserisiko i ung voksen alder (artikkel 3).

Opplysninger fra 2348 ungdommer og deres foreldre som deltok HUNT2 (1995-1997) eller Ung-HUNT1 (som foregikk samtidig), og for ungdommene i oppfølgingen i Ung-HUNT2 (2000-2001), dannet grunnlaget for å studere hvilke faktorer som hadde9ammenheng med endringer i fysisk aktivitet i ungdomsårene.

1869 ungdommer som deltok i Ung-HUNT1 (1995-1997), og da var 13-19 år gamle ,ble fulgt opp som voksne i HUNT3 (2006-08), Ved HUNT3 var de i alderen 23-31 år, og ble spurt om fysisk aktivitet, og fikk undersøkt psykisk helse og risikofaktorer for hjerte- og karsykdom i ung voksen alder.

Spørsmål om fysisk aktivitet benyttet i Ung-HUNT syntes å være et akseptabelt instrument for å måle fysisk form. Selvrapportert fysisk aktivitet hadde hos jenter en bedre pålitelighet og gyldighet enn hos gutter. Spørsmålene om fysisk aktivitet brukt på ungdommer i HUNT, var et akseptabelt instrument for å måle fysisk aktivitet blant ungdommer, mens IPAQ derimot ikke var et spesielt gunstig spørreskjema for måling av fysisk aktivitet blant ungdommer.

Misnøye med livet, det å være overvektig, og ikke å delta aktivt i idrett var de faktorene som viste sterkest sammenheng med redusert fysisk aktivitet blant gutter i løpet av ungdomsårene. Det som var sterkest forbundet med redusert fysisk aktivitet i løpet av ungdomsårene blant jenter var risikoatferd som røyking, bruk av alkohol, mor med lav utdanning og fysisk inaktiv mor. Ungdommer som hadde foreldre med høyere utdanning og som var fysisk aktive, hadde større sjanse for å være fysisk aktive gjennom ungdomsårene.

De som var fysisk aktive både som ungdommer og i ung voksen alder hadde en klart lavere risikofaktorer for hjerte-og karsykdom og de hadde også bedre psykisk helse sammenlignet med de som var fysisk inaktive på begge tidspunkter. En økning av den fysiske aktiviteten (fra å være inaktiv til å bli fysisk aktiv) i løpet av perioden på 11 år ga ingen sikker redusert hjerte- og karsykdomsrisiko sammenlignet med de som var fysisk inaktive på begge tidspunkter eller sammenlignet med de som reduserte den fysiske aktiviteten i løpet av tidsperioden mellom undersøkelsene. En økning av den fysiske aktiviteten fra ungdomsårene til ung voksen alder syntes heller ikke å beskytte mot psykiske plager

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Finansieringskilde: *Høgskolen i Nord-Trøndelag*
Bedømmelseskomité: *Professor Pernille Due, professor Oddrun Samdal og professor Siv Mørkved (administrator)*

Avhandlingen er funnet verdig til å forsvares offentlig
for graden Doctor Philosophiae.
Prøveforelesning og påfølgende disputas finner sted i Orangesalen, Nylåna, HiNT Røstad, Levanger
torsdag, 13. juni, kl.10:15

Norsk sammendrag

Fysisk aktivitetsadferd blant ungdom og påfølgende helserisiko sett i et folkehelseperspektiv. *Helseundersøkelsen i Nord-Trøndelag.*

Bakgrunn

Fysisk aktivitet er positivt relatert til både fysisk form og fysisk, sosial og psykisk helse, både i ungdomsårene og senere i livet. Fysisk inaktivitet er en etablert risikofaktor for hjerte-og karsykdommer, type 2-diabetes og kreft. Representative data på fysisk aktivitet og inaktivitet i befolkningen er avgjørende for å studere forekomst og utvikling og sammenhengen mellom fysisk aktivitet og helseutfall. Få longitudinelle studier har analysert hva som predikerer endringer i fysisk aktivitet i løpet av ungdomsårene, og lite er kjent om hvordan effekten av ulik fysisk aktivitetsadferd gjennom ungdomsårene til tidlig voksen alder påvirker metabolske risikofaktorer og mental helse i tidlig voksen alder.

Mål

Det overordnede formålet med avhandlingen er å se på reliabilitet og validitet av selvrapportert fysisk aktivitet blant ungdom, og å undersøke fysisk aktivitetsadferd i ungdomstiden og i overgangen fra ungdom til ung voksen alder. Videre, å studere fysisk aktivitetsadferd og dens relasjon til risikofaktorer for helse og sykdom i en norsk befolkning.

Metoder

Data fra 71 tilfeldig utvalgte ungdommer i alderen 13-18 år ble samlet inn for å studere validitet og reliabilitet av spørreskjemaer om fysisk aktivitet som er mye brukt; WHO, Health Behaviour in Schoolchildren (HBSC) Questionnaire og International Physical Activity Questionnaire (IPAQ), kort versjon (artikkel 1). Data fra to prospektive longitudinelle studier i Helseundersøkelsen i Nord-Trøndelag (HUNT) ble brukt til å studere prediktorer for fysisk aktivitetsmønstre og deres forhold til senere helserisiko gjennom ungdomsårene (artikkel 2) og fra ungdom til ung voksen alder (artikkel 3).

Data fra 2348 ungdommer og deres foreldre som deltok HUNT2 (1995-1997) eller ungdomsdelen (Ung-HUNT1) og for ungdommene i oppfølgingen i Ung-HUNT2 (2000-2001), dannet grunnlaget for å studere hvilke faktorer som predikerte endringer i fysisk aktivitet i ungdomsårene.

Totalt 1869 personer ble inkludert i Ung-HUNT1 (1995-1997) i alderen 13-19 år (baseline) og ble fulgt opp i HUNT 3 (2006-08). Ved HUNT3 var de i alderen 23-31 og ble undersøkt med henblikk på fysisk aktivitetsmønstre og risikofaktorer for hjerte- og karsykdom og psykisk helse i ung voksen alder.

Deltakerne besvarte spørreskjemaer og deltok i kliniske undersøkelser. Blodprøver ble tatt på voksne.

Deskriptiv statistikk, multippel binær logistisk regresjon (artikkel 2 og 3) og lineær regresjon (artikkel 3) ble brukt til å studere fysisk aktivitetsadferd og dens assosiasjon til risikofaktorene. Spearman korrelasjonsanalyse ble brukt til å teste validiteten på selvrapportert fysisk aktivitet (artikkel 1).

Resultater

Reliabiliteten (intraclass korrelasjonskoeffisient) for WHO HBSC spørreskjema var 0,71 for frekvens og 0,73 for varighet av fysisk aktivitet, med betydelige forskjell mellom kjønnene. Validiteten (Spearman korrelasjonskoeffisienter) for både WHO HBSC spørreskjemaet og IPAQ målt mot VO_{2peak} var moderat. WHO HBSC spørreskjema målt mot VO_{2peak} for jentene var akseptabelt. Begge spørreskjemaer viste lav korrelasjon med ActiReg (målt som fysisk aktivitetsnivå og totalt energiforbruk i syv etterfølgende dager).

Overvekt, misnøye med livet og ikke å delta i organisert idrett ved baseline var signifikante prediktorer for redusert fysisk aktivitet blant gutter i ungdomsårene. For jenter var røyking, alkoholbruk og det å ha mor med lav utdanning prediktorer for redusert fysisk aktivitet og stabil inaktivitet. Å ha foreldre med høyere utdanning og å ha fysisk aktive foreldre ved baseline syntes å beskytte mot å få redusert fysisk aktivitet i ungdomsårene for begge kjønn.

Personer som var fysisk aktive fra ungdoms- til ung voksen alder (stabilt fysisk aktive) hadde signifikant lavere hjertefrekvens i tidlig voksen alder, sammenlignet med de som hadde endret fysisk aktivitet og de som var stabilt inaktive. Menn som var aktive ved begge tidspunktene, hadde signifikant lavere livvidde enn de som reduserte aktiviteten eller var inaktive ved begge tidspunktene. Justert for alder og kjønn, hadde de som var stabilt fysisk aktive en signifikant bedre helseprofil knyttet til livvidde, kroppsmasseindeks, hjertefrekvens, diastolisk blodtrykk og HDL-kolesterol sammenlignet med de som hadde en annen fysisk aktivitetsadferd. Menn som økte sin fysiske aktivitet hadde ikke en

signifikant lavere kardiovaskulær risiko profil. Blant kvinner var økning av fysisk aktivitet assosiert med lavere hjertefrekvens og totalkolesterol. De som var fysisk aktive hadde også bedre psykisk helse enn de fysisk inaktive. Menn som var fysisk aktive både i ungdomsalder og tidlig voksen alder, hadde en økt sannsynlighet for god psykisk helse i forhold til de som var inaktive ved baseline, men som økte den fysiske aktiviteten. Kvinner som var stabilt fysisk aktive rapporterte større tilfredshet med livet sammenlignet med de som var inaktive, men som økte den fysiske aktiviteten.

Konklusjon

WHOs HBSC-spørsmål syntes å være akseptable virkemidler for å måle kardio-respiratorisk form. Selvrapportert fysisk aktivitet hadde hos jenter en bedre reliabilitet og validitet enn hos gutter. WHOs HBSC-spørsmål om fysisk aktivitet var et akseptabelt instrument for å måle fysisk aktivitet blant ungdommer, mens IPAQ derimot ikke var et valid instrument.

Misnøye med livet, å være overvektig, og å ikke delta aktivt i idrett var de sterkeste prediktorene for redusert fysisk aktivitet blant gutter i ungdomsårene. Blant jenter var risikoatferd som røyking og bruk av alkohol, og det å ha mor med lav utdanning og som var fysisk inaktiv de sterkeste determinantene for redusert fysisk aktivitet i løpet av ungdomsårene. Foreldre med høyere utdanning og som var fysisk aktive var assosiert med økt fysisk aktivitet hos sine ungdommene.

De som var fysisk aktive både som ungdommer og i ung voksen alder hadde en signifikant lavere kardiovaskulær risiko og bedre psykisk helse sammenlignet med de som var fysisk inaktive på begge tidspunkter. En økning av den fysiske aktiviteten (fra å være inaktiv til å bli fysisk aktiv) i løpet av perioden på 11 år ga ingen signifikant redusert kardiovaskulær risiko sammenlignet med de som var fysisk inaktive på begge tidspunkter eller sammenlignet med de som reduserte den fysiske aktiviteten i tidsperioden. En økning av den fysiske aktiviteten fra ungdomsårene til ung voksen alder syntes heller ikke å beskytte mot psykiske plager.

Acknowledgements

First of all I want to thank the adolescents and adults of Nord-Trøndelag who participated in the HUNT2 and 3 Studies, thus making extensive health research possible. In particular I am grateful to the four schools allowing data collection for the validity study in the school setting.

This PhD scholarship was funded by the Nord-Trøndelag University College. I appreciate very much that the college had faith in this project and in me. Hopefully the project may contribute to further development of the Nord-Trøndelag University College.

I want to express my gratitude to everyone who contributed to this research project. This thesis would not have been possible without their support. My sincere appreciation goes to:

Professor Kristian Midthjell, (HUNT Research Centre), my main supervisor, who has encouraged and supported me from the very beginning when I started to apply for PhD scholarships. He deserves thanks for believing in me, and for his friendliness. I highly appreciate his knowledge and patience, especially in terms how this project has evolved. This was supposed to be a regular PhD fellowship of four years, but due to parallel necessary and interesting engagements at the University College ended up taking more than seven years altogether

Professor, Turid Lingaas Holmen (HUNT Research Centre), has been my co-supervisor. With her scientific skills, valuable criticism and knowledge on the adolescents' health, being project manager for Young-HUNT, she has been an invaluable resource for this project.

Professor Nanna Kurtze, Norwegian Knowledge Centre for the Health Services, has also been co-supervisor. I am very grateful for her knowledge related to the measurement of physical activity. This was invaluable in the design and implementation of the validation study.

Sesquicentenary professor Adrian Bauman, at the School of Public Health, University of Sydney deserves great credit for inviting me to his research department for two research stays. I truly appreciated my time "down under", and am very grateful to Bauman for

sharing his broad knowledge in the physical activity area and for valuable comments to papers 2 and 3.

PhD student Koenraad Cuypers, is thanked for contribution in collecting, nalysing and interpreting data in one of the papers. I also want to thank him for fruitful discussions in our shared offices in the “brakka” at HUNT Research Centre.

PhD Grete Bratberg, associate professor at HUNT Research Centre, has made a substantial contribution to writing, editing, analysing and interpreting data in one of the papers.

I am forever grateful to my parents for giving me the perfect ballast in life, and for all their support, especially during this project. Thanks so much for helping me, whether it applies to childcare or other assistance that certainly was needed avoiding the rest of the family to “suffer” too much in this period.

Tuva, Hedda and Rasmus, our wonderful children have given me the inspiration to persevere, not to mention that they have kept my feet on the ground and have always reminded me of what is most important in life. This thesis is dedicated to you, my lovely three children.

At last, and not at all least, I want to express great thanks to my dear wife, Tone, for invaluable patience and support so I could complete the project. We've had our moments, due to a husband working hard to complete the PhD, and at the same time building a new house for the family, having three children in their first years of life and a demanding job as a program coordinator / vice dean at the University College in addition to the PhD project. She has given invaluable support throughout this work and has taken the greatest "burden" on the home court.

Table of contents

List of papers

This thesis is based on the following three papers:

Paper 1: Rangul V, Holmen TL, Kurtze N, Cuypers K and Midthjell K: Reliability and validity of two frequently used self-administered physical activity questionnaires in adolescents. *BMC Medical Research Methodology* 2008, 8**:**47.

Paper 2: Rangul V, Holmen TL , Bauman A, Bratberg GH, Kurtze N and Midthjell K: Factors predicting changes in physical activity through adolescence; the Young-HUNT Study, Norway. *Journal of Adolescent Health*. 2011, 48:6. 616-24.

Paper 3: Rangul V, Bauman A, Holmen TL and Midthjell K: Is physical activity maintenance from adolescence to young adulthood associated with reduced CVD risk factors, improved mental health and satisfaction with life: the HUNT Study, Norway. *International Journal of Behavioral Nutrition and Physical Activity* 2012, 9:144

List of abbreviations

ActiReg®	Objective combination measurement (activity monitor) for physical activity
BMI	Body mass index
CVD	Cardiovascular disease
HBSC	Health Behaviour in School-aged Children Survey
HDL-C	High-density lipoprotein cholesterol
HUNT	The Nord-Trøndelag Health Study (Helseundersøkelsen i Nord-Trøndelag)
HR	Heart rate
IPAQ	International Physical Activity Questionnaire
MET	Metabolic equivalent (The ratio of the working metabolic rate to the resting metabolic rate)
MVPA	Moderate to vigorous physical activity
PAL	Physical activity level
TC	Total cholesterol
TEE	Total energy expenditure
VO_{2peak}	Maximal oxygen uptake – Cardio-respiratory fitness
WC	Waist circumference
Young-HUNT	The adolescent part of the HUNT Study (13-19 years)

Summary

Adolescent physical activity patterns and subsequent health risk in a public health perspective. ***The Nord-Trøndelag Health Study***

Background

Physical activity is positively related to both physical fitness and physical, social and mental health in adolescence as well as later in life. Physical inactivity is an established risk factor for diseases like cardiovascular disease, type 2-diabetes and cancer. Representative data are essential to assess and monitor physical activity and inactivity in populations in order to study prevalence and time trends, including estimating the impact of physical activity on health outcomes. Few longitudinal studies have analysed predictors associated with changes in physical activity levels in adolescents. Little is known about which effects different physical activity patterns followed from adolescence to early adulthood, might have on cardiometabolic risk factors and mental health in early adulthood.

Aims

The overall purpose of this thesis was to test the reliability and validity of self-reported physical activity questions to investigate physical activity behaviour in adolescence, and from adolescence to young adulthood. Furthermore, we wanted to study physical activity patterns and their relation to risk factors for health and morbidity in a Norwegian population

Methods

To validate the answers of two of the most frequently used physical activity questionnaires; the WHO, Health behaviour in Schoolchildren (HBSC) questionnaire and the International Physical Activity Questionnaire (IPAQ), short version, we compared them with more objective measurements; the ActiReg and VO_{2peak}. Data was collected from 71 randomly selected adolescents aged 13-18 years old (paper 1). Data from two prospective longitudinal surveys in the Nord-Trøndelag Health Study were used to study predictors of physical activity patterns and their relation to subsequent health risk through adolescence (paper 2) and from adolescence to young adulthood (paper 3).

Data from 2348 adolescents and their parents who participated in the Nord-Trøndelag Health Study (HUNT2, including the concomitant youth part, Young-HUNT1, 1995-97) and at follow-up in Young-HUNT 2, performed in 2000-2001 formed the basis for studying factors that predicted changes in physical activity during adolescence. A total of 1869 individuals participating in Young-HUNT1 (1995-97), aged 13-19 years (baseline), and followed-up at HUNT 3 (2006-08), aged 23-31 were included. We examined physical activity patterns and subsequent cardiovascular disease (CVD) risk factors and mental health in young adulthood.

The participants completed a self-reported questionnaire and participated in clinical examinations. Blood samples were collected only in adults.

Descriptive statistics, multiple binary logistic regression (paper 2 and 3) and linear regression (paper 3) were applied to study physical activity patterns and their relation to risk factors. Spearman correlation analysis was used to test the validity of self-reported physical activity questionnaires (paper 1)

Results

The reliability (intraclass correlation coefficient) for the WHO HBSC questionnaire was 0.71 for frequency and 0.73 for duration, with significant differences between genders. The validity (Spearman correlation coefficients) for both the WHO HBSC questionnaire and the IPAQ measured against VO_{2peak} was fair. The WHO HBSC questionnaire measured against VO_{2peak} for girls was acceptable. Both questionnaires, except the walking question in IPAQ, showed a low correlation with the objective activity measure; the ActiReg (physical activity level and total energy expenditure measured continuously for seven days).

Overweight, dissatisfaction with life and no active participation in sports at baseline, were significant predictors of relapse in physical activity among boys during adolescence. For girls, smoking, consumption of alcohol, low maternal education and physical inactivity, predicted relapsing and inactive maintaining of physical activity. A higher level of education and more physically active parents at baseline were associated with increased physical activity during adolescence for both genders.

Those who maintained physical activity from adolescence to young adulthood (active maintainers), had significantly lower heart rate in young adulthood, compared to all other physical activity patterns. Active maintaining men had significantly lower waist

circumference than relapsers and inactive maintainers. When adjusted for age and gender, waist circumference, BMI, heart rate, diastolic blood pressure and HDL-cholesterol, significant differences were demonstrated comparing active maintainers to other physical activity patterns. Male adopters did not differ significantly in CVD risk factors compared to inactive maintainers and relapsers. Among females adopting was associated with lower heart rate and total cholesterol compared to inactive maintaining. Active maintainers showed better mental health than inactive maintainers. Male active maintainers had an increased likelihood of good mental health compared to adopters. Female active maintainers reported greater satisfaction with life compared to adopters.

Conclusions

The WHO HBSC questions seemed to be acceptable instruments to measure cardio-respiratory fitness. Answers from girls were more reliable and valid than the answers from boys. The IPAQ was not a valid instrument for adolescents.

Dissatisfaction with life, overweight and no active participation in sports were the strongest predictors for decreased physical activity during adolescence in boys. For girls, hazardous risk behaviors like smoking and alcohol use, low maternal education and maternal physical inactivity were the strongest determinants of decreased physical activity. A high parental level of education and physically active parents were associated with increased physical activity during adolescence.

Those who maintained their physical activity from adolescence to young adulthood had a significantly lower CVD risk profile and better mental health, compared to inactive maintainers. Compared to inactivity maintainers and to relapsers, adopting physical activity was not significantly associated with lowered CVD risk profile. Adopting physical activity between adolescence and young adulthood was not associated with lower mental distress

1 Introduction

1.1 Physical activity in a historical perspective

Since the Stone Age, from hunting to agriculture and animal domestication, and then in the industrial age, strength, endurance and skill have been associated with survival and later with economic success. From this early start of Human Era, the needs for physical activity have changed markedly [1]. More scientific knowledge of the importance of physical activity and exercise for health is not new. It dates at least back to Hippocrates (460-370 B.C) and Galen (129-210 A.D).

Hippocrates wrote about the benefits of exercise for a variety of ailments, including mental illnesses, and noted "eating alone will not keep a man well; he must also take exercise. For food and exercise, while possessing opposite qualities, yet work together to produce health" [2]. Hippocrates also recommended walking and other forms of moderate intensity exercise. Many of the other ancient Greek physicians who practiced medicine recommended moderate or vigorous exercise to maintain health and treating a variety of diseases [3].

Claudius Galenus (Galen) was the first scientist who described the human body and to recognized that contraction is the main action/effect of the muscles. Galen promoted his beliefs that everyone could benefit from exercise. Both Hippocrates and Galen stated that lack of physical exercise was detrimental to health [4].

This influence of the ancient Greeks on exercise and physical activity faded during the Middle Ages. But during the Renaissance; in the 15th century, schools were established in which children participated in exercise to meet their individual needs and played many sports. Cristóbal Méndez published one of the first books on exercise in 1553, "Book of bodily exercise", where he prescribed exercise for the elderly [5]. Girolamo Mercuriale studied diet, exercise and hygiene and the use of natural methods for the cure of diseases. Based on this he published in 1569 the six volume *"De Arte Gymnastica"*, where he recommended that all sedentary people should start exercising [3]. During the later part of the 19th century, exercise and sport became widely practised, and leisure time activities became organized with more sports activities. But even in this century there were laws that

governed many sports, which led to social inequalities, such as excluding those who performed physical activity at work on the basis that they were not true amateurs [6].

1.1.1 Public Health approach

It was not until the early 20th century that the "exercise science" began to study systematically the relationship between physical activity and health, and some of the first studies on the relationships between physical activity and coronary heart diseases became a reality [6]

Epidemiologists began to study the rate of which diseases occurred in the population and identified factors associated with incidence of specific diseases. In 1949, the modern physical activity epidemiology started with the "London Bus Study", performed by Jeremy N. Morris and his collegues [4]. The study showed that London´s double decker bus conductors, who climbed stairs and were standing on their shifts, had lower rates of coronary heart disease than bus drivers, who were entirely sedentary during the day [7]. From these findings, the evidence of the relationship between physical activity and health continued to progress in the 20th century. Especially R. Paffenbarger and his colleagues contributed to this development by major studies on physical activity and health outcomes, such as cardiovascular disease. Steven N. Blair is also important in the development of physical activity epidemiology, through his studies on the relationships between physical fitness and a wide range of chronic diseases [8].

The works of these epidemiologists have been very important, because they showed a correlation between physical activity and health at the population level [3].

The focus on the importance of physical activity culminated in 1996, by the Surgeon General´s Report on Physical Activity and Health from USA [9]. This statement is a landmark summarizing the health benefits of physical activity, recommending that all adults should perform at least 30 minutes of moderate physical activity on all or most days of the week.

In a public health perspective this should have been a warning, because the industrial revolution and the development of new technologies have reduced much of the hard work and active transport. This has made people´s lives easier, but the drawback is that the social development has caused inactivity.

Now there is a clear re-thinking about the epidemiology of physical activity. It is no longer just counting heavy short duration intense activities like sports, fitness, running on a treadmill etc. Physical activity is also a cultural challenge with physical activity as a behaviour, by focusing on an active lifestyle where physical activity is an integrated part [10].

In 2012, van der Ploeg et al. reported some new findings from a large population based study in Australian adults, that total sitting time was associated prospectively with all-cause mortality, independent of physical activity [11]. This indicates that people who meet the minimum amount of physical activity recommendation (30 min brisk walking on most days) but are sitting the rest of the day are still at increased risk for all-cause mortality. This probably is more prominent due to the rapid changes in our physical, economic and social environments in the recent years, necessitating greater focus on the total daily activity level.

The ideas and hypotheses from the ancient Greeks and the Renaissance, stating that an active life promotes a healthy life and prevents disease, have been supported by modern scientific studies in the last century and are still valid. It is likely that studies on physical activity and health will continue to change scientific recommendations and will result in new ways of understanding the complexities between physical activity and various health outcomes. The focus of physical activity promotion has been advising individuals to change their lifestyle. But the worldwide challenges are more comprehensive, and we need to redefine our strategy, focusing more on societal efforts, i.e. a broader view of physical activity, creating a society which facilitates and focuses on physical activity behaviour as a part of everyday life.

This thesis will try to explain some of this complexity, aiming at contributing to the understanding of, and thus actions against the 21th century`s most important public health challenge, physical inactivity [12].

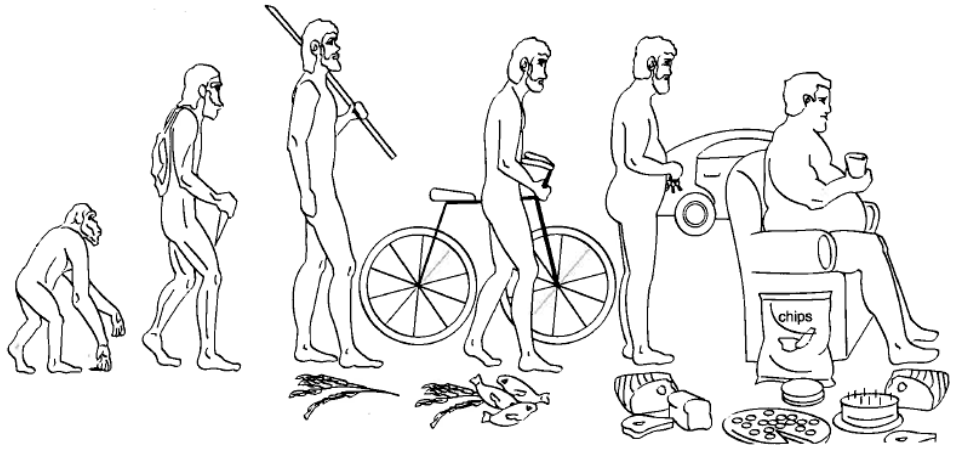

Figure 1. Is our sedentary behaviour leading us to homo sedens? (Bouchard C, Blair SN, Haskell WL: Physical activity and health. Champaign, IL: Human Kinetics; 2012)

1.2 Physical activity - principles and concepts

1.2.1 Definitions

Physical activity and concepts related to physical activity are complex and cover multiple dimensions and components. The definitions most often used today to describe physical activity are those from Caspersen et al. [13]:

Physical activity is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" [13]. This broad term includes almost everything a person does, which increases the energy expenditure. This includes a variety of forms of behaviour such as physical exercise, brisk walking, playing, home and family care, occupational activities and different types of sports.

Physical exercise is defined as a subgroup of physical activities which are planned, structured and repeated body movement done to improve or maintain one or more components of physical fitness and/or health [13].

Physical fitness is a set of attributes that are either health or skill related, which requires physical activities such as cardio-respiratory endurance, muscular endurance and strength, body composition and flexibility, and is determined by a combination of regular activity and genetically inherited ability [13].

Leisure time activities include activities that have elements of free choice in leisure time settings. This includes activities such as recreational activities, playing, house chores, gardening, outdoor activities and active transportation.

Occupational physical activity is the physical activity that occurs during normal working hours.

Active transport refers to any form of human produced transportation and includes many active modes and methods of travel such as walking, cycling, wheel chairing and skiing.

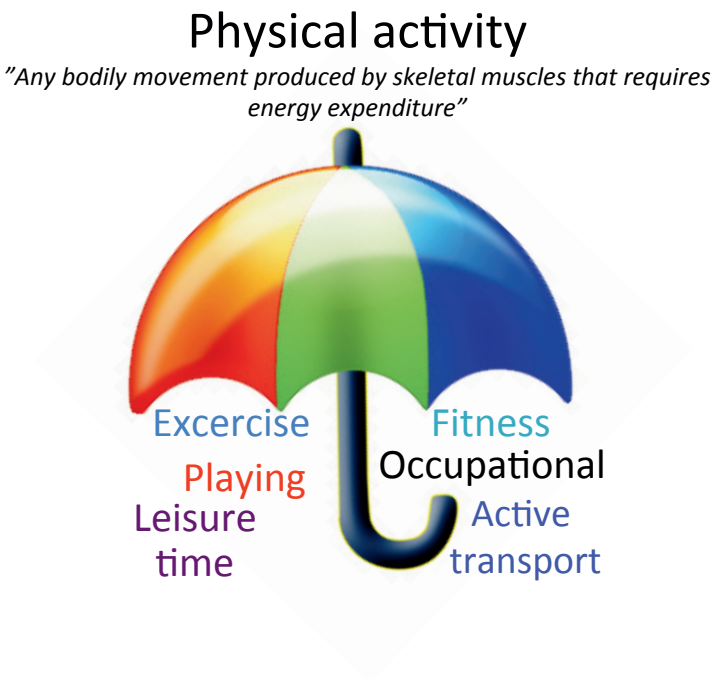

Figure 2. Physical activity, a complex concept that includes several sub-categories of physical movement

1.2.2 Principles of physical activity measurement

When measuring physical activity in epidemiological studies, several dimensions including frequency, intensity, duration and mode describe physical activity. These dimensions combined constitute the total dose of physical activity.

Frequency is given by number of days or sessions the activity is performed within a particular time period (per day, week or month). For example, The American College of Sports Medicine (ACSM) recommends moderate physical activity five days a week to reduce chronic disease and enhance health [14].

Intensity refers to the effort required to perform the activity. It is usually expressed in absolute (objective) or relative (subjective) terms. The absolute intensity, a calculated metabolic equivalent (MET), is the rate of energy expenditure of the activity compared to resting energy expenditure (RMR). 1 MET is equal of 3.5ml $O_2 \cdot kg^{-1} \cdot min^{-1}$ or 1 $kcal \cdot kg^{-1} \cdot h^{-1}$). MET values are often categorised in low (METs < 3), moderate (METs 3-6) and high activity (METs > 6) [15]. Relative intensity can be recorded using the Borg Rating of Perceived Exertion (RPE) scale [16], where they individuals rate their exertion level based on their experience during physical activities. The intensity can also be measured retrospectively by asking how people rate their physical activity by including increased heart rate, increased respiration, breathing rate and increased sweating.

Duration is the amount of physical activity within a time period in hours or minutes (activity session, per day, week, and month). For example, the physical activity guidelines for children and adolescents includes performing 60 minutes or more moderate and vigorous-intensity physical activity daily [17].

These three dimensions are different, and may therefore have different effects on the dose of physical activity. Often this dose is expressed in terms of energy expenditure. One can perform physical activity with high intensity and reduce the time, and all the same burn the same amount of calories as physical activity at low intensity but over a longer time.

To measure and assess the "total physical activity", it is also important to measure the type or *mode*, which refers to the specific activity itself (e.g. cycling, walking, weight bearing or non-weight bearing, aerobic), and in which context/setting the physical activity is performed [18]. Important contexts are leisure time, occupational time and transportation activities [19].

1.3 Physical activity assessment

The choice of methods of measuring physical activity is important, and must be suitable to measure relevant aspects of physical activity in a public health perspective. The perfect

measure of physical activity does not exist and the choice of method is often a trade-off between the quality of the method and the resources available.

1.3.1 Reliability and validity

Reliability and validity are fundamental in the measurements of physical activity. All assessment tools should be tested for reproducibility and be validated in the given population, and it is important to identify the source of error, systematically or randomly for physical activity [20].

To consider physical activity measures as reliable, they have to be reproducible and stable under different conditions, and in the conditions they will be used. The most important problems for reliability are systematic bias and random error [21].

Validity expresses how our measurement assesses the true exposure of interest. This is different from reliability, and more difficult to measure, and refers to the accuracy of the measurement. In physical activity epidemiology we normally are concerned with three categories of validity; *content validity* (the degree to which the test content is tied to the domains it intends to measure), *criterion validity* (the degree to which a test predicts some criterion) and *construct validity* (the degree to which a test measures the theoretical construct it intends to measure) [22].

1.3.2 Measurements and methods

The choice of method to measure physical activity depends on what is the objective of the study. In general, one should strive at assessing the levels of physical activity and physical activity behaviour as exactly as possible. It is required to register the different dimensions such as frequency, duration, intensity, type and domain of physical activity [23].

Numerous objective and subjective methods and measurement techniques exist for assessing physical activity. Each of these methods has its limitations and strengths. The variety of methods indicates that no single method can fully cover a person's total daily physical activity behaviour.

Objective methods

Among objective methods and techniques to assess physical activity, we in this thesis used an aerobic capacity measure and a combination method.

Aerobic capacity measured as maximal oxygen uptake (VO_{2peak}), is an indirect measure of physical activity [13], and is seen as the best single marker for aerobic fitness [24]. VO_{2peak} is either measured directly in a laboratory (using a treadmill or cycle ergometer) or indirectly by maximal exercise tests with a standardised protocol in the field. Aerobic capacity can be assessed in two ways; maximal tests or sub-maximal test. Direct measurement requires specialized equipment measuring volume and gas concentration of expired and inspired gas concentrations, in order to measure maximal oxygen consumption. These gas exchange tests are based on the Douglas bag method, which is the gold standard for measuring VO_{2peak} [25]. The sub-maximal tests are less precise, as they are built on several assumptions as predicted heart rate and a linear relationship to the workload. The advantages of these tests are that they are easy to perform, and large groups can perform the test at the same time. Some of these tests also have shown acceptable reliability and validity [26, 27]. In the validity study we used treadmill for the maximal test with a standardised protocol for adolescents, because this is the best single marker for cardiorespiratory fitness.

During the last decade several combination methods for physical activity measurements have been developed. These methods often combine techniques such as motion and heart rate monitoring. Combining several methods utilises the unique advantages of each method, thereby eliminating some disadvantages of each method used alone [28]. The ActiReg® is an example of an instrument that combines body positions and heart rate [29]. This instrument is validated against the doubly labelled water (DLW) method [30], and does not need heart rate monitoring. In the validation study we used the ActiReg® to measure physical activity level and total energy expenditure continuously during seven consecutive days.

Other objective methods and techniques, not used in this thesis, are pedometers, accelerometers, heart rate monitoring, doubly labelled water, calorimetry and others.

Another available instrument in the combination methods category is the Actiheart, which combines heart rate and motion sensing. Both these instruments provide better data for low intensity, and allow classification into low, moderate and high activities. Even newer products make it possible to combine GPS (Global Position System) and cellular phone data, and make it possible to measure distance, altitude and speed.

The *doubly labelled water* (DLW) (radio-labelled isotope; $^{2}H_{2}{}^{18}O$) method measures total energy expenditure (TEE) by observing the differences between the declines in labelled oxygen and hydrogen isotope (The deuterium, $^{2}H_{2}$ and oxygen, ^{18}O diffuse throughout the body's water). The carbon dioxide production rate can be calculated, and it represents the expended energy. This method is considered the golden standard for measuring energy expenditure (EE) in free-living conditions [31-33]. The DLW technique has several advantages in EE measurement, but is very expensive and not suitable for large studies. The DLW method does not give any specific information about the elements intensity, frequency or duration of physical activity.

Calorimetry measures physical activity by heat production, produced by body movement by skeletal muscles. In *direct* calorimetry the heat production is measured in a calorimetric chamber. In *indirect* calorimetry, energy expenditure is calculated from O_2 consumption and CO_2 production (respiratory exchange ratio of CO_2 and O_2). The method is considered as a valid measure of short-term energy expenditure, but is difficult and impractical to study continuous measurements over time and in population studies, because it is usually needs a mouthpiece or a mask connected to a stationary or portable device that captures gas exchange.

Pedometers are simple electronic devices, worn on a belt or waistband and respond to vertical movement, for instance walking. The device estimates mileage walked or number of steps taken over a period of time. Several validation studies indicate that some pedometers may be suitable for population based assessments of physical activity [34], but pedometers only provide data on steps taken and will not capture activities such as cycling, swimming, skiing and position movements like weight lifting.

Accelerometers are more sophisticated electronic devices that measure acceleration of the body by piezoelectric or seismic sensors in one (vertical body axis), two (vertical and medio-lateral or vertical and anterior-posterior) and three (vertical, medio-lateral and anterior-posterior) directions [35]. Accelerometers provide an objective, usable tool for assessing physical activity. They have been extensively tested for validity and reliability in large studies [36, 37]. Validation studies to established cut-off limits for different intensities have also been performed [38]. In future epidemiological population studies an objective measure like validated accelerometers might be a good choice.

Heart rate is an indirect measure of physical activity, as heart rate is a direct physiological response to physical activity. The basis of this measure is the linear relationship between heart rate and energy expenditure in exercise/activity involving large muscle groups, and other changes in response to body movement [39]. But this relationship is not robust during low grade activities, and heart rate can be affected by other factors than body movement, such as psychological and environmental stress [40] and medication. This physiological influence is a drawback for this method, but heart rate monitoring is a valid means of estimating energy expenditure and provides valuable insight into young people`s physical activity patterns [41].

Subjective methods

The most common methods for measuring physical activity in large epidemiological studies are subjective methods (self-reported methods). Physical activity *questionnaires* are the most widely used self-reported instrument, and the method used in this thesis. Questionnaires are easy to administer and cost-effective, but are hampered by low accuracy related to recall bias, social desirability bias, deliberate misrepresentation and other biases. Physical activity questionnaires vary greatly in design and detail. Most physical activity questionnaires are designed to measure several dimensions of physical activity reporting the mode and type of activity, and also provide intensity, frequency and duration of physical activity, that typically are recall questions that contain 1-8 items [42]. Thus it may be possible to rank individuals according to differences in physical activity levels. The challenge of physical activity questionnaires is to capture the different domains in which activity occurs (leisure time, occupation, transport) and the various dimensions of this activity [43]. The complex nature of physical activity itself, along with the diversity of contexts and uses of scores makes the measure complex [22]. However, by taking into consideration the complexity and using appropriate terms for the population targeted (children and adolescents, adults and the elderly), self-reported questionnaires are suitable for epidemiological studies and as a screening tool in a clinical setting. However, one should consider that all research should include an objective method to validate the information given in the questionnaire [44]. A recent review article found that only a limited number of standard physical activity questionnaires had acceptable reliability and validity [45].

Self-reported physical activity by *diary* or *log* is not common in large epidemiological studies, but several smaller population studies and clinical studies have used this method. The log was used as a measure in the validity study (paper1), mainly as a control for the objective measure. Both diary and log methods should provide a detailed record of an individual´s physical activity pattern, and capture the time spent physically active in different intensities, sitting, in which domain and type of activity [46]. The diaries are often less structured than logs, but often give more detailed information. But on the other hand, a diary is more inconvenient for the participants.

Direct *observation* is often used as a criterion measure for physical activity in children due to flexibility in procedures and greater comprehensiveness than questionnaires [34]. Typically the observer uses specific observational systems and records physical activity levels into a coding form. The strengths of direct observations include the ability to gather information of a detailed physical activity pattern in different settings [47]. However, the method is labour- and time consuming, and it could also be hampered by subjective judgement by the observers.

Measurement methods used in this thesis

For this thesis it was important to validate the physical activity questionnaires we wanted to use in the longitudinal cohort study (paper 2 and 3). For practical reasons only self-reported physical activity questionnaires were applied in the HUNT Study.

For the validity study (paper 1), we used two objective methods, the ActiReg (total energy expenditure (TEE) and physical activity level (PAL)) and aerobic capacity/physical fitness (VO_{2peak}). To select an appropriate comparison measure several validation criteria were used [48]. Each of these different measures has disadvantages and advantages, and the methods used in paper 1 were based on the dimensions of physical activity. The energy consumption was a measure of total activity (frequency and duration), and aerobic capacity as a direct measure of physical fitness. Physical fitness is an indirect measure of the intensity dimension in physical activity behaviour, and studies that have analyzed the relationships between physical activity and aerobic fitness have reported weak to moderate associations [49, 50]. However, fitness has been related to total and cardiovascular mortality and heart disease, and is considered as the gold standard in assessment of exercise tolerance [51]. Based on the available measurement tools and the literature, the

ActiReg and physical fitness (measured as VO_{2peak}) were chosen as objective methods in paper 1.

1.4 Physical activity in adolescence

Several studies have assessed physical activity in adolescents, but lack of consistency and accuracy in the assessment of physical activity make it difficult to compare results. The physical activity guidelines that suggest that children and adolescents should participate in moderate to vigorous physical activity (MVPA) for 60 min/day are widely accepted and implemented [52, 53]. Using this high cut-off of physical activity, studies may be compared and prevalence of adequate physical activity related to the recommendations might be observed.

Prevalence according to guidelines

Worldwide, the physical activity level among adolescents is low. Hallal et al. have recently combined information from the Global School-based Student Health Survey (GSHS) [54], and the Health Behaviour in School-aged Children (HBSC) Survey in 2000-01 [55]. These data indicate that 80.3% of 13-15 year olds did not meet the 60 min/day recommendations [56]. This is a higher proportion compared to the Young-HUNT Study, where in this age group 13-19 years 72.7% in 1995-97 (figure 3) and 59.5% in 2006-08 (figure 4) did not meet the recommendation. The high physical activity group in figure 3-5 is comparable to the recommendations of at least 60 min per day, because this is requested in spare time, and in addition all Norwegian pupils have two hours of physical activity or more included in their school hours per week.

Gender and age

A higher proportion of girls than boys are reported not to meet the recommended guidelines, and are less active compared to boys [57-60]. In the Young-HUNT1 Survey (1995-97) 22.3 % of the girls and 32.3% of boys, aged 13-19 years, met the recommendations (figure 3), in accordance with other studies. The gender difference was still the same ten years later in Young-HUNT3 (2006-08), where 35.8% of the girls and 45.3% of the boys did meet the recommendations (figure 4).

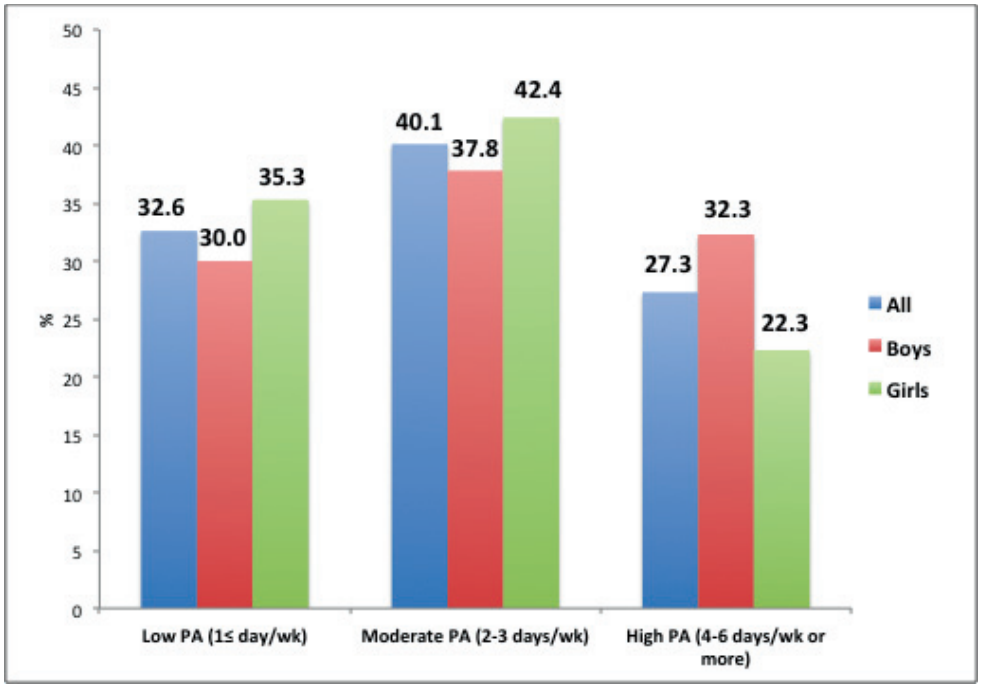

Figure 3. Prevalence of physical activity in Young-HUNT1, 13-19 years old (n=8861)

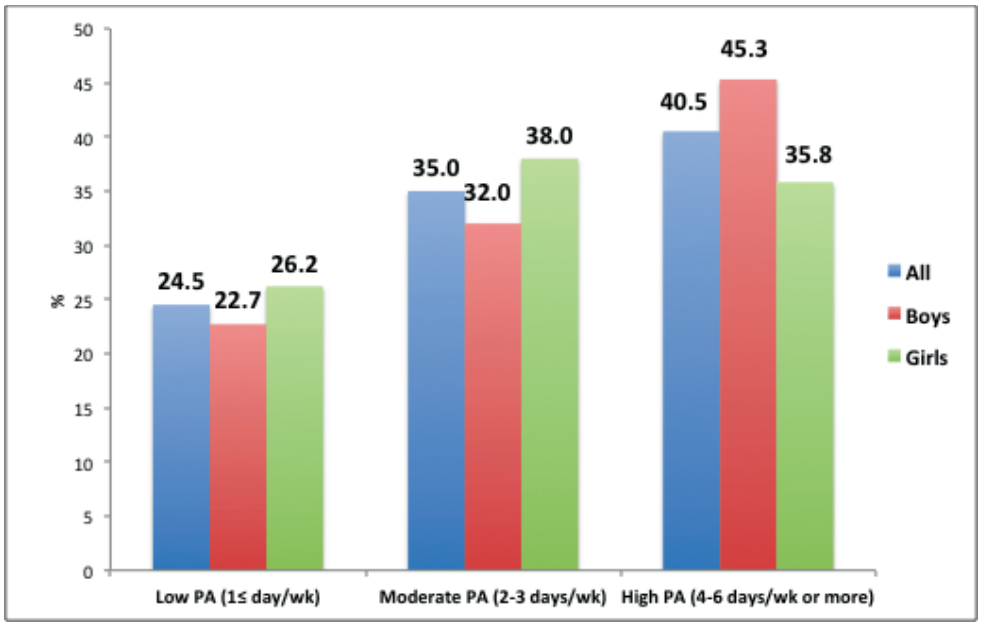

Figure 4. Prevalence of physical activity in Young-HUNT3, 13-19 years old (n=8072)

One of the most consistent findings in physical activity epidemiology is that physical activity decreases with increasing age [61, 62]. Most of the studies are cross-sectional, and there is a lack of longitudinal studies that study physical activity levels from childhood into adolescence. Cross-sectional data from Oslo (Norway) indicate which proportion of girls and boys who meet the recommendations for physical activity among six, nine and 15 year olds [63]. Among the six year olds, a total of 87% of girls and 95.7% of boys followed the recommendations. Among nine year olds 69.8% of girls and 86.2% of boys acted accordingly, while corresponding data among 15 year old girls and boys were 43.2% and 58.1% respectively, with significant differences between the genders.

This decline in physical activity with increasing age was also seen in the HUNT Study. Figure 5 shows the prevalence of physical activity for each year group from age 13 to 19 years old. Among the 13 year olds, 44.4% met the recommendations (high physical activity) while among the 19 year olds this prevalence had declined to 28.7%. The decline in physical activity with age among adolescents is seen in other studies [64], so are the differences between boys and girls [65].

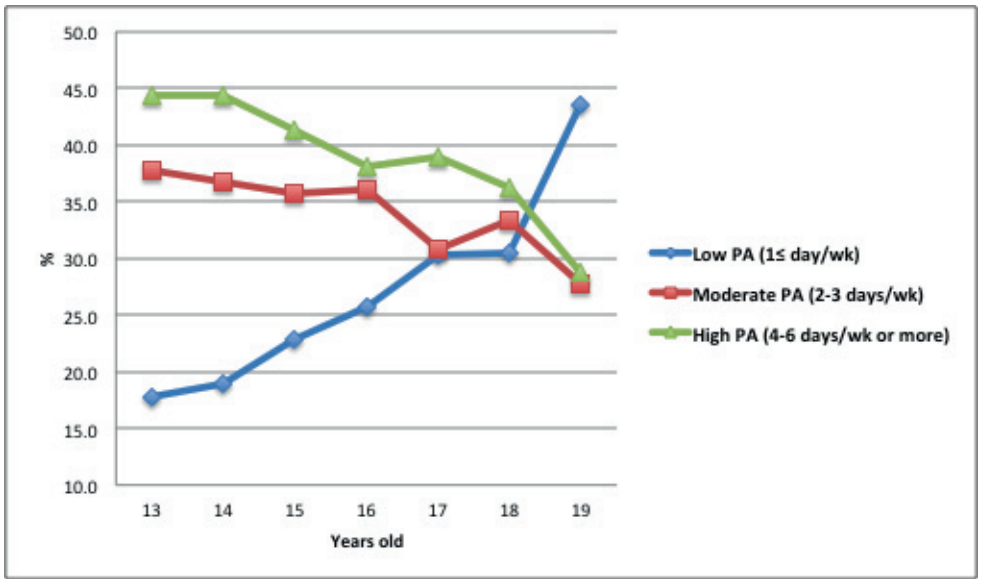

Figure 5. Physical activity level in different age groups, in Young-HUNT3 (n=8031)

Trends

Because of the limitations of self-reported physical activity, one should be careful presenting absolute prevalence and study trends. It is a common belief that children today are less active than they were in previous generations. However, there are few scientific data that confirm this belief, and there is a significant gap in physical activity monitoring, compared with surveillance of chronic disease risk factors, and internationally significant lack of comparable data [66, 67]. Data from the HUNT Study indicate an increase in vigorous physical activity (prevalence) from 27.3% to 40.5% in a ten-year perspective. This is in accordance with other country specific data, revealing an increase in vigorous physical activity both in girls and boys [68]. Conversely, related to other domains of physical activity, several studies have found that physical activity as part of physical education at school [69] and use of active transportation has decreased [56]. Several studies have documented that active transport can enhance physical activity in the entire population [70, 71].

1.5 Physical activity and health

It is well documented that physical inactivity represents a major health problem, and physical inactivity has been identified as the fourth leading cause of death [12, 72]. The health benefits of physical activity is widely demonstrated in the literature, and there is strong evidence of the associations between physical activity and several health outcomes [73]. It has been shown that physical activity reduces the risk of several non-communicable diseases (NCDs), such as coronary heart disease, type 2-diabetes, hypertension and cancer [74]. The World Health Organisation (WHO) has estimated that 63% of global deaths in 2008 were due to NCDs [75], and the global increase in NCDs was the main topic in UN's general assembly in 2012

Compelling research demonstrates that a low level of physical activity are associated with an increased risk for morbidity and mortality [8]. However, the relationship between physical activity and health is complex. Regular physical activity at a certain frequency and intensity will increase health related fitness [76], which indicates that the health benefits is mediated by fitness. This complexity is further enhanced, as the connections of of physical activity or physical fitness to health are not necessarily causal paths. Regular

physical activity can affect physical fitness, and is positively associated with health. But healthy individuals are even more inclined to be physically active.

Table 1. Health benefits of regular physical activity (adapted from World Health Organisation: Global health risks: mortality and burden of disease attributable to selected major risks. In.: World Health Organisation; 2009)

Condition	Effect
Cardiovascular disease	Reduced risk
Hypertension	Reduced risk
Overweight and obesity	Reduced risk
Diabetes	Reduced risk
Cancer	Reduced risk
Musculoskeletal health	Improvement
Mental health	Improvement
Functional health and prevention of falls	Reduced risk

Table 1 lists some of the major health challenges facing society today. This thesis has focused on physical activity associated with CVD risk factors, overweight and obesity and some aspects of mental health.

Cardiovascular disease (CVD)

The connection between physical activity and cardiovascular disease (CVD) is documented in several randomised controlled trails, showing that physical activity has beneficial influence on blood lipids, lipid proteins, blood pressure and coronary heart disease in adults [77-79]. These observations support the inference that physical inactivity is causally related to the incidence of CVD among adults. In adolescents the literature is less clear, and the association between objectively measured moderate to vigorous physical activity (MVPA) and CVD risk factors in adolescence have been unclear. Some studies on children and adolescents report that increased sedentary time is associated with increased risk factors of CVD. A systematic review by Tremblay et al. concluded that increased sedentary time was associated with several CVD risk factors later in life [80]. Ekelund et al. pooled data from 14 studies, and examined the independent association between MVPA and CVD risk factors [81]. They concluded that MVPA was associated with a favourable

CVD profile in adolescence, independent of sedentary time. But, still there has been a lack of evidence as to whether physical activity in adolescence is associated with more favourable CVD risk profile in adulthood.

Overweight/Obesity

The relationship between physical activity/exercise and overweight/obesity has been studied extensively. Data suggest that physical inactivity is a primary cause of obesity, and in prevention of overweight and obesity physical activity is an essential component [82]. Observational studies have shown that a higher level of physical activity is associated with lower age adjusted body mass index (BMI) in children and adolescents [81]. Still it is unclear whether physical activity is an independent factor for overweight and obesity. This is a paradox, since most physical activity interventions so far have been unsuccessful in improving body mass index or body composition in children and adolescents. One explanation may be that the physical activity interventions have not increased the activity sufficiently to affect obesity [83]. Some theories propose that screen time among children and adolescents leads to increased prevalence of overweight and obesity, because such time will replace physical activity. Ekelund et al. found that body fatness was significantly related to gender, sexual maturity, birth weight, and parental BMI. Moderate to vigorous physical activity was independently associated with body fatness. But they did not find any association between physical activity and body fatness when it was defined by BMI [84].

It is reasonable to conclude that physical activity is strongly related to weight maintenance [85], and that physical inactivity is a major cause of obesity. The need to increase activity is clear. But evidence from systematic reviews and meta analyses show that physical activity interventions have little effect on reducing body mass or on increasing overall physical activity levels in children and adolescents [84, 86]. This is important knowledge for further research and interventions, implying that in the future measurements and interventions must have at least as much focus on overall daily physical activity level, as on specific exercise programs.

Mental health

Mental health problems are a growing burden for public health. Mental health has been defined as a state of well-being in which an individual realizes his or her own abilities, can

cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community [87]. Health promotion in mental health is related to promotion of well-being, prevention of mental illness, and treatment and rehabilitation of people affected by mental illness.

Anxiety and depression are the most common problems, but there are several other conditions that are included in the term such as emotional well-being (e.g. perceived life satisfaction, happiness), psychological well-being (e.g. self-acceptance, hopefulness) and social well-being (e.g. social acceptance) [88].

Cross-sectional data from observational studies demonstrate that physical activity is associated with reduced symptoms of depression and has a small-to-moderate beneficial effect on anxiety reduction and stress reactivity [89]. However, data from prospective studies are more uncertain.

It has been documented that regular physical activity may improve psychological well-being in adults [90], and physical activity is recommended as a tool in therapy for anxiety and depression [91]. Cross-sectional studies have reported that reduced physical activity may increase depressive symptoms [92]. The lack of studies on, and growing concern of psychological and behavioural problems in children and adolescents, supports the need for research with increased focus on the association between physical activity and mental health in childhood and adolescence. A review by Ekeland et.al., using randomised controlled trials, found associations between exercise and improved self-esteem among children and adolescents [93].

A three-year follow-up study among adolescents 15-16 years olds indicated that physical activity influenced mental health three years later [94]. But there is still a lack of longitudinal data [95], especially cohort studies, focusing on associations between mental health problems and different types of physical activity (sports vs. leisure activities and total daily activity) and how these are associated with mental health.

Other health conditions

Hypertension is a major independent risk factor for cardiovascular disease, and the most important modifiable cause of mortality [96]. Regular physical activity is found to lower not only blood pressure at rest, but also reduces the blood pressure response during

physical work [97], and in patients with hypertension [98]. Several longitudinal studies and cross-sectional studies support the relationship between low physical activity and an increased risk of developing hypertension. Even moderate aerobic exercise (three to five times pr. week, during 30-60 min per session) is found to reduce systolic/diastolic blood pressures in normotensives (2.6/1.8 mmHg) and hypertensives (7.4/5.8 mmHg) [99].

Glucose tolerance decreases with increased age and obesity, and exercise has been shown to slow this effect [100]. Type 2 diabetes and obesity tend to cluster with other CVD risk factors. These include raised blood pressure and low HDL cholesterol. This has been termed the 'metabolic syndrome' or 'insulin resistance syndrome' and is associated with low physical activity and fitness. Physical inactivity is a risk factor for type 2 diabetes, because it leads to decreased insulin sensitivity. Several studies have demonstrated that exercise is an important preventive factor against development of type 2 diabetes [101].

A well-functioning musculoskeletal system is an important factor for physical capacity in all ages. Maintaining physical activity throughout life will increase and maintain musculoskeletal health and reduce the decline in functional capacity and the risk of degenerative diseases in the musculoskeletal organs, occurring with increased age and sedentary behaviours [102]. Neck and shoulder pain is an increasing problem due to the decreasing physical activity, and increased stress related to work. A physically active lifestyle is recommended to maintain or increase musculoskeletal and motor fitness to reduce neck and shoulder pain.

2 Objective

The overall aim of this thesis was to investigate physical activity behaviour during adolescence and from adolescence to young adulthood in a Norwegian population. Furthermore, to study physical activity patterns and their relation to indications of impaired health and risk factors for cardiovascular morbidity;

- to study the reliability and validity of self-reported physical activity questionnaires used for adolescents, compared with objectively measured physical fitness and physical activity level (paper 1)

- to study factors predicting changes physical activity levels from early adolescence (13-15 years) to late adolescence (17-19 years), and whether these factors differ between boys and girls (paper 2)

- to study whether differences in physical activity patterns from adolescence to young adulthood have different impacts on metabolic measures and mental health, and whether these factors differ between boys and girls (paper 3)

3 Materials and methods

3.1 The Nord-Trøndelag Health Study (The HUNT Study)

The Nord-Trøndelag Health Study (HUNT) is collaboration between the Norwegian University of Science and Technology, Faculty of Medicine (HUNT Research Centre) and Nord-Trøndelag County Council.

The county of Nord-Trøndelag is located in the central part of Norway, and has a population which is fairly representative for the Norwegian population. The HUNT Study includes a large total population consisting of every citizen of Nord-Trøndelag being 13 years or older, and so far three surveys of the population have been completed. The first Nord-Trøndelag Health Survey (HUNT1) was conducted in 1984-1986, the second survey (HUNT2) in 1996-1997 and the third survey (HUNT3) conducted in 2006-2008.

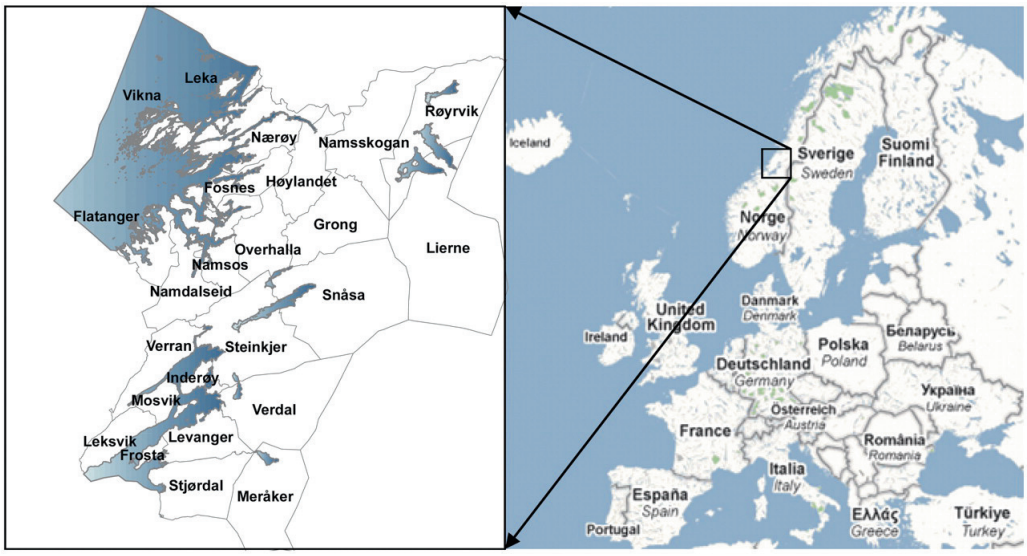

Figure 6. The Nord-Trøndelag Health Study area (Krokstad et al.: Cohort Profile: The HUNT Study, Norway. *International Journal of Epidemiology* 2012; 1-10)

Norway is a European country characterized as a social democratic welfare state, with universal public health insurance coverage and predominately public health services. The Nord-Trøndelag County is one of 19 counties, geographically situated in the central part of the country. The demographic, geographic and occupational structure in Nord-Trøndelag is

fairly representative for Norway as whole. Nord-Trøndelag is mostly a typical rural area, consisting of 24 municipalities with a population of 700 to 21000. The population size is relatively stable (about 129 000 in HUNT3, 2008), and the migration in- and out of the county has been low, except for young adults [103]. About 10% of the population in the age group 13-19 years old [104].

3.1.1 The Young-HUNT Study

The Young-HUNT Study is the adolescent part of HUNT included for the first time in 1995-97 (Young-HUNT1) as part of HUNT2 [105]. All inhabitants aged 13-19 years old (grades 8th and 13th) were invited, and 9141 (90%) participated. A four years follow-up survey of Young-HUNT1 was conducted in 2000-01 (Young-HUNT2) inviting students in the last two years of high school or in corresponding vocational training (aged 16/17–19 years). Totally 77% of the invited adolescents participated. Included in this thesis are participants in Young-HUNT1 who also participated in Young-HUNT2 (paper 2) and those who participated as young adults in HUNT3, in 2006-2008 (paper 3). The Young-HUNT3 survey was a new adolescent cohort as part of HUNT3 and not included in this thesis. Data from HUNT1 and Young-HUNT3 is not used in this thesis.

3.2 Study design and participation

3.2.1 Paper 1

This was a validation study. The study population was recruited from two municipalities in Nord-Trøndelag. The participants, aged 13-18 years old, were randomly selected from four different schools in the included municipalities.

Participation in the study was voluntary. A total of 200 adolescents were invited; 71 participated. With an estimated power of 80%, a sample size of 58 was sufficient to detect a correlation of 0.5 (two-sided) between the scores from the physical activity questionnaires and the objective measures.

Reliability

The reliability of two commonly used questionnaires to measure physical activity was evaluated applying a test-retest design. The questionnaires were completed two times; at first before applying objective measurements and the second time 8-12 days later.

Validity criteria

Criterion validity was assessed comparing the self-reported physical activity questions in the WHO HBSC questionnaire and the IPAQ, short version (appendix 1) with physical fitness (cardiorespiratory fitness) measured by VO_{2peak} and physical activity measured continuously for seven days by the ActiReg. Cardiorespiratory fitness reflects the ability to transport and utilise oxygen during prolonged, strenuous physical activity. Physical activity was measured as total energy expenditure (TEE) and physical activity level (PAL), applying the ActiReg continuously for seven days.

3.2.2 Paper 2

In a longitudinal design this study included the 2348 adolescents who participated in both Young-HUNT1 (aged 13-16 years) and four years later in Young-HUNT2 (figure 7). Data from the adolescents' parents who participated in the HUNT2 survey were also available through linkage with the National Family Register.

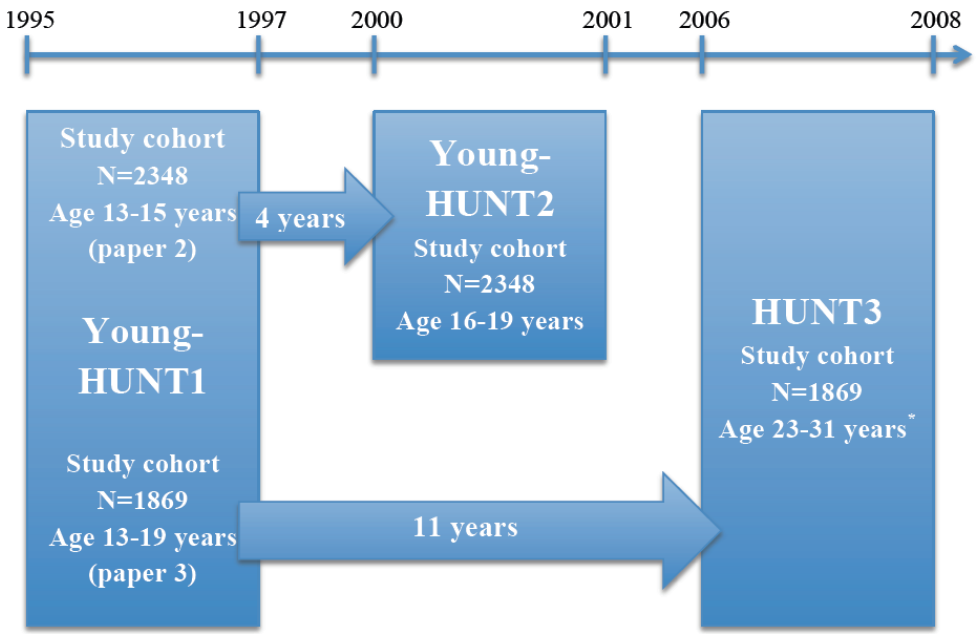

Figure 7. Flow chart of the population used in paper 2 and 3 (*Some of the participants was 23 years and 31 years in this 11-year follow-up, because the data collection was done over a period of two years).

3.2.3 Paper 3

This was an 11-year follow-up of the 2172 Young-HUNT1 participants who also participated in the adult part of the HUNT3 Study carried out in 2006-08. A total of 303 persons were excluded from the analysis because they had insufficient blood results. In the present analysis, the study cohort sample comprised 1869 individuals (838 males) who participated both in Young-HUNT1, aged 13-19 years old and HUNT3, aged 23-31. Age groups 13, 23 and 31 were not complete and consisted of some who belonged to the right year group, but were not yet 14 or 24 years when examined in Young-HUNT1 or HUNT3, and some who were examined.

3.3 Variables used in this thesis

In the HUNT surveys all participants completed self reported questionnaires and clinical examinations. In the adult part of HUNT2 and 3 venous blood samples were also collected (used in paper 3).

In Young-HUNT participants completed a self-administrated questionnaire during one school session in an exam setting. Within a month specially trained nurses visited all

schools for the clinical examination. Adults attending HUNT3 completed the questionnaires at home and delivered them when they met at screening stations for the clinical examination and collection of blood samples. More comprehensive descriptions of the HUNT surveys are given elsewhere [105, 106]. Additionally, in the validation study (paper 1) we also measured physical activity and cardiorespiratory fitness with objective measurements.

3.3.1 Anthropometric measures

Height and weight were measured according to the same standardized protocols with participants without shoes and wearing light clothes. Height was measured to the nearest 1.0 cm (nearest 0.5 cm in adults) by a calibrated wall-mounted measuring instrument, while body weight was measured to the nearest 0.5 kg (nearest 0.1 in adults) using a calibrated laboratory scale.

BMI in adolescents was assessed by using age and sex specific BMI cut-offs, applying the International Obesity Task Force cut-off values (ISO BMI) for children and adolescents [107]. The WHO definitions of normal weight, overweight and obesity were used as cut-offs when data were dichotomised in adults [108].

Waist circumference was used as an exposure and indicator of central adiposity in paper 3. Waist circumference was measured to the nearest 1.0 cm using a non-elastic measuring tape, assessed after maximal expiration, and measured at the umbilicus or midway between the subcostal margins and the iliac crests, if the latter was largest.

3.3.2 Physical activity assessments

Physical activity questionnaires

The WHO HBSC Physical Activity Questionnaire used in Young-HUNT has been used in the Health Behaviour in Schoolchildren Study (HEVAS/HBSC) in Norway [55, 105, 109], and also in other adolescent studies.

The questionnaire records the respondent's physical activity level in sports and exercise outside of school hours, by asking the adolescent to report the frequency and total amount of time spent exercising vigorously to the point where they got out of breath or sweated. In paper 1, these questions were independently recoded into three categories of physical

activity for both frequency and duration. “Low activity” represents “one day a week or less” combined with “one hour a week or less”; “moderate activity” represents “2-3 days a week” and “2-3 hours a week”; “high activity” corresponds to “four days a week or more” and “four hours a week or more”. We also validated the International Physical Activity Questionnaire (IPAQ), short version, in paper 1, to see how these questions intended for adults, corresponded to measured activity in adolescents [110]. This questionnaire inquires about activity during the last week. The questions focus on four activity types performed in sessions of at least 10 min: “vigorous activity”; “moderate activity”, “walking” and time spent “sitting” on weekdays. Frequency of activity is measured in days and duration in hours and minutes. Answers from the IPAQ were classified into three categories; “low”, “moderate” and “high” physical activity as defined by the IPAQ working group [110].

Based on the results from validity study (paper 1) we used the frequency question from the WHO HBSC surveys as primary physical activity assessment in adolescence in paper 2 and 3. Based on the international recommendations, the physical activity variable in paper 2 was recoded as dichotomous based on the following cut-offs: moderate to vigorous physically active less than 4 days/week = “inactive” and moderate to vigorous physical active ≥ 4 days/week = “active”.

In paper 3, we used another cut-off to compare the adolescents` and adult`s questions. The adults questionnaire asks, “How often do you exercise?”. Response alternatives were: “never”, “less than once a week”, “once a week”, “2-3 times a week” and “nearly every day”. Both questions were dichotomised into; “inactive” if the response was <2-3 days/week (adolescence) or <2-3 times a week (adulthood) and “active” if the response was ≥2-3 days/week or ≥2-3 times a week.

Based on the different physical activity categories, we constructed a measurement of patterns of physical activity both from early to late adolescence (paper 2) and from adolescence to young adulthood (paper 3) (figure 8). Those who were active at both time points, were defined as “active maintainers” (AM), while those who had been active and became inactive were described as “relapsers”. Those who moved from being inactive to active were classified as “adopters”, and those who were inactive during adolescence and still inactive at young adulthood were classified as “inactive maintainers” (IM) (figure 8).

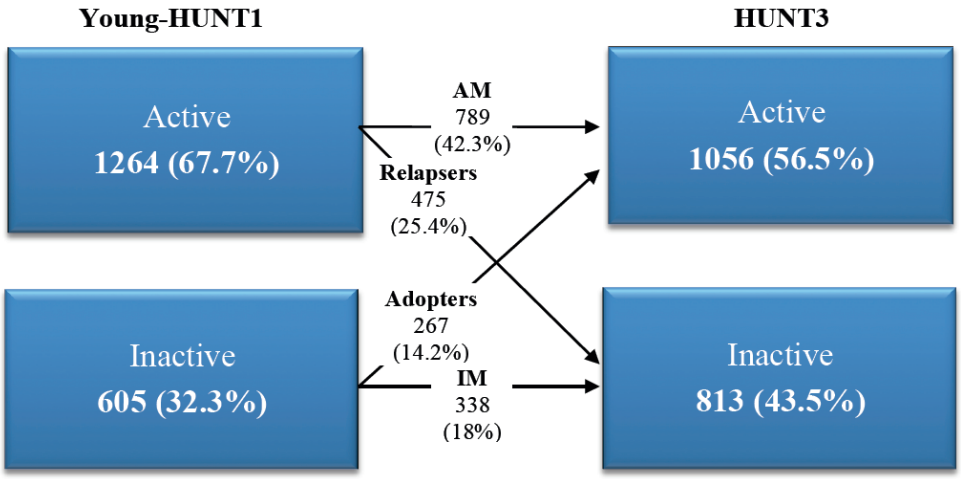

Figure 8. These four physical activity patterns described in paper 3.
AM = active maintainers, IM = inactive maintainers.

Physical fitness

In the validity study (paper 1), physical fitness (cardiorespiratory fitness as VO_{2peak}) was measured using a treadmill, applying the Oslo protocol, designed for children and adolescents [111]. The main criterion for VO_{2peak} was the lack of further increase in O_2 uptake or exhaustion.

The physical fitness test was performed on treadmill at the participants' schools, using a portable metabolic analyser, Metamax II. The data collected were stored, using the program Cortex Metasoft. The Metamax II has been validated applying the Douglas bag technique as the criterion method [112].

VO_{2peak} was defined as the median of the three highest consecutive values. Before each test started, the instrument was calibrated against ambient air and a commercial gas with known concentrations of O_2 (16%) and CO_2 (4%). The concentration of O_2 and CO_2 in room air was recorded, and the flow transducer was calibrated using a 3 –L high-precision calibration syringe (Calibration syringe D, Sensormedics, Yorba Linda, CA).

Activity monitor

The ActiReg (PreMed AS, Oslo, Norway) was used to measure total daily physical activity level in the validation study. This activity monitor recorded both body position and movement, opposed to an accelerometer, which records body position only. The ActiReg distinguishes between four body positions; standing, sitting, bent forward and lying down. Every second the combination between body position and movement are registered, and every 60 seconds, the activity factor was calculated. An especially designed computer program, the ActiCalc, processed the collected data. This program stores all specific data and calculates energy expenditure. Hustvedt et al have published description and validation of the ActiReg.[29].

Physical activity was measured continuously for seven days. The energy expenditure for each day was added up, and total energy expenditure (TEE) and physical activity level (PAL) were calculated. PAL is defined as TEE divided by basal metabolic ratio [24]. The ActiReg calculated a metabolic equivalent (MET) value each minute, which expresses intensity of the activity compared to resting energy expenditure (1 MET = 3.5ml $O_2 \cdot kg^{-1} \cdot min^{-1}$ or 1 $kcal \cdot kg^{-1} \cdot h^{-1}$) [25].

In paper 1, MET values were categorised in low (METs < 3), moderate (METs 3-6) and high activity (METs > 6). Basal metabolic rate was calculated using the Food and Agriculture Organization/ World Health Organization (FAO/WHO) equation [113].

3.3.3 Psychological measures

Mental health was measured with the Cohort of Norway Mental Health Index (CONOR-MHI). The CONOR-MHI includes seven questions asking about psychosocial distress (appendix 3), and is modified from the General Health Questionnaire [114] and the Hopkins Symptom Checklist [28]. The CONOR-MHI has been shown to be a valid measure of mental health status encompassing both anxiety and depression [115]. The CONOR-MHI was analysed both as a continuous and a categorical variable. The categorical variable was constructed by dividing the summary score distribution into tertiles (scores of 1.00–1.79, 1.80–2.29 and 2.30–6.00). Five of the 7 questions (item 1, 2, 4, 6 and 7) were also analysed separately in the logistic regression models. Each question was dichotomized into "no" and "a little, moderately and very much". The answers were

recoded into two categories, and the outcomes were “no” and “a little, moderately and very much”.

Self reported health had four answering alternatives that were combined into two categories; “poor and not so good health” and “good and very good health”. Adolescents’ *body image* was assessed in paper 2. The participants were asked about their perceived body size. They classified themselves as “slim”, “ normal, as others” and “overweight” (appendix 2).

3.3.4 Subjective pain and well-being

Subjective pain and *well-being* were measured among adolescents. The three variables, “headache”, “neck/shoulder pain” and/or “joint/muscles pain” were combined and recoded as “subjective pain” in paper 2. The participants reported their *‘satisfaction with life’*, measured by a question asking: “Thinking about your life at the moment, would you say that you by and large are satisfied with life, or are you mostly dissatisfied?”. Responses were recoded into two categories, “dissatisfied”, (including “a bit of both”, “somewhat dissatisfied”, ”dissatisfied” and “very dissatisfied”) and (“satisfied” including “satisfied and very satisfied”).

3.3.5 Leisure time activities and lifestyle behaviour

Three different behaviours and leisure time activities were measured; time spent 1) playing or listening to music, 2) watching television/video, and 3) time participating actively in sports.

Smoking was defined as smoking cigarettes daily or occasionally. An adolescent who had tried, but had stopped smoking or had never smoked was defined as non-smoker.

Alcohol use was defined by combining the questions about having tried alcohol and information about intoxication. Those who had never tried alcohol or reported never to have been drunk were categorised as “never having been drunk” opposed to “having been drunk once or more”.

3.3.6 Metabolic measures

A non-fasting blood sample was drawn from all participants at follow-up in paper 3 (HUNT3). Serum samples were analysed for total cholesterol (TC), HDL-cholestereol

(HDL-C), glucose and triglycerides. TC was analysed by enzymatic cholesterol esterase methodology, and HDL-C was analysed by accelerator selective detergent methodology. Non-fasting glucose was analysed by Hexokinase/G-G-PDH methodology. Triglycerides were analysed by Glycerol Phosphate Oxidase methodology. The results were reported in mmol/L.

3.3.7 Blood pressure and heart rate

In HUNT3 trained nurses measured blood pressure (BP) in seated participants, with a Dinamap 845XT (Criticon, Florida, USA) based on oscillometry. Blood pressure was measured automatically three times at one-minute intervals. The arithmetic mean of the second and third systolic and diastolic blood pressure readings was used in this study. The resting heart rate (HR) was measured by the Dinamap, and expressed as beats/min.

3.4 Statistical analysis

All statistical analyses were performed with SPSS for Windows, SPSS Inc., Chicago IL, USA (version 14.1, 15.1 and 19.1).

Before recruiting participants to the examinations described in paper 1, we estimated how many we needed based on an estimated effect size of 0.5 and a power of 80% (two-tailed alpha = .05). This estimation was between done scores from physical activity questionnaires and objective measures. These analyses estimated a study sample of 58 participants. Sample size analysis, was done by Sample Power 2.0 (SPSS Inc. Chicago IL)

To evaluate reliability in paper 1, we calculated single measure intraclass correlation coefficients (ICC). Unweighted kappa (two level) coefficients were also calculated, but were quite similar to the ICC and are therefore not reported. A 95% confidence interval (CI) was used to describe the variety/difference in the ICCs. The statistical analyses were performed for the total group and stratified by gender and age.

To assess the validity of the physical activity questionnaires, Spearman rank correlation was used between the questionnaires and the objective measures (VO_{2peak}, TEE and PAL).

Descriptive analysis

Descriptive data were analysed by cross tabulations (paper 1 and 2), and presented by means, standard deviations and 95% confidence intervals. In paper 3, the participants' characteristics were calculated as means (±standard deviation) and percentages. ANOVA with Scheffé's method for post-hoc contrasts was applied to test the differences between means. P-values (significance level $p<0.05$) and F-statistics were presented from these analyses. This is a flexible and conservative post hoc procedure, and is a preferable method for comparisons that involve contrasts of more than two means at a time. The Scheffé method corrects alpha for all pair-wise or simple comparisons of means and for all complex comparisons of means as well.

Logistic regression

Multiple binary logistic regression analysis was used in both paper 2 and 3. To study associations between predictors at Young-HUNT1, and whether participants had changed or maintained physical activity 3.9 years later at Young-HUNT2, separate logistic regression models were performed for each predictor at baseline, stratified by gender and adjusted for age (paper 2). We also adjusted for possible confounding in the different models for each predictor. Results from these adjusted models did not change the results. In all models, physical activity at follow-up was the dependent variable (paper 2). Separate analyses were done for the adopters, relapsers and maintainers.

Statistically significant interactions were found between gender and most of the predictors, therefore gender specific analyses were performed. Results are reported as adjusted odds ratio (OR) for odds of decreased or increased physical activity, with two-sided *p*-values and 95% confidence intervals for OR.

To examine the relationship between physical activity patterns and mental health and satisfaction with life in paper 3, regression analyses were also done in separate models. The analysis compared physical activity patterns from adolescence to young adulthood (inactive maintainers (IMs) vs. active maintainers (AMs) and IMs vs. adopters) and outcome (perceived health, satisfaction with life and mental health status) at follow-up. Gender specific analyses were performed, and all analyses were age adjusted.

Linear regression

We used separate linear regression models to investigate associations between physical activity and each of the different CVD risk factors (paper 3). First, physically active maintainers (AMs) were compared to inactive maintainers (IMs), unadjusted and adjusted for age and gender, to examine the linear relationships between CVD risk factors and physical activity maintenance. Second, we grouped relapsers, adopters and IMs and compared them against AMs to investigate the relationship with CVD risk factors. In addition, we also separately examined the linear relationships by comparing adopters against AMs and adopters against the common group of IMs and relapsers. We also combined IMs and relapsers, and compared them with AMs and investigated the associations with CVD risks factors and mental health (not shown in tables). On the basis of these analyses, we stratified analyses by gender and repeated the same analyses.

In our linear regression models, we also compared those who became physically active (adopters) against those who were physically inactive (inactive maintainers), to test the hypothesis that increasing physical activity is associated with health benefits compared to those remaining inactive. We also combined IMs and relapsers and compared them with adopters to further investigate these associations. All linear regression variables was tested for normal distributions.

3.5 Ethics

The Regional Committee for Ethics in Medical Research and the Norwegian Data Inspectorate approved the HUNT2 and HUNT3 surveys as well as Young-HUNT1, 2 and 3. All principals and school authorities of secondary and high schools approved the studies in Young-HUNT and the validation study. Written information about rights for protection of privacy and future use of the data was delivered to each participant, who signed a consent form after reading the information. For students under the age of 16, parents or guardians also gave their written consent.

Statistics Norway (SSB) did a randomized selection of pupils in the four selected schools, and 200 participants were invited to the validation study (paper 1). The teachers at the schools distributed the invitation. The Regional Committee for Ethics in Medical Research approved all studies in this thesis, in addition paper 1 was approved by the Norwegian Data Inspectorate.

4 Results

4.1 Paper I

Reliability and validity of two frequently used self-administered physical activity questionnaires in adolescents

Aims

We investigated the reliability and validity of two different physical activity questionnaires in 71 adolescents aged 13-18 years; the WHO, Health Behaviour in Schoolchildren (HBSC) questionnaire (physical activity questions applied in the Young-HUNT Study), and the International Physical Activity Questionnaire (IPAQ, short version).

Methods

Validity was assessed by comparing the physical activity questions with cardiorespiratory fitness (VO_{2peak}) and seven days activity monitoring with the ActiReg, measuring physical activity level (PAL) and total energy expenditure (TEE). The reliability was assessed by test-retest design, 8-12 days apart.

Results

For the total population, a statistically significant correlation was found between VO_{2peak} and the questions on both frequency ($r = 0.39$) and duration ($r = 0.33$) in the WHO HBSC questionnaire. The correlation was also significant when the answers were divided into three categories. Girls had a higher correlation between the WHO HBSC questionnaire and VO_{2peak} (r varied between 0.41 and 0.55) compared to boys (r varied between 0.21 and 0.31), and correlations were statistically significant in girls only.

The correlation coefficients of the WHO HBSC questions measured against the total energy expenditure and physical activity level was low.

Vigorous activity (days per week) measured in the IPAQ and classified into three categories, was significantly correlated with VO_{2peak} (All; $r = 0.32$; girls $r = 0.43$). Vigorous activity (minutes per day) and walking (minutes per day) in the IPAQ correlated negatively with VO_{2peak}, indicating that more minutes of both vigorous activity and walking were associated with a lower VO_{2peak}. There was, however, a significant

correlation between the IPAQ expressed as walking (minutes per day) and VO_{2peak} for girls (r = -0.41).

The correlation coefficient between the IPAQ questions and physical activity level was significant for walking (minutes per day) in both genders combined (r = 0.43) but only for boys when split by gender (r = 0.61). The IPAQ question on sitting (minutes per day) showed a significant negative correlation with physical activity level for boys (r = -0.68) and was significantly correlated with total energy expenditure in girls (r = 0.54). The other associations between the IPAQ questions and the ActiReg measures had a low correlation and were not significant.

The WHO HBSC questionnaire indicated a substantial overall reliability (frequency r = 0.73 and duration r = 0.71). Significant differences were found between girls and boys on the WHO HBSC frequency question (r = 0.87 and r = 0.59 respectively), and between age groups on the duration question (13-15 years r = 0.62 and 16-18 years r = 0.85).

The overall reliability of the IPAQ questionnaire varied for the different physical activity categories (from walking (days/wk); r = 0.62, to walking (min/day); r = 0.10), but had in general a lower reliability than the WHO HBSC questionnaire.

Conclusions

The WHO HBSC questionnaire had a substantial reliability and was an acceptable instrument for measuring cardiorespiratory fitness, especially among girls. None of the questionnaires seems however to be a valid instrument for measuring physical activity compared to total energy expenditure and physical activity level in adolescents.

4.2 Paper II

Factors predicting changes in physical activity through adolescence; the Young-HUNT Study, Norway

Aims

The main purpose of this four-year prospective analysis was to investigate factors that may explain changes in levels of physical activity during adolescence. We also investigated whether these factors differed between boys and girls.

Methods

Data presented were from 2,348 adolescents and their parents who participated in the Nord- Trøndelag Health Study, Young-HUNT1 or HUNT2, 1995–1997 and at follow-up in Young-HUNT2, 2000–2001. Participants completed a self-reported questionnaire and participated in a clinical examination including measurements of height and weight.

Results

Inactive girls reporting subjective pain occasionally or often at baseline, had a reduced likelihood of becoming physically active at follow-up (OR 0.6, 95% CI 0.4-0.9). Inactive boys who perceived themselves as overweight, had a reduced likelihood of becoming active compared to boys with self-perceived "normal weight". Being overweight and satisfied with life was not associated with increased physical activity in any gender.

Those who did not participate actively in sports and/or attended vocational subjects in high school had a lower likelihood of adopting physical activity, than those who were active in sports and/or attended academic subjects. Leisure time recreational activities or lifestyle factors did not influence changes in physical activity during adolescence.

Boys having mothers with college/university educational attainment were more likely to increase their physical activity than boys having mothers with lower educational attainment. This was, however not found in girls. Girls with a physically active father showed an increased chance of adopting physical activity (OR 1.8, 95% CI 1.1-3.1).

Overweight at baseline was associated with an increased risk of relapsing physical activity among boys but not among girls. However, both boys and girls who characterized themselves as overweight at baseline had a significantly higher likelihood of decreasing their physical activity, compared to those who considered their weight as normal. Dissatisfaction with life was also associated with decreased physical activity among boys. Subjective pain did not predict reduction of physical activity.

Leisure time recreational activities were associated with relapse among boys, while lifestyle factors, such as smoking and alcohol use were important predictors for relapse in girls. Boys who listened to music or played a music instrument four times or more a week and those who did not participate actively in sports had a greater risk of relapse, as did girls who were smokers, had been drunk once or more or were studying vocational subjects in high school.

Adolescents with highly educated parents had a lower risk of relapse than those who had parents with low education. Girls with highly educated mothers had a reduced risk of relapse, while boys having fathers with high education, had a 50% reduced risk of relapse. Girls, who had a physically active mother, had a 60% reduced risk of relapse.

Boys who were dissatisfied with their life or considered themselves as slim or overweight were significantly more likely to be inactive maintainers. Both boys and girls, who did not participate actively in sports, were 13-14 times more likely to remain inactive, compared to those who were active in sports. Smoking in both genders, and alcohol use for girls predicted greater rates of inactive maintainers.

Adolescents choosing vocational subjects in high school were more likely to remain inactive, than academic subjects students. The adolescents (both genders) of mothers who had attained high school education were less likely to remain inactive, than children of less educated mothers, but this was only true for fathers' education in relation to their male offspring. Maternal activity predicted girls not remaining inactive, but fathers' activity levels did not predict relapse or maintaining in either gender.

Conclusions

Predictors of change or maintaining physical activity during adolescence differed by gender. Dissatisfaction with life, being overweight, and not participating actively in sports were the strongest predictors for reduction of physical activity among boys. Hazardous risk behaviours like smoking and drinking, low maternal education, and maternal physical inactivity were the strongest determinants of decreased physical activity in girls.

4.3 Paper III

Is physical activity maintenance from adolescence to young adulthood associated with reduced CVD risk factors, improved mental health and satisfaction with life: the HUNT Study, Norway

Aims

We investigated whether differences in physical activity patterns from adolescence to young adulthood showed different associations with subsequent cardio-metabolic risk factors and mental health in young adulthood.

Methods

We included 1869 individuals (838 males) participating in Young-HUNT1 (1995-97), aged 13-19 years and followed-up at HUNT3 (2006-08), aged 23-31. Self-reported physical activity, mental health and perceived health were recorded, along with measurements of body mass index (BMI), waist circumference (WC) and several metabolic markers for risk of cardiovascular disease. Physical activity was registered at baseline and follow-up. Physically active maintainers were compared to inactive maintainers. Adopters (physically inactive as adolescents and active as young adults) were compared to inactive maintainers (inactive both at baseline and follow-up) and to those who were active and became inactive (relapsers).

Results

Mean resting heart rate was in both genders significantly lower in active maintainers, compared to the three other physical activity patterns. Among men, active maintainers had significantly lower waist circumference than relapsers and inactive maintainers, and active maintainers had significantly higher HDL-C compared to relapsers. Among females, active maintainers had significantly lower total cholesterol (TC) than adopters.

Adjusted for age and gender, active maintainers had significantly lower waist circumference (WC), lower resting HR and higher HDL-C compared to inactive maintainers. Comparing the remaining groups (combined inactive maintaining+relapsing+adopting) against active maintaining, we found significant differences also for TC, triglyceride levels and BMI.

Compared to adopters, the adjusted analyses showed that active maintainers had a significantly lower waist circumference, heart rate, diastolic blood pressure (BP) and TC. However, compared to the inactive maintainers+relapsers, the adopters did not differ in any of the cardiovascular risk parameters.

Active maintaining men had more favourable risk factor profiles for WC, HR and HDL-C, compared to inactive maintainers. Among females, only HR was significantly lower in this comparison. Comparing adopters against active maintainers, active maintaining men had a

lower HR, and higher HDL-C, and for active maintaining women had a lower HR and diastolic BP. Comparing active maintainers with all others, males had significantly more favourable BMI, WC, HR and HDL-C, and females had favourable WC, HR and diastolic BP. Male adopters did not have a favourable profile compared to inactive maintainers and relapsers, and only HR was lower among adopting females.

Active maintainers reported better self-rated health status, and had lower mental health CONOR scores than IMs. Female active maintainers had a twofold greater likelihood of being satisfied with life, and a reduced risk of feeling nervous or being troubled by anxiety compared to inactive maintainers. Compared to adopters, male active maintainers had an increased likelihood of good cardiovascular risk factor status, satisfaction with life, and a lower likelihood of reporting high CONOR scores or depression. Active maintaining females had greater life satisfaction, compared to adopters. Active maintainers had reduced anxiety compared to other groups.

Conclusions

Those who maintained their physical activity from adolescence to young adulthood had a significantly lower CVD risk and better mental health, compared to inactive maintainers. Compared to inactivity maintainers and relapsers, adopting physical activity was not significantly associated with lower CVD risk. Adopting physical activity between adolescence and young adulthood was not associated with reduced mental distress.

5 Discussion

Based on increasing focus on the importance of physical activity for future health, this thesis has aimed at evaluating measures of physical activity in adolescents and studying changes in, and some consequences of, changes in physical activity during adolescence.

Epidemiology is the study of how the distribution and determinants of disease or health outcomes are in a population, and what factors influence or determine this distribution [116]. There are two underlying premises in epidemiology: human diseases are not randomly distributed and human diseases have causal and preventative factors that can be identified through scientific investigation of different populations or subgroups of individuals within a population [117, 118].

Accuracy is an overall goal in epidemiological studies. To achieve this, a study should be designed and conducted aiming at increasing precision in measurements (lack of random errors) and the validity of the study (lack systematic errors).

5.1 Methodological considerations

Both prospective and retrospective longitudinal studies have been used successfully to study how physical activity levels may have an impact on health and disease. Still there has been a lack of prospective studies in adolescents. Physical activity epidemiology typically incorporates both the assessment of physical activity, as well as intervention efforts focusing on increasing physical activity [119]. To assess physical activity in large-scale population surveys self-reported questionnaires has been the only feasible method, also often used to measure effects of health promotion purposes [120]. It is important that physical activity questionnaires are addressed to the actual population, for instance adolescents, and that they are reliable and valid.

5.1.1 Study design

The validation study (paper 1)

The validation study compared self-reported physical activity with objective monitoring by ActiReg (measuring total energy expenditure) and by VO_{2peak} (measuring cardiorespiratory

fitness) of a randomly selected cohort of adolescents. Validity in regard to physical activity has been defined as the extent to which an instrument assesses the "true" level of physical activity [121]. This is complex because of the multidimensional nature of physical activity. A limitation for validation studies of physical activity is the lack of a "gold standard", which incorporates all the three important dimensions; frequency, intensity and duration that reflect the physical activity pattern. The advantage of our design is the use of two objective measures to validate the physical activity questions. The ActiReg measures energy expenditure and physical activity level, while peak oxygen uptake reflects aerobic fitness.

The epidemiological studies (paper 2 and 3)

The longitudinal study in paper 2 had a four-year follow-up period, by many regarded as too short to be able to detect significant changes. However, the focus in this study was change during adolescence, which in itself has a limited time perspective. As strong significant associations between the exposure variables and physical activity patterns were found, the four-year follow-up seemed sufficient.

The prospective study design made it possible to obtain information about the change of physical activity over time. Both baseline and follow-up data were used to categorize participants into different levels of stability in physical activity during the two time points.

A limitation to this design could be the lack of possibility to track changes in physical activity between baseline and follow-up. This is most important in paper 3, with 11 years of follow-up. Some additional analyses were done on the sample of 574 adolescents who participated at all three time points (Young-HUNT1 and 2 and HUNT3) making it possible to study one time point between baseline and follow-up by measuring physical activity four years after baseline (Young-HUNT2), thus showing whether changes in physical activity occurred already during the first four of these eleven years. We found that as many as half of the participants who changed their activity did so during the first four years of the eleven year follow-up period. We thus do not believe that our results are hampered by a majority changing behaviour shortly before follow-up. If that were the case, would have impact on likelihood of our associations.

5.1.2 Precision (Lack of random error)

Precision refers to that reproducibility of results under unchanged conditions and how well the results can be determined, irrespective of how close the results are to the "true" value [122]. In epidemiological studies, a high number of subjects and a high response rate would increase the precision.

In this thesis precision was indicated with statistical significance quantified by p-values or confidence intervals, to evaluate whether the observed value, or a more extreme value, was caused by chance or not. P-values at ≤ 0.05 were used to assume that the probability of the observed result being by chance was 5% or less. The Young-HUNT surveys are large comprehensive population based studies, and in generally the estimates in paper 2 and 3 showed high precision with narrow confidence intervals. This large sample made it possible to detect the sub-groups differences in associations (the four different physical activity patterns). However, in paper 3 some associations that included the adopting group, had fewer participants, especially among males and these estimates was less precise.

5.1.3 Validity (Lack of systematic error)

Validity is the extent to which a concept, conclusion or measurement corresponds accurately to the real world. The validity of a measurement tool is considered to be the degree to which the tool measures what it claims to measure [123]. Validity can be divided into internal validity and external validity.

Internal validity

Internal validity is defined as to which extent the results of an observation are representative for a particular group of people under study. Based on the definition, one can draw inferences between two variables if the causal relationship is properly demonstrated. This depends on the extent to which the study has been able to eliminate systematic errors [123]. The most important threats to internal validity are bias and confounding.

A systematic error or bias occurs when there is a difference between the true value (in the population) and the observed value (in the study) from any other cause than sampling variability [124].

Three types of biases can reduce internal validity; selection bias, information bias and confounding.

Selection bias

The selection of a study population is essential for the generalisability of the study results, and may be influenced by many factors. The final study participation is dependent on a number of factors, which either separately or together may influence results in the population the study is representing.

To prevent a potential selection bias in the validation study a random sample from the four largest schools in two of the most populous municipalities in Nord-Trøndelag was selected. A random sample of 200 pupils aged 13-18 years in these schools were invited to the study, and 71 fully participated. The rather low response rate of 35% might cause a risk of overrepresentation of physically active adolescents, representing a selection bias. The participants' physical fitness (VO_{2peak}) was, however, comparable to other similar Norwegian studies [125] also to a study performed in the Young-HUNT3 population [126]. Mean BMI in our participants was comparable to mean BMI in the total Young-HUNT1 population. We therefore do not think that selection bias is an important constraint in paper 1.

Although studies encompassing a very large part of the total population (paper 2 and 3) tend to minimize selection bias, our prospective longitudinal design had some disadvantages associated with non-response (drop-out) at follow-up. If individuals, who participated and remained in the study, showed different associations compared to those who did not participate or were drop-outs (loss-to-follow-up bias), we might have a selection bias. In paper 2, the high response rate (92%) at baseline (age group 13-15 years) indicates that the study cohort in Young-HUNT1 and Young-HUNT2 represented the population well. Still the outcomes in paper 2 and 3 might be different between participants lost to follow-up versus those who remained in the study.

Non-response may be a potential bias, especially in a lifestyle survey [127]. Some studies have reported significant differences in lifestyle between responders and non-responders [128]. The HUNT Study is based on repeated cross-sectional surveys of the total population, also making longitudinal follow-up from Young-HUNT1 to HUNT3 (paper 3) possible. Thus, even if the participation rate in Young-HUNT1 was high, the response rate

in HUNT3 was low in young adults, aged 23-31 (follow-up in paper 3). Young people often may leave the county permanently for education or work and about 1/3 of the Young-HUNT1 participants were not eligible for invitation to HUNT3. What impact this might have had on the results, is difficult to estimate. One might assume that non-participants were less physically active than the participants. Data from HUNT3 were compared to data collected by a questionnaire mailed afterwards to non-participants [106]. Baseline data from Young-HUNT1 was compared between Young-HUNT1 participants who participated in HUNT3 those who did not, showing no significant differences concerning mean BMI, systolic and diastolic blood pressure, heart rate and physical activity [105]. This indicates no significant selection effects on physical activity or health behaviour between the two groups, minimizing the potential selection bias.

Information bias

Information bias occurs when a systematic distortion or error arises from the procedures used for measurements or classification of an exposure or outcome variable. Any data source or data collection can be a source of error. Sources of measurement misclassification errors include any instrument for measuring selected conditions, questionnaires and data interpreting. In addition the respondents may have misunderstood the questions, or may have been unable to recall the requested information (recall bias). But the questions in the HUNT Study used in this thesis, were time-independent, asking about a usual week or covering the last one or two weeks, making recall bias less probable.

Wording of the questions, or applying the wrong term in a selected population may cause under- or overestimation of physical activity. Young people and adults may understand the concept of physical activity and exercise differently from adults, thus causing inaccurate results, especially if questionnaires designed for adults are used. This was one of the reasons why we also included questions designed for adults (IPAQ) in the validity study (paper 1). The validation study confirmed that the WHO HBSC questions used at baseline in the longitudinal studies had an overall good reliability and validity and they were better than the IPAQ questionnaire, which is designed for adults.

We cannot ignore the possibility that some of the variables used in this thesis might be subject to some misclassification. All subjective, self-reported information through questionnaires might be over – or underestimated, and may be interpreted differently by

the participants. But as questionnaires in HUNT were thoroughly filled out and most of the variables in this thesis are validated, we think that this type of misclassification is not of great importance here.

Confounding

A confounder is a variable with an effect that is entangled with the effect of the exposure in such a way that the variable may act as common cause of the exposure and the outcome [129]. Obesity might be a confounder of the relationship between physical activity and high blood pressure, if: 1) Obesity was related to physical activity, but not affected by it; 2) Obesity was related to high blood pressure, but not affected by it. If obesity should be a confounder, both criteria must have been met. Confounding would be present if obesity was a common cause of both physical activity and high blood pressure.

Confounding may cause overestimation, underestimation and even a change in direction of the estimated effect of interest. Confounders, therefore, need to be controlled for, employing statistical procedures to ensure accurate results [130]. In the assessment of which factors should be regarded as potential confounders in physical activity epidemiology, the basis should be prior knowledge about their relations with the exposure (physical activity) and the outcome. Therefore, the inclusion of confounders in the analysis should not be assessed on statistical grounds only, but also take into account the causal pathways. Thus, there are two main ways of handling confounding, by stratification and regressions models [123].

The HUNT Study includes comprehensive data on the participants` health conditions, data on demographics and also family data, allowing for extensive controlling for many confounding factors. Still we cannot exclude the possibility of confounding factors that were not included in the surveys.

Potential confounding was identified by prior knowledge, and in paper 2 and 3 confounding was controlled for by stratification and in the statistical analysis. Stratification was used to separate the gender effects, by running gender specific analyses.

Smoking could be considered a potential confounder for the relation between physical activity pattern and CVD risk factors. Smoking could also be a risk factor, in its own right, for CVD risk factors. But smoking is not necessarily associated with physical activity

behaviour (exposure variable), especially not in adolescence. Therefore, we assumed that smoking was not a confounder for the association between physical activity patterns and CVD risk factors.

We also conducted bivariate crosstabulation of physical activity pattern and smoking. There was no statistically significant difference in proportion of smokers between the physical activity groups.

The association between physical activity behaviour and CVD risk may also be confounded by obesity, which is associated with higher triglyceride and cholesterol levels [131]. Our descriptive data indicated no significant differences in BMI between participants with different physical activity patterns. This lack of differences in BMI between the different physical activity patterns is interesting, especially since the patterns showed differences for CVD risk. Additional analyses examined whether obesity would affect the associations, adjusting for obesity measured as BMI both at baseline and follow-up. These analyses did not attenuate the results, indicating that physical activity and subsequent CVD risk were likely to be independent of obesity.

External validity

External validity refers to whether the causal relationship can be generalised to other persons or cohorts.

Based on our design and selection criteria the participants in the validation study (paper 1) were fairly representative for the adolescent population in Nord-Trøndelag.

The population of Nord-Trøndelag County is fairly representative for Norway as a whole. In Young-HUNT1 all adolescents (13-19 years old) attending school were invited, and the participation rate was high. This strengthens the external validity in paper 2 and 3, and the generalisability towards adolescents and young adulthood. Although Nord-Trøndelag and its population have some limitations compared to other counties in Norway, such as lack of large cities and a slightly lower mean income and mean education level. However, age and gender distribution of adolescents, geography and occupational structure are fairly similar to the rest of Norway.

5.1.4 Reliability

Reliability is synonymous with repeatability. A measurement that yields consistent results over time is said to be reliable. When a measurement is prone to random error, it lacks reliability. The reliability of a measurement places an upper limit on its validity. A measurement that lacks reliability will necessarily be invalid. There are three basic methods to test reliability: test-retest, equivalent form, and internal consistency. In paper 1 we applied the test-retest method, also known as stability. We measured the ability of the physical activity questions to produce consistent results when we measured physical activity once more, under the same conditions. By this we could specify the stability or lack of it. This test-retest method assumes that there is no substantial change in physical activity between the two measuring time points

The time between measures is critical, the shorter time gap, the higher correlation and the longer time gap, the lower correlation. The time gap in our study was 8-12 days, being within the preferable time gap for this method [132, 133]. Physical activity literature has been discussing whether the time interval should be 1-3 days and not greater than 7 days. The time interval should match the instrument that is tested for recall. A seven days recall questionnaire should be retested after seven days, to prevent that the real variation is confounded by the reliability estimation. These coincident periods provide the best estimate for reliability [22]. The WHO HBSC questionnaire refers to an average week, therefore 8-12 days was preferable to avoid the disadvantages related to the length of intervals between measurements. The IPAQ showed differences in reliability for each specific item. Vigorous activity measured by days per week had higher reliability than vigorous activity measured by minutes per day. The same differences were found for moderate activity. This is probably related to the time gap between test-retest.

A commonly used correlation technique for computing correlation between two variables is Pearson r, a bivariate statistic often called interclass correlation. There are several weaknesses of Pearson r. One of them is that two values for the same variable cannot be correlated. This is the case in our study (paper 1). Therefore Pearson r is not an appropriate test for reliability in paper 1. We instead expressed the reliability through intraclass correlation (ICC). ICC uses ANOVA to obtain the correlation coefficient (reliability) and then provides estimates of systematic error variance, allowing that systematic differences between baseline and follow-up, can be examined.

5.2 Main findings

5.2.1 Reliability and validity of WHO HBSC physical activity questionnaire and IPAQ

Our results indicated that the WHO HBSC physical activity questionnaire had substantial reliability concerning frequency as well as duration of physical activity. This is in accordance with other studies [134]. A recent review paper, identified 96 papers with studies that had tested the reliability and validity of physical activity questionnaires. Median reliability correlation coefficients for adolescents were 0.64 and 0.69 (Intra class correlation) [135]. The reliability in these studies was also in accordance with our results.

We also found differences between age groups; WHO HBSC Physical Activity Questionnaire being most reliable for the oldest group. This could be due to differences in the ability to interpret the questions correctly. Those aged 16-19 years might have a better or different understanding of the questionnaires than those 13-15 years old. This was very evident concerning the question of duration, where there was a significant difference between age groups.

The reliability of the IPAQ, was poor to moderate, but showed differences for each item. Vigorous activity (days/week) and walking (days/week) had the best reliability. Other studies on the IPAQ, have shown acceptable or strong reliability in adults [136]. The IPAQ is designed for adults 18-69 years old, and our results in adolescents' are in line with results from other studies on adolescents [137]. This evidence indicates that IPAQ should not be applied in an adolescent population.

The WHO HBSC questions had moderate validity concerning physical fitness. Analysing the different items included separately, the frequency question had a higher correlation than the duration question. This is in accordance with other studies as the majority of studies present low to moderate correlation coefficients for validity in adolescents [45]. A possible explanation for the differences in the dimensions (duration and frequency) is that the frequency question, inquiring days per week, estimates physical activity more precisely than the duration question, requesting hours per week of physical activity. The IPAQ question on vigorous activity (days/week) supported this explanation, as vigorous activity (min/day) had a negative correlation coefficient towards physical fitness. The other items

in IPAQ had a low validity, corresponding to previous research indicating that vigorous activity is easier to recall than light activity [138, 139].

The validity measured against total energy expenditure and physical activity level (ActiReg, 7-day records), was low both for WHO HBSC and the IPAQ. It is difficult to explain the lack of correlation between the questionnaires and the ActiReg, but there are several possibilities. Our descriptive analysis revealed that the answers tended to underestimate physical activity, compared to the objective measure (The ActiReg). Individual variations and the underestimation could explain the low validity compared with physical activity level and total energy expenditure, illustrating the difficulty to capture individual energy expenditure in questionnaires. Comparing physical fitness and the ActiReg, physical fitness measured as VO2peak, might be a more stable measure than physical activity measured as total energy expenditure and physical activity level. Physical activity may change considerably from day to day, and even from one week to the next, while physical fitness does not change considerably in 2-3 weeks' time. A possible bias could be related to the reference period, possibly explaining why we did not find correlations towards total energy expenditure and physical activity level.

5.2.2 Physical activity patterns

Several studies have compared the effects of cardiorespiratory fitness and physical activity as risk factors for cardiovascular disease. They have found a noticeably stronger and more consistent effect for cardiorespiratory fitness than for physical activity [140-142]. There is a common belief that cardiorespiratory fitness is mediated by physical activity level, but if this is true, why then is physical activity not a stronger predictor for CVD risk factors than cardiorespiratory fitness. This could be explained by the fact that fitness is most often measured using precise objective measures as VO_{2peak}, while physical activity have been assessed by using less precise measures as subjective measures [8]. The relationship between physical activity and risk factors for cardiovascular disease might be biased due to fluctuations in activity and individual activity habits due to different reasons. To minimize this, we measured physical activity as a behavior over a certain period of time, and four different physical activity patterns emerged:

1. Those who were physically active at T1, but became physically inactive at T2 (relapsers)

2. Adolescents being physically inactive at T1, but became physically active at T2 (adopters)

3. Those being physically active at both time points (active maintainers)

4. Those who were and stayed physically inactive (inactive maintainers).

The largest group was inactive maintainers (paper 2) and more than half of those who were active in early adolescence became inactive later, leaving 75% of the population inactive at follow-up in late adolescence (17-19 years). This is in accordance with other studies, estimating that the prevalence of inactivity in this age group was about 80% [57, 63]. From adolescence to young adulthood (paper 3) we classified participants in the same four physical activity pattern groups. An interesting finding was that comparing the proportions in the different classes of patterns during adolescence and from adolescence to young adulthood, a higher proportion of active maintainers were registered from adolescence to young adulthood than during adolescence. This could be due to different cut-offs of physical activity in the two papers, thus the prevalence's in the two papers might not be comparable.

On the other hand we found a high proportion of relapsers from adolescence to young adulthood, indicating that the decline in physical activity observed during adolescence, tended to persist into young adulthood. The proportion of adopters was quite similar during adolescence and from adolescence to young adulthood.

5.2.3 Predictors of physical activity change during adolescence

To develop preventive lifestyle strategies in adolescence it is necessary to have information about predictors of both physical activity change and the maintenance of physical activity during adolescence. Since physical activity declines with increasing age, particularly during adolescence, it is important to focus on adopting and maintaining physical activity [143].

We found similar predictors for both relapse and adoption risk in physical activity during adolescence, but with inversed effects. This is noteworthy since the predictors are also important risk factors for physical activity maintenance.

Participating in sports, high parental education and academic subjects in high school were in both genders significant predictors both for physical activity changes and for

maintaining physical activity. This means that adolescents who either had parents with a high educational level, or chose academic subjects at high school, had a positive physical activity behavior, compared with the others. Adolescents who did not participate actively in sports, had an increased risk of being an inactive maintainers or relapsers. This supports the relationship between participation in sports during adolescence and increased physical activity later in life [144]. Participation in sports is linked to socioeconomic status. Associations between socioeconomic status and high physical activity have been described earlier [145, 146]. Highly educated parents tend to transmit a positive attitude to education and related behavior to their children. Family income is also a factor affecting whether parents stimulate their offspring to participate in sports, which often may be expensive. Young people from lower socio-economic background should be an important target group in promotion of or continuing increased physical activity.

We found differences in gender for several of the predictors. Boys dissatisfied with life, and who considered themselves as being overweight had a high risk of relapse or maintained inactivity. This was, however, not evident among girls. Interaction between genders was significant, indicating a substantial gender difference in the importance of BMI for decreased physical activity among adolescents. We found that in both genders, adolescents who considered themselves as overweight/fat were less physical active, but the association between BMI and physical activity was only significant in boys. Some of the disagreement concerning weight (both perceived weight and BMI) and physical activity may relate to this gender difference. Dissatisfaction with actual body weight has been associated with perceived under- and overweight (body image). Longitudinal studies have shown a significant increase in dissatisfaction with body weight throughout early adolescence, especially among girls [147, 148].

Parents' education and their physical activity level seem to influence physical activity patterns in their adolescents. An interesting finding in our study was the different effects of the education and lifestyle of mothers and fathers on their children's physical activity. Low education and physical activity level in mothers seemed to influence relapse and maintenance of physical inactivity in girls, but not in boys. Correspondingly did the same factors in fathers influence the boys. Our study (paper 2) showed a significant gender difference, where apparently mothers were important role models for girls. The need for gender specific role modeling may be an explanatory factor. Previous studies have reported

that parents have an impact on their offspring`s physical activity, but this relationship is complex [149].

5.2.4 Physical activity pattern in adolescence and health risk in young adulthood

Physical inactivity and sedentary behaviours are shown to be associated with adverse patterns of CVD risk factors [150, 151]. Correspondingly, cardiorespiratory fitness in adolescence is associated with a healthier CVD risk factor profile later in life [152]. Our study confirmed this association. We found that active maintainers had a better CVD risk profile in early adulthood than inactive maintainers, supporting other studies reporting that physical activity and physical fitness may protect against CVD risk [153].

There is considerable evidence that physical activity contributes to a raise in HDL-C and a reduction in triglycerides in both genders [154], but our results showed that only active maintaining males had a lower triglyceride concentration and higher HDL-C compared to inactive maintainers. Previous studies have reported that high levels of total cholesterol and low HDL-C levels are independent risk factors for CVD for both genders [155]. Our results showed that male active maintainers had significantly higher HDL-C compared to inactive maintainers, but this was not seen in females. The gender difference could be anticipated for total cholesterol, where previous population studies have found higher total cholesterol in men compared women in the first fifty years [155, 156]. However, it is still important to focus on total cholesterol and HDL-C level in both genders among those who are not physically active.

Obesity is one of the leading risk factors for premature mortality and chronic health conditions [108]. The cause of obesity is imbalance between the amount of energy intake and energy expended by the body. The prevalence of obesity is increasing all over the world [108], also well documented in the HUNT Study, both for adults [157, 158] and for adolescents [159]. The evidence of the relationship between physical activity and obesity has increased during the last decade. BMI is the most commonly used measurement for body fat. Mean BMI increases in all gender and age groups in Nord-Trøndelag [158]. In our study we found no differences in overweight/obesity measured as BMI, between the physical activity patterns (paper 3). This is in accordance with previous studies on the relationship between physical activity and obesity measured as BMI, reporting that the relationship may be more strongly related to cardiorespiratory fitness or screen activities (watching television, computer use) than physical activity [160, 161]. Prospective studies

demonstrate that even a high level of leisure time physical activity could not prevent increased BMI during the follow-up [162].

Waist circumference (WC) is a simple measure estimating abdominal fat. In the HUNT Study obesity defined by WC (WHO) is increasing even more than BMI, especially in women [158]. We revealed that WC was lower among active maintaining males, compared to relapsers and inactive maintainers. Active maintaining was also associated with lower WC compared to the other physical activity patterns (paper 3). BMI and waist circumference are the most widely used measurements to assess overweight and obesity in epidemiological studies, but as fat distribution is an important dimension of obesity and being closely linked to metabolic risk factors, our associations between physical activity and waist circumference and not with BMI is interesting. Abdominal obesity is associated with an increased CVD risk in spite of a normal BMI [163], and waist circumference is independently associated with cardiovascular disease [164, 165], and Lakerveld et al., found that abdominal obesity was associated with reduced physical activity over five years [166]. Improvement in physical activity reduces subsequent obesity and CVD risk [167], and physical activity is effective in reducing abdominal adiposity in overweight and obese adults [168]. In addition, overweight/obesity is associated with decreased probability of being physically active, and is likely to enhance difficulties achieving energy balance and thus result in further weight gain [169].

Physical activity has preventive and therapeutic effects on mental illness, and also has an impact on mental health in the general population. Our longitudinal data in paper 3 indicated that active maintainers had better life satisfaction and better mental health than inactive maintainers. Female active maintainers had a lower likelihood of feeling nervous/restless and being troubled by anxiety, compared to female inactive maintainers. We found the same trend in men, but it was not significant. This is in accordance with previous studies, where physically active adults reported fewer symptoms of anxiety than physically inactive persons [170], and other studies reported that maintaining an inactive lifestyle over several years was associated with clinically defined depression [171, 172]. Tremblay et al. found negative associations between sedentary behaviour and mental health, while sedentary behaviour as TV viewing was associated with increased odds of mental distress [173]. Our finding as well as other studies, indicate that physical activity is associated with favourable mental health. However, the optimal intensity, frequency or duration of physical activity to achieve this, still remains to be defined.

5.2.5 Gender differences in physical activity

This thesis revealed extensive significant gender differences in physical activity. Answers from girls on the WHO HBSC questionnaire was more reliable than answers from boys. Few validation studies have reported results for each gender, but those who have, have not found gender differences [174]. The gender differences in paper 1 could be due to the fact that girls tend to be more precise in their answers. Girls probably are less competitive than boys concerning physical activity, and thus might be more "honest" in their answers Girls might have different focus and value physical activity and being physically fit less than boys, while boys might want to “show off” and overestimate their strength and physical activity. This may strengthen the reliability patterns for girls.

More girls than boys were inactive maintainers or relapsers, while more boys were active maintainers. The same gender differences are reported in other studies of physical activity trends, in particular linked to the decline in physical activity with increasing age [65, 175, 176]. These gender differences as well as the interaction with age should gain more focus in preventing weight gain and negative development of other CVD risk factors, especially because of the increasing CVD risk in women and the worrying general increase in WC in women, especially in young adults [158]. However, as mentioned above, methodological issues must also be considered, since the instrument may be more sensitive for girls.

Our finding strengthens a growing concern about the development in girls, where girls who were active at baseline, but reported a more “risky” behaviour (smoking, having been drunk) had an increased risk of becoming physically inactive through adolescence. This was not found in boys. Other studies on smoking and physical activity have confirmed that smokers are less physically active and less active in sports than non-smokers [177]. Girls who had been drunk once or more also had a higher risk of decreasing physical activity during adolescence.

In paper 3, comparing inactive maintainers and active maintainers, we found that the association between physical activity and waist circumference was only significant in males. An inverse relationship between physical activity and overweight/obesity is well known [178, 179], but few studies have examined males and females separately, although it is clear that an increase in daily physical activity is required in both genders for obesity prevention and reduction.

6 Importance for further practice and research

Physical activity has throughout history been an important part of human life. Our modern way of living seemingly has reduced our need of being physically active. We have clearly passed a limit where our lifestyle affects our health negatively. Still, cardiovascular mortality has shown a continuous decrease, probably mostly due to smoking cessation. It is every reason to believe that the focus on physical activity will increase in the future. The main importance of this thesis is to place some stones in the building of a better lifestyle, discussing measurement of, effects of, indicators for and consequences of young age changes in physical activity.

In population surveys, questionnaires are convenient and extensively applied to measure physical activity. Up to now few physical activity questionnaires have been able to document acceptable and good reliability and validity [45]. Sedentary behaviour is particularly difficult to measure by questionnaires. Objective or semi-objective instruments to measure physical activity should be used to a greater extent to ensure good measures. Our study has employed both questionnaires and objective measures. For the further research and evaluation of self-reported instruments, more detailed questions are needed to map the various dimensions and to distinguish between assessment of physical activity and physical fitness. New insights have clarified that registration instruments and prevention programmes should contain additional focus on total daily physical activity of all domains, and not only whether spare time physical exercise for 30 minutes in adults and 60 in children and adolescents is achieved.

Based on the findings of this thesis, the understanding of physical activity concepts needs more investigating. The concepts, and use of words, could be both age and gender specific. Further improvement and development of self-reported questionnaires will help us to increase both reliability and validity.

Failure to maintain physical activity has negative health consequences, independent of health status and gender. As documented in this thesis, increased physical activity will contribute to lower risk profile for several of our main public health threats. Our study has shown that several factors should be taken into account establishing and maintaining high physical activity in adolescents: Interventions should start early, preferably in childhood; we should focus on parents as role models; on differences between genders; on differences

between pupils attending vocational and academic classes; on facilitating participation in active sports; on creating a milieu and on enhancing physical activity also outside physical activity school sessions thus becoming an increasing part of the daily life both in schools and elsewhere,

To implement these and other strategies it is necessary in the future to focus both on population strategies and high-risk strategies in disease prevention and public health promotion. The recent implementation of new laws and regulations in Norway, focusing on local public health prevention strategies is a good start.

7 Conclusions

The WHO HBSC physical activity questionnaire had a good reliability in adolescents. It was an acceptable instrument for measurement of cardiorespiratory fitness in girls. The IPAQ had fair validity, but only on the item measuring vigorous activity, compared to cardiorespiratory fitness.

None of the questionnaires seemed to be a valid instrument for measuring physical activity as total energy expenditure and physical activity level by the ActiReg, among adolescents. The answers from girls were more reliable and valid than the answers from boys.

Factors affecting whether adolescents maintained or changed their physical activity during adolescence, differed between boys and girls.

Boys who were overweight, was dissatisfied with their life or did not participate actively in sports were inclined to decrease their physical activity. For girls the strongest determinants or risk factors for decreased physical activity were hazardous risk behaviors like smoking and alcohol use, having a mother with low education or low. In general, having parents who had high levels of education or were physically active was associated with increased of physical activity from baseline to follow-up in their adolescents.

The likelihood of physically inactive 13-15-year adolescents, who did not participate in sports or had chosen vocational subjects in high school, becoming physically active (adoption) at 16-19 years of age, was very low. Physically inactive girls who reported that they occasionally or often experienced subjective pain were also unlikely to become more active.

We found a strong association between low physical activity at baseline and high CVD risk and impaired mental health at follow-up. Those who maintained high physical activity from adolescence to young adulthood had a better CVD risk profile and better mental health status than those staying physically inactive. Physically active maintainers had a significantly lower CVD risk profile, and reported less mental distress than those with other physical activity patterns.

Unexpectedly, changing from low to high physical activity during adolescence (adoption) was not associated with a lower CVD risk profile or better mental health in young adulthood, compared to those who stayed inactive or reduced their activity.

In order to enter young adulthood in good mental health and with a positive risk profile for future cardiovascular and other chronic diseases it is important to stay physically active. Good questionnaires and other instruments to follow this development are available, and factors affecting maintenance of physical activity have been identified. Ensuring a high physical activity in all age groups, but in particular in children and adolescents should have a high priority in health promotion.

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Paper I

BMC Medical Research Methodology

BioMed Central

Research article

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Reliability and validity of two frequently used self-administered physical activity questionnaires in adolescents

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Published: 15 July 2008

BMC Medical Research Methodology 2008, **8**:47 doi:10.1186/1471-2288-8-47

Received: 27 February 2008
Accepted: 15 July 2008

This article is available from: http://www.biomedcentral.com/1471-2288/8/47

Abstract

Background: To create and find accurate and reliable instruments for the measurement of physical activity has been a challenge in epidemiological studies. We investigated the reliability and validity of two different physical activity questionnaires in 71 adolescents aged 13–18 years; the WHO, Health Behaviour in Schoolchildren (HBSC) questionnaire, and the International Physical Activity Questionnaire (IPAQ, short version).

Methods: The questionnaires were administered twice (8–12 days apart) to measure reliability. Validity was assessed by comparing answers from the questionnaires with a cardiorespiratory fitness test (VO_{2peak}) and seven days activity monitoring with the ActiReg, an instrument measuring physical activity level (PAL) and total energy expenditure (TEE).

Results: Intraclass correlation coefficients for reliability for the WHO HBSC questionnaire were 0.71 for frequency and 0.73 for duration. For the frequency question, there was a significant difference between genders; 0.87 for girls and 0.59 for boys ($p < 0.05$). The intraclass correlation coefficients the IPAQ varied between 0.10 and 0.62 for the reliability. Spearman correlation coefficients for validity for both the WHO HBSC questionnaire and the IPAQ (recoded into low, moderate and high activity) measured against VO_{2peak} were fair, ranging between 0.29 – 0.39. The WHO HBSC questionnaire measured against VO_{2peak} for girls were acceptable, ranging between 0.30 – 0.55. Both questionnaires, except the walking question in IPAQ, showed a low correlation with PAL and TEE, ranging between 0.01 and 0.29.

Conclusion: These data indicate that the WHO HBSC questionnaire had substantial reliability and were acceptable instrument for measuring cardiorespiratory fitness, especially among girls. None of the questionnaires however seemed to be a valid instrument for measuring physical activity compared to TEE and PAL in adolescents.

Background

Physical activity during adolescence is positively related to physical fitness and health both in adulthood and later life [1,2]. However, physical activity is not synonymous with physical fitness. Physical activity is defined as any body movement produced by skeletal muscles resulting in a substantial increase in energy expenditure [3], while physical fitness is a set of attributes related to people's ability to perform physical work [4]. The cardiorespiratory component of physical fitness is related to the ability to perform dynamic large muscle mass work at moderate to high physical intensity over a prolonged period. This is important from a health point of view [3]. Physical fitness measured as cardiorespiratory fitness (maximal oxygen uptake) is positively related to improved health in general and to prevention of cardiovascular diseases in particular [5,6]. Recent studies show that the dose-response gradient for various health outcomes is steeper across categories of cardiorespiratory fitness than across groups with different levels of physical activity [7]. The greatest improvements in health status have been found when people who are sedentary become physically active. Church et al. [8] found a graded dose-response change in fitness across different levels of physical activity, and even exercise at only 50% of the physical activity recommendations provided some improvement on fitness. This promotes the understanding and importance of frequent physical activity at any level, thus even low physical activity is beneficial [9].

Representative data are essential in order to assess and monitor physical activity and physical fitness in a population and to study time trends. In epidemiological studies the use of self-reported questionnaires is often the only feasible method [10]. Self-reported questionnaires assessing vigorous physical activity have shown acceptable reliability and validity for adults [11,12]. The challenge is to get valid data for moderate and low physical activity [13]. To assess trends in the population a standardised questionnaire is strongly recommended [14]. Finding an accurate and reliable measurement of physical activity for children and adolescents is especially challenging because this group most often lacks a precise understanding of concepts like physical activity, exercise, sport and fitness [4]. In addition, these concepts are often not precisely defined in questionnaires. It is therefore of particular importance to study the validity and reliability of questionnaires aiming at measuring physical activity among adolescents.

One frequently used questionnaire for children and adolescents is the World Health Organization Health Behaviour in Schoolchildren (WHO HBSC) Survey Questionnaire [15]. To our knowledge only one study, conducted among Australian students, has validated the questions about physical activity in the WHO HBSC survey [16]. The International Physical Activity Questionnaire (IPAQ) is a physical activity questionnaire designed by a multinational working group as a common instrument for epidemiological studies [17]. Long and short versions of the IPAQ are available. It is designed for adults aged 15–65 years [18], but has only been validated for those 18 years and older [17,19,20]. The questionnaire has been used to monitor physical activity among people aged 15–78 years [21].

The purpose of this study was to investigate the reliability and validity of the physical activity questions from the WHO HBSC questionnaire and from the IPAQ (short version) among adolescents aged 13–18 years. Comparisons were done with objective measures of both physical activity and physical fitness.

Methods

Participants

The study population was recruited from two municipalities in Nord-Trøndelag County, Norway. The participants, aged 13–18 years old, were identified and randomly selected from four different schools in the included municipalities. An invitation was distributed by the teachers at the schools. Each participant received an information folder and signed a written consent. The parents of participants below 16 years also signed the consent.

Participation in the study was voluntary. A total of 200 adolescents were invited, 71 participated. With an estimated effect size of 0.5 and power of 80% (two-tailed alpha = .05), between the scores from the physical activity questionnaires and the objective measures, the study needed a sample of 58 participants

Instruments

Physical activity questionnaires

The WHO HBSC Physical Activity Questionnaire has recently been used in two extensive studies in Norway; The Young-HUNT Study (adolescents 13–19 years, the Youth Part of the second Nord-Trøndelag Health Study, HUNT 2), and in the Health Behaviour in Schoolchildren study (HEVAS/HBSC) [15,22]. The questionnaire records the responder's physical activity level in sports and exercise by asking the adolescent to report the frequency and total amount of time spent exercising vigorously outside school hours. The frequency question was: "Outside school hours: How often do you usually exercise in your free time so much that you get out of breath or sweat?". The frequency question had eight response alternatives: "every day", "4–6 days a week", "2–3 days a week", "one day a week", "not every week, but at least once every 14th day", "not every 14th day, but at least once a month", "less than once a month" and "never". The duration question was: "Outside school hours: How many hours do you usu-

ally exercise in your free time, so much that you get out of breath or sweat?". The duration question had six response alternatives: "7 hours per week or more", "about 4–6 hours a week", "about 2–3 hours a week", "about one hour a week", "about half an hour a week" and "none". Answers were recoded into three categories of physical activity for both frequency and duration. "Low activity" represent "one day a week or less" or "one hour a week or less"; "moderate activity" represent "2–3 days a week" or "2–3 hours a week"; "high activity" represent "four days a week or more" or "four hour a week or more" (Table 1).

The International physical activity questionnaire (IPAQ), self-administered short version was designed for use among young and middle aged adults, 15–69 years old [18]. The questionnaire inquires activity during the last week. The questions focus on four activity types: "vigorous activity" periods for at least 10 min; "moderate activity" periods for at least 10 min, "walking" periods for at least 10 min and times spent "sitting" on weekdays. Frequency of activity is measured in days and duration in hours and minutes. Answers from the IPAQ were recoded in a categorical score, classified into three categories (Table 1); "low", "moderate" and "high" physical activity as defined by the IPAQ working group [18].

Maximal oxygen uptake (VO_{2peak})

A metabolic analyzer, Metamax II (Cortex Biophysic GmbH, Leipzig, Germany), was used for measuring VO_{2peak}. The measurements were done in the participants' schools. The analyser recorded and displayed data every 10th second. The data collected were stored, using the program Cortex Metasoft. The Metamax II has been validated applying the Douglas bag technique as the criterion method [23].

The instrument has built-in sensors for O_2 and CO_2. It contains a barometer and a thermometer and measures the flow of the breathed air by means of a turbine flow meter attached to the breathing mask. Before each test started, the instrument was calibrated against ambient air and a commercial gas with known concentrations of O_2 (16%) and CO_2 (4%). The concentration of O_2 and CO_2 in room air was recorded, and the flow transducer was calibrated using a 3-L high-precision calibration syringe (Calibration syringe D, Sensor Medics, Yorba Linda, CA) before testing each participant.

ActiReg

The ActiReg (PreMed AS, Oslo, Norway) is an activity monitor recording both body position and movement,

Table 1: Classification of physical activity by three categories

Category	Description			
	ActiReg	WHO HBSC frequency question	WHO HBSC duration question	IPAQ
Low activity	METs < 3	Exercise one day a week or less, so much that you get out of breath or sweat	One hour a week or less of exercise, so much that you get out of breath or sweat	Individuals who do not meet the criteria for moderate-intensity and vigorous-intensity activity categories are considered inactive.
Moderate activity	METs 3–6	Exercise 2–3 days a week, so much that you get out of breath or sweat	2–3 hours a week of exercise, so much that you get out of breath or sweat	• 3 or more days pr. week of vigorous activity, at least 20 minutes per day OR • 5 or more days pr. week of moderate intensity activity or walking, at least 30 minutes per day OR • 5 or more days pr. week of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 600 MET-min/week.
High activity	METs > 6	Exercise four days or more a week, so much that you get out of breath or sweat	Four hours or more a week of exercise, so much that you get out of breath or sweat	• Vigorous-intensity activity on at least 3 days pr. week and accumulating at least 1500 MET-min/week OR • 7 or more days pr. week of any combination of walking, moderate-intensity or vigorous-intensity achieving a minimum of a least 3000 MET-min/week.

METs = Intensity of activity compared to resting energy expenditure

contrary to an accelerometer, which records body position only. The ActiReg has two pairs of position and motion sensors connected by cables to a battery-operated storage unit fixed to a waist belt. Each pair of sensors was attached by medical tape to the chest and to the front of the right thigh respectively. The ActiReg distinguishes between four body positions; standing, sitting, bent forward and lying down. Every second the combination between body position and movement is registered, and every 60 seconds activity factors are calculated. An especially designed computer program, the ActiCalc, processes the collected data. This program stores all specific data and calculates energy expenditure. Description and validation of the ActiReg was published by Hustvedt et al. [24]. The ActiReg has been used to validate energy intake estimated from precoded food diaries in adolescents [25].

Measurements

Anthropometric measures

Height and weight were measured with light clothes and without shoes in all participants. Height was me asured to the nearest 0.5 cm by a calibrated wall-mounted measuring instrument, while body weight was measured to the nearest 0.1 kg using a calibrated laboratory scale. Body mass index (BMI) was calculated as weight divided by height squared ($kg \cdot m^{-2}$).

Physical fitness

Physical fitness (cardiorespiratory fitness as VO_{2peak}) was measured using a treadmill, applying the Oslo protocol, designed for children and adolescents [26]. The speed and incline were increased every second minute, one factor at the time. The starting level was speed at 5 km/h and an incline at 1%. The main criterion for VO_{2peak} was the lack of further increase in O_2 uptake or exhaustion. Participants were instructed not to eat or smoke for at least 2 hours before the test, to avoid high physical activity efforts the last 12 hours before the test and to wear clothing and shoes appropriate for exercise.

Physical activity

The ActiReg measured physical activity during seven consecutive days. The energy expenditure for each day was added up, and total energy expenditure (TEE) and physical activity level (PAL) were calculated. PAL is defined as TEE divided by basal metabolic ratio [27]. The ActiReg calculated a metabolic equivalent (MET) value each minute, which expresses intensity of the activity compared to resting energy expenditure (1 MET = 3.5 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$ or 1 $kcal \cdot kg^{-1} \cdot h^{-1}$) [28]. MET values were categorised in low (METs < 3), moderate (METs 3–6) and high activity (METs > 6) (Table 1). Basal metabolic rate was calculated using the FAO/WHO equation [29].

Study design

Reliability

The reliability was evaluated applying a test-retest design. The questionnaires were completed a first time before taking the objective measurements and the second time, 8–12 days later.

Validity criteria

Criterion validity was assessed comparing the self-reported physical activity questions in the WHO HBSC and the IPAQ with physical fitness (cardiorespiratory fitness, VO_{2peak}) and physical activity measured by the ActiReg. Cardiorespiratory fitness reflects the ability to transport and utilised oxygen during prolonged, strenuous physical activity. Physical activity was measured in total energy expenditure (TEE) and physical activity level (PAL) for seven days.

Ethics

The study followed the principles outlined in the Helsinki Declaration. It was approved by The Norwegian Data Inspectorate Board and recommended by The Regional Committee for Ethics in Medical Research.

Data analysis

SPSS Inc., Chicago IL, version 14.1 was used for all analyses. The statistical analyses were performed for the total group and stratified by gender and age. To evaluate reliability, we calculated single measure intraclass correlation coefficients (ICC). A 95% confidence interval (CI) was used to describe the variety/difference in the ICCs.

To assess the validity of the physical activity questionnaires we used Spearman rank correlation between the questionnaires and the objective measures (VO_{2peak}, TEE and PAL). In the validity analyses, we used the answers from the first assessment for the WHO HBSC questions. For the IPAQ we used the answers from the second assessment, because the questions asked for activity the last seven days.

Results

Subject characteristics

Seventy-one participants, 56.3% girls, completed the questionnaire and anthropometric measurements. Mean age was 14.9 years (girls 15.3 years, boys 14.4 years) (Table 2). Sixty-seven participants completed the VO_{2peak} measures (30 boys and 37 girls), while 62 (26 boys and 36 girls) completed all parts of the study.

Boys had a significantly higher VO_{2peak} compared to girls (Table 3), but there was no significant difference in VO_{2peak} between age groups. The PAL values for seven days differed significantly between age groups. Adolescents 13–15 year olds were more physically active than the 16–

Table 2: Physical characteristics of participants stratified by gender and age

Characteristic	All (*n* = 71)	Girls (*n* = 40)	Boys (*n* = 31)	13–15 years (*n* = 42)	16–18 years (*n* = 29)
Age (year)	14.9 (1.64)	15.3 (1.65)	14.35 (1.50)	13.64 (0.62)	16.66 (0.77)
Height (cm)	166 (8.37)	163.6 (6.49)	169.2 (9.53)	164.9 (6.93)	167.6 (10.08)
Weight (kg)	57.0 (11.33)	56.0 (9.88)	58.4 (13.08)	54.7 (9.76)	60.4 (12.76)
Body mass index (kg/cm^2)	20.5 (2.86)	20.8 (2.81)	20.2 (2.94)	20.0 (2.76)	21.3 (2.89)

The values are presented by Means with Standard deviations in brackets

18 year olds. Internally in category "METs < 3", boys were physically active for fewer minutes than to girls. The age group 13–15 year had significantly fewer minutes registered at "METs < 3" compared to the 16–18 year olds, while in the "METs 3–6" (minutes) the 13–15 year olds had significantly more minutes registered than age group 16–18. There were no significant age and gender differences concerning answers on physical activity in any of the questionnaires (Table 3).

Reliability

According to Landis and Koch divisions of agreement [30], the WHO HBSC questionnaire indicated a substantial overall reliability (frequency $r = 0.73$ and duration $r = 0.71$) (Table 4). Significant differences were found between girls and boys on the WHO HBSC frequency question ($r = 0.87$ and $r = 0.59$ respectively), and between age groups on the duration question (13–15 years $r = 0.62$ and 16–18 years $r = 0.85$).

Table 3: Physical fitness and physical activity stratified by gender and age

Measurements	All (*n* = 71)	Girls (*n* = 40)	Boys (*n* = 31)	13–15 years (*n* = 42)	16–18 years (*n* = 29)
Physical fitness					
VO_{2peak} (l·min^{-1})	3.04 (0.77)	2.73 (0.58)*	3.44 (0.81)	2.93 (0.60)	3.24 (0.99)
VO_{2peak} (ml·kg^{-1}·min^{-1})	52.54 (8.12)	48.06 (6.21)*	58.06 (6.73)	53.14 (7.66)	51.53 (8.92)
Physical activity					
Actireg (PAL for 7 days)	1.70 (0.24)	1.66 (0.22)	1.77 (0.26)	1.75 (0.28)#	1.63 (0.14)
Actireg (TEE for 7 days)	59.39 (8.65)	57.72 (8.51)	61.70 (8.47)	59.97 (9.93)	58.47 (6.20)
ActiReg (min at METs < 3 for 7 days)	8,954 (441)	9,083 (314) *	8,775 (528)	8,850 (476) #	9,118 (325)
ActiReg (min at METs 3–6 for 7 days)	845 (313)	776 (207)	942 (402)	953 (328) #	675 (192)
ActiReg (min at METs > 6 for 7 days)	256 (210)	219 (180)	308 (240)	277 (249)	224 (122)
Questionnaires					
WHO HBSC questionnaire					
Frequency (days per week)	3.80 (1.77)	3.61 (1.57)	3.97 (2.01)	3.64 (1.81)	3.95 (1.73)
Duration (hours per week)	4.10 (1.29)	3.81 (2.15)	4.48 (2.36)	4.03 (2.23)	4.21 (2.32)
IPAQ					
Vigorous activity (days/week)	2.76 (1.84)	2.85 (1.78)	2.65 (1.94)	2.81 (1.70)	2.69 (2.06)
Vigorous activity (min/day)	73 (43)	71 (39)	74 (47)	78 (51)	65 (28)
Moderate activity (days/week)	2.89 (2.18)	2.93 (2.10)	2.84 (2.34)	2.98 (2.17)	2.76 (2.23)
Moderate activity (min/day)	65 (42)	65 (42)	66 (44)	71 (40)	61 (44)
Walking (days/week)	4.39 (2.19)	4.26 (2.08)	4.57 (2.34)	4.70 (2.26)	3.97 (2.04)
Walking (min/day)	43 (53)	44 (55)	40 (50)	48 (52)	36 (53)
Sitting (min/day)	374 (196)	414 (209)	327 (171)	289 (177)	484 (164)

The values are presented in means with standard deviations in brackets
PAL = Average physical activity level for 7 days (PAL = total energy expenditure/basal metabolic rate)
TEE = Total energy expenditure in mega joule
METs = Intensity of activity compared to resting energy expenditure
* Significant difference between genders ($p \leq 0.01$)
# Significant difference between age groups ($p \leq 0.05$)

Table 4: Test-retest reliability based on intraclass correlation coefficients (ICC) for the WHO HBSC questionnaire and the IPAQ

Questionnaire	All (*n* = 71)		Girls (*n* = 40)		Boys (*n* = 31)		13–15 years (*n* = 42)		16–18 years (*n* = 29)	
	ICC	95% CI	ICC	95% CI	ICC	95% CI	ICC	95% CI	ICC	95% CI
WHO HBSC questionnaire										
Frequency	0.73	0.60–0.82	0.87*	0.77–0.93	0.59	0.31–0.78	0.71	0.53–0.83	0.76	0.55–0.88
Duration	0.71	0.57–0.81	0.76	0.58–0.86	0.66	0.40–0.83	0.62#	0.39–0.78	0.85	0.70–0.93
IPAQ										
Vigorous activity (days/week)	0.54	0.34–0.69	0.55	0.29–0.73	0.53	0.22–0.75	0.46	0.18–0.67	0.65	0.37–0.82
Vigorous activity (min/day)	0.30	-0.07–0.56	0.57	0.20–0.80	0.24	-0.21–0.62	0.46	0.05–0.74	0.23	-0.23–0.61
Moderate activity (days/week)	0.55	0.36–0.70	0.58	0.33–0.75	0.53	0.21–0.75	0.57	0.32–0.74	0.53	0.20–0.75
Moderate activity (min/day)	0.34	0.22–0.60	0.36	-0.06–0.67	0.33	-0.20–0.72	0.67	0.25–0.88	0.21	-0.21–0.57
Walking (days/week)	0.62	0.45–0.75	0.53*	0.27–0.72	0.77	0.56–0.89	0.81#	0.67–0.90	0.37	0.01–0.65
Walking (min/day)	0.10	-0.10–0.39	0.06	-0.33–0.44	0.11	-0.35–0.54	0.11	-0.30–0.49	0.07	-0.36–0.49
Sitting (min/per day)	0.27	-0.50–0.54	0.18	-0.22–0.54	0.43	-0.09–0.77	0.32	-0.13–0.67	0.03	-0.41–0.46

ICC = Single measure intraclass correlation coefficient
* Significant difference between genders ($p < 0.05$)
# Significant difference between age groups ($p < 0.05$)

The overall reliability of the IPAQ questionnaire varied for the different physical activity categories. The lowest correlation was found for walking (minutes per day) ($r = 0.10$), while the highest correlation was found for walking (days per week) ($r = 0.62$). The IPAQ walking (days) question showed statistically significant difference between genders (girls $r = 0.53$ and boys $r = 0.77$) and age groups (13–15 years $r = 0.81$ and 16–18 years $r = 0.37$) (Table 4).

Validity

For the total population, a statistically significant correlation was found between VO_{2peak} and the questions on both frequency ($r = 0.39$) and duration ($r = 0.33$) in the WHO HBSC questionnaire (Table 5). The correlation was also significant when the answers were divided into three categories (Table 5). Girls had a higher correlation between the WHO HBSC questionnaire and VO_{2peak} (r varied between 0.41 and 0.55) compared to boys (r varied between 0.21 and 0.31), and correlations were statistically significant in girls only.

The correlation coefficients of the WHO HBSC questions measured against the TEE and PAL was low (Table 5).

Vigorous activity (days per week) measured in the IPAQ and classified into three categories, was significantly correlated with VO_{2peak} (Table 5). Vigorous activity (minutes per day) and walking (minutes per day) in the IPAQ correlated negatively with VO_{2peak}, indicating that more minutes of both vigorous activity and walking was associated with a lower VO_{2peak}. There was, however, a significant correlation between the IPAQ expressed as walking (minutes per day) and VO_{2peak} for girls ($r = -0.41$).

The correlation coefficient between the IPAQ questions and PAL was significant for walking (minutes per day) including all ($r = 0.43$) and for boys when split by gender ($r = 0.61$). The IPAQ question on sitting (minutes per day) showed a significant negative correlation with PAL for boys ($r = -0.68$) and was significantly correlated with TEE in girls ($r = 0.54$). The other associations between the IPAQ questions and the ActiReg measures had a low correlation and were not significant (Table 5).

Discussion

The WHO HBSC physical activity questionnaire had a substantial reliability concerning frequency as well as duration of activity, and validity expressed as the spearman correlation coefficient between the answers and physical fitness (VO_{2peak}). The IPAQ question on vigorous activity (days per week) and recoded into three categories showed a fair correlation with physical fitness (VO_{2peak}). The other questions had a low validity against VO_{2peak}. Measured against TEE and PAL (ActiReg, 7-day records), validity for both questionnaires was low.

Reliability

In general the reliability of WHO HBSC questionnaire was comparable to a study among Australian high school students [16]. An interesting observation in our study is that the WHO HBSC questionnaire tended to be more reliable for girls. A reliability study by Treuth et al. [31] found no gender difference in the Fels physical activity questionnaire for children. Few studies have however, focused on possible gender differences. The gender differences in our study could be due to the fact that girls tend to be more precise in their answers. Girls probably are less competi-

Table 5: Spearman rank-correlation coefficients for the WHO HBSC questionnaire and the IPAQ against VO_{2peak}, TEE and PAL to assess validity

Questionnaire	VO_{2peak} ($l \cdot min^{-1}$)			TEE			PAL		
	All (*n* = 67)	Girls (*n* = 37)	Boys (*n* = 30)	All (*n* = 62)	Girls (*n* = 36)	Boys (*n* = 26)	All (*n* = 62)	Girls (*n* = 36)	Boys (*n* = 26)
WHO HBSC									
Frequency	0.39**	0.55**	0.31	0.20	0.25	0.08	0.02	0.01	-0.07
Duration	0.33**	0.41*	0.21	0.23	0.21	0.24	0.01	-0.1	0.07
Frequency, 3 categories	0.36**	0.53**	0.31	0.22	0.28	0.11	0.02	0.05	-0.06
Duration, 3 categories	0.29*	0.30	0.31	0.22	0.23	0.25	-0.02	-0.08	0.03
IPAQ									
Vigorous activity (days/week)	0.26*	0.37*	0.02	0.19	0.20	0.10	0.09	0.03	0.05
Vigorous activity (min/day)	-0.32*	-0,27	-0.31	-0.14	-0.02	-0.29	-0.08	0.12	-0.08
Moderate activity (days/week)	-0.03	0.11	0.04	0.07	0.04	0.18	0.05	-0.02	0.14
Moderate activity (min/day)	0.13	0.02	-0.17	0.01	-0.17	0.25	0.01	-0.09	0.10
Walking (days/week)	0.12	0.19	-0.12	0.15	0.11	0.22	0.13	0.05	0.25
Walking (min/day)	-0.14	-0.41*	0.20	0.24	0.15	0.38	0.43**	0.28	0.61**
Sitting (min/day)	0.18	0.33	0.30	-0.04	0.54**	-0.42	-0.29	0.25	-0.68**
3 categories	0.32**	0.43**	0.18	0.09	011	-0.02	-0.03	-0.12	-0.05

TEE = Total energy expenditure for 7 days.
PAL = Average physical activity level for 7 days.
* $p < 0.05$;
** $p < 0.01$
3 categories = Classification of physical activity in three levels; "low", "moderate" and "high" activity

tive than boys concerning physical activity, and thus they may be more "honest" in their answers. Girls value different things and they do not need to emphasise themselves as very physically active. This may strengthen the reliability patterns for girls.

Our results also revealed a difference between age groups. The WHO HBSC questionnaire was more reliable for the oldest group. This is similar to what Treuth et al. found in their study [31]. The lower reliability in the 13–15 year old could be due to a failure to interpret the questions correctly. Those 16–18 years probably had a better understanding of its contents, explaining the higher correlation in the oldest group. The reliability of the IPAQ was lower than that of the WHO HBSC questionnaire. This could be explained by the less structured format (open-ended questions) in the IPAQ. The lower test-retest reliability of the IPAQ could also be related to the reference period, because the questionnaire focuses on the last seven days, while physical activity may change considerably from one week to the next.

Concerning the IPAQ there were only minor differences between genders, except for the question about walking/days, where boys had a higher reliability than girls. The same was shown in the IPAQ, 12-country reliability and validity study among adults [17].

Validity

In our study, we used two objective methods to validate the questionnaires; physical activity (TEE and PAL) and physical fitness (VO_{2peak}). Physical activity is difficult to measure. Validating self-reported physical activity by questionnaire is therefore a great challenge. Different methods have been applied as validation criteria; accelerometer, pedometer, recall-logs, heart-rate monitoring and different energy expenditure methods [32]. The doubly labelled water method (DLW), indirect calorimetry and direct observations are the most reliable and valid measurements. The DLW method has drawbacks like financial costs and limitations due to the laboratory test situation [32]. Accelerometers have become increasingly popular as measurement tools for physical activity. However, inaccuracies, especially related to underestimation and inconsistency in the definition of what constitutes light, moderate, and vigorous activity have been reported [33-35]. The ActiReg, used in this study, has been validated against DLW and indirect calorimetry. Hustvedt et al. [24] found good agreement in moderate activity groups (moderately activity from 38 to 104 min per day) with a mean

PAL of 1.70, which is comparable to our mean and therefore support the representativeness of our sample. The ActiReg has some limitations for PAL above 1.70. Applied on a population with low PAL (patients with chronic obstructive pulmonary disease), the ActiReg is found to be a valid tool to assess energy expenditure and distinguish between both the low intensity activity range and moderate to high intensity activity range of physical activity [36]. ActiReg is also able to recognise activities such as sitting and different intensities of movements. We have analysed these separately, but these analyses showed no changes in results (data not shown)

Physical fitness has been related to total and cardiovascular mortality and heart disease. Therefore, cardiorespiratory fitness, measured as VO_{2peak}, has been preferred as the validation criterion for physical fitness in the last decades, and is considered the gold standard in the assessment of exercise tolerance [37].

There was a significant correlation between the WHO HBSC questionnaire and VO_{2peak} for all, except for boys when analysed stratified by gender. When each question in the WHO HBSC questionnaire was analysed separately, the frequency question had a higher correlation than the duration question. The same trend was evident when split by gender. A possible explanation for the differences in the dimensions (duration and frequency) is that the frequency question, which inquires days per week, estimated physical activity more precisely than the duration question, which requests hours per week of physical activity. Another explanation could be related to the fact that days per week are a rougher estimate than hours per week. The IPAQ had a low validity measured against VO_{2peak}, except for the question about vigorous physical activity during the last 7 days for all. This corresponds to previous research showing that vigorous activity is easier to recall than light activity [38]. Craig et al. [17] reported a typical correlation coefficient for the IPAQ was 0.30 for validity. In our study, the IPAQ recoded in three categories had an acceptable correlation against VO_{2peak} for all (0.32) as well as separately for girls when split on gender. Nevertheless, each question separately was not a valid measure of physical fitness. The IPAQ seemed to be an acceptable instrument when the questions were compiled. This is important because physical activity is most often recoded and classified using a scoring protocol in epidemiological studies.

The validity for single IPAQ questions within "moderate activity", "walking" (days per week) and "sitting" was poor. "Walking", expressed as minutes per day, was negatively correlated to VO_{2peak}. This probably means that the girls reporting walking for small distances do not perform vigorous physical activity, and that those with a high intensity activity associated with high cardiorespiratory fitness are inclined not to report lower physical activity like walking. To improve cardiorespiratory physical fitness sedentary persons need an intensity 40 to 60% of maximal aerobic power, corresponds to being slightly out of breathing or sweating [39]. In general an exercise intensity above 80% to 90% of the individuals' maximal aerobic power (vigorous activity; MET > 6) is recommended to increase VO_{2peak} [40].

The ActiReg registered all activity performed by the participants for seven consecutive days. It was surprising that only the IPAQ questions about walking and sitting expressed as minutes a day showed significantly negative correlations against the TEE and PAL. Adolescents who reported many walking minutes had a high PAL value. For the IPAQ measured as sitting (minutes per day), these findings indicated that the girls who reported many sitting minutes had a high TEE. In the boys, however, we found the opposite; namely that those who reported many sitting minutes had a lower TEE, which we would expect. The low correlations between IPAQ and TEE/PAL could be related to underreporting of vigorous and moderate activity. We also found this underreporting in the WHO HBSC questions and this could explain the low validity measured against the ActiReg. It is difficult to explain the lack of correlation between the questionnaires and the ActiReg. Based on our results one consideration is that the WHO HBSC questionnaire and the IPAQ have questions which are related to activities that increase cardiorespiratory fitness [15,19], and therefore correlate better with VO_{2peak} than TEE and PAL. However, this large difference between the answers and ActiReg could also be caused by the difficulties in creating accurate questions, and this could be an indication that we should prefer objective methods to measure physical activity in youth [41]. Another explanation might be that our participants were younger than the age group for which the IPAQ was designed, and thus might not fully understand the questions. Recall bias in questionnaires, especially among adolescents, may influence the retrospective response. Active adolescents tend to overestimate physical activity, whereas obese adolescents underestimate physical activity [42]. These variations may result in weaker correlations, thus influencing the validity. Because regular physical activity over a long period leads to physical fitness, we would expect good correlation between answers in questionnaires on physical activity and both ActiReg and VO_{2peak}.

VO_{2peak} is a more stable measure than physical activity. Physical activity may change daily, and from one week to next week, while physical fitness does not change considerably in 2–3 weeks' time. A possible bias could be related

to the reference period, and we therefore did not find correlations on the criterion physical activity measure.

In our study, the questionnaire answers tended to underestimate physical activity, compared to the ActiReg (Table 3). The individual variations and the underestimations could be the explanation on the low validity, compared with PAL and TEE, and illustrates the difficulty to capture the individual energy expenditure in questionnaires [43].

For an accurate validation, the strength of our study is the use of two objective measures to validate the questionnaires. The sample size in this study is an additional aspect. Our response rate of 35% is, however, rather low and might introduce a risk of an overrepresentation of those who are most physically active. Based on the participants' cardiorespiratory fitness and BMI, our population were, however quite comparable to those in other studies [44,45], including the Young-HUNT study, including 90% of the population 13–19 years of age in Nord-Trøndelag County (data not shown). This indicates a low selection bias of our population.

Our findings of higher correlations with VO_{2peak} than TEE and PAL could be because adolescents report vigorous activity most precisely. Respondents with a high-energy expenditure may not necessarily have high VO_{2peak}. Adolescents, who perform vigorous physical activity and thereby have a high VO_{2peak}, may do little moderate activity and therefore have relatively lower total energy expenditure. Although physical activity and physical fitness are two different dimensions, they are linked and both are correlated to health and survival [13].

Conclusion

The WHO HBSC questions seemed to be acceptable instruments to measure cardiorespiratory fitness for girls. The IPAQ (recoded into three categories) seemed to be a fair instrument but based on our results none of the questionnaires seemed to be a valid instrument for measuring physical activity among adolescents. In addition, the answers from girls were more reliable and valid than the answers from boys. Thus, validity and reliability of the WHO HBSC questionnaire were acceptable, while validity of the IPAQ was fair for girls. But, they may become better instruments if gender differences are taken into account and the distinction between assessing physical activity and physical fitness is made more precise. These issues should be addressed in the near future.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All authors read and approved the manuscript. VR made a substantial contribution to the initial conception of the research reported in this study, designing this study, collecting data, analyzing, interpreting data and wrote the original manuscript. TLH made a substantial contribution to writing this paper and revising drafts for important contents. NK made a substantial contribution to designing this study and revising drafts for important contents. KC made a substantial contribution to collecting data and analyzing and interpreting data. KM made a substantial contribution to designing this study to answer the research questions, interpreting data and revising drafts for important intellectual contents.

Acknowledgements

The Nord-Trøndelag University College (HiNT) and the Norwegian University of Science and Technology (NTNU) supported this study by a doctoral research fellowship. The authors are grateful to associate prof. Tove Anita Fiskum for assistance in the data collection and associate prof. Bo-Egil Hustvedt for technical assistance with the ActiReg.

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Pre-publication history

The pre-publication history for this paper can be accessed here:

http://www.biomedcentral.com/1471-2288/8/47/prepub

Paper II

Journal of Adolescent Health 48 (2011) 616–624

ELSEVIER

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ADOLESCENT
HEALTH

www.jahonline.org

Original article

Factors Predicting Changes in Physical Activity Through Adolescence: The Young-HUNT Study, Norway

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Article history: Received April 19, 2010; Accepted September 17, 2010
Keywords: Physical activity; Adolescents; Prospective study; Lifestyle

A B S T R A C T

Purpose: The purpose of this prospective population-based study was to analyze predictors of changes in physical activity (PA) levels from early to late adolescence.
Methods: Data presented are from 2,348 adolescents and their parents who participated in the Nord-Trøndelag Health study (HUNT 2, 1995–1997) and at follow-up in Young-HUNT 2, 2000–2001 Participants completed a self-reported questionnaire and participated in a clinical examination that included measurements of height and weight.
Results: Four patterns of PA emerged in the study: active or inactive at both time points (active maintainers, 13%; inactive maintainers, 59%), inactive and became active (adopters, 12%), active and became inactive (relapsers, 16%). Being overweight, dissatisfied with life, and not actively participating in sports at baseline were significant predictors of change regarding PA among boys at follow-up. For girls, smoking, drinking, low maternal education, and physical inactivity predicted relapsers and inactive maintainers. Higher levels of education and more physically active parents at baseline seemed to protect against decreased PA during follow-up for both genders.
Conclusion: Predictors of change in, or maintaining PA status during adolescence differed by gender. These results suggest that PA-promoting interventions should be tailored by gender and focus on encouraging activity for inactive adolescents and maintenance of PA in those already active.

Physical activity (PA) is related to numerous health benefits and is an important component of healthy lifestyle [1]. Regular PA reduces the risk of chronic disease, and contributes to obesity prevention [2]. Good lifestyle habits at younger ages are important both for current health and from a preventive perspective. Recommendations for PA for youth have been debated over the last decade [3], and expert-based PA guidelines suggest that children and youth should participate in moderate to vigorous physical activity (MVPA) for 60 min/d [4]. The 60 min/d recommendation is widely accepted and implemented in many countries, including Norway. Recently, some evidence has indicated 60 min/d of MVPA might be minimum, and dose-response evidence suggests that 90 min/d might be preferred [5]. The guidelines can be met by physical education or/and other activities at school, participation in different types of moderate leisure PA (e.g., brisk walking, bicycling, riding), and participation in vigorous physical activities including running, football, or sport training. It is also important to reduce total time spent in sedentary behaviors [6].

Several studies have reported that most of the adolescents do not perform MVPA 5 days or more a week [7]. The CITY100 Teen/Parent Study observed that more girls than boys failed to meet the guidelines [8]. Previous studies have shown that self-

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doi:10.1016/j.jadohealth.2010.09.013

reported PA declines with age in both genders. Girls have been shown to be less active than boys at all ages and the decline in girls occurs earlier than boys [9].

Few longitudinal population-based studies have analyzed predictors associated with changes in PA levels in adolescents. Information on the predictors of changes is necessary to develop effective prevention programs to maintain and increase PA among adolescents.

The main purpose of this 4-year prospective analysis was to investigate factors that may explain changes in levels of PA during adolescence. We also investigated whether these factors differed between boys and girls.

Material and methods

Study population

Nord-Trøndelag county is located in central Norway. In 1995–1997, all inhabitants (approximately n = 127,000) aged ≥13 years were invited to participate in a large population survey, the Nord-Trøndelag Health Study (HUNT 2). A total of 9,131 adolescents (92% response rate) participated in the youth component (13–19-year olds) of the study (Young-HUNT 1). In 2000–2001, students in the last 2 years of high school and students in vocational training were invited to Young-HUNT 2 (81% response rate). This included the youngest participants in Young-HUNT 1. A total of 2,348 adolescents (1,089 boys) participated in both Young-HUNT 1 (T1) and Young-HUNT 2 (T2) (mean: 3.9 years), and were included in the data analysis. Data from their parents participating in the HUNT 2 study were available for these adolescents.

Measures

The Young-HUNT 1 and Young-HUNT 2 surveys had identical procedures in which participants completed a self-administrated questionnaire during one school session and participated in a clinical examination that included measurement of height and weight. The HUNT study is described elsewhere [10,11].

Physical activity

PA was assessed by questions used in the World Health Organization Health Behavior in School-Aged Children surveys [12]. Among adolescents in Nord-Trøndelag, these questions have been validated against physical fitness (VO_{2peak}) and PA level (ActiReg) [13,14]. The questions recorded the responder's PA in sports or exercise, asking the number of days a week they were physically active with a moderate to vigorous intensity (MVPA) in their leisure time. The question was "Outside school hours: How many days a week do you play sports or exercise so that you get out of breath or sweat?" The response alternatives were "every day," "4–6 days a week," "2–3 days a week," "1 day a week," "not every week, but at least once every 14th day," "not every 14th day, but at least once a month," "less than once a month," and "never" [15]. On the basis of the international guidelines recommending adolescents to participate in MVPA for at least 60 min/d [4], and that the question excludes PA in school hours, adolescents were defined as "inactive" or "active," depending whether the activity was for <4 days a week or >4 d/wk outside school hours, respectively.

Body image and weight-related factors

Trained nurses measured the participants' height and weight following standardized procedures, wherein the participants were required to wear light clothing and be without shoes. Body mass index (BMI) was calculated as weight divided by height squared ($kg \times m^{-2}$). Normal weight and overweight was defined using the International Obesity Task Force cutoff values (International Organization for Standardization BMI) for children and adolescents [16]. Adolescents were asked whether they considered themselves as "very fat," "chubby," "about the same as others," "thin," or "very thin." Those answering "very fat" and "chubby" were classified as "perceived overweight," and those who answered "thin" or "very thin" were classified as "slim."

Subjective pain and well-being

Adolescents were asked how often they had any or more of the following health ailments during the last 12 months: headache (without known medical cause), neck/ shoulder pain, and/or joint/ muscle pain. These variables were combined in a new variable called "subjective pain." Response categories "never," "seldom," "occasionally," or "often," were dichotomized into "never or seldom" or "occasionally or often." General well-being was obtained by asking the participants about how satisfied they were with their life at the moment, with response categories dichotomized into "satisfied" ("very satisfied," "satisfied," or "somewhat satisfied") and "not satisfied" ("neither satisfied nor dissatisfied," "somewhat dissatisfied," "dissatisfied," or "very dissatisfied").

Leisure time activity and lifestyle factors

Behaviors and leisure time activities were measured as "time spent playing or listening to music for at least 15 minutes," "spent watching television/video," and "time participating actively in sports." Response options for the weekly frequency of watching television and playing or listening to music were "not once," "once," "2–3 times," and "4 times or more**";** recoded into "less than 4 times a week" and "4 times or more a week." For "participating actively in sports," those not answering "yes" were classified as "not being current sport participants."

Those who had tried smoking and responded "yes, I smoke daily" or "yes, I smoke occasionally, but not daily" were classified as smokers. Adolescents, who had never tried or had stopped smoking, were classified as nonsmokers. Alcohol use was defined by combining a question on having tried alcohol with information about intoxication. Those who had never tried alcohol or had never been drunk were classified as "never been drunk," and compared with adolescents who had been "drunk once or more."

The academic stream in high school (at T2) was categorized as "academic subjects" or "vocational training subjects" in the analysis.

Parental data

The parental factors included their education level and PA, and were obtained from the adult part of the HUNT 2 survey. Parents were linked to their offspring who participated in Young-HUNT 1. Educational level was asked as "primary school," "high school," and "college or university." Parents who reported "three hour or more per week" of low-intensity PA or "one hour or more per week" of intense PA were classified as "active."

Ethics

Participants and the parents or legal guardians of adolescents under the age of 16 years, signed a written consent to take part in

the study. The study was approved by the Regional Committee for Medical Research Ethics and the Norwegian Data Inspectorate Board.

Statistical analysis

We presented descriptive data on the patterns of PA over time, and applied logistic regression analysis to study associations between predictors at Young-HUNT 1, and changes and maintaining PA 3.9 years later at Young-HUNT 2. Separate logistic regression models were performed for each predictor at T1, stratified by gender and adjusted for age. We also adjusted for possible confounding, in different models for each predictor. In each model, we adjusted among the other predictors studied. The findings from these adjusted models did not change the result, and therefore not shown in the results. PA at T2 was the dependent variable in all models. Separate analyses were performed for the adopters, relapsers, and maintainers. The outcome variable, PA, was recoded as dichotomous, on the basis of the following cut-offs: MVPA $<$ 4 d/wk = "inactive"; MVPA $\geq$ 4 d/wk = "active" [3].

Statistically significant interactions were found between gender and most of the predictors, so gender-specific analyses were performed. Results are reported as adjusted odds ratio (OR) for risk of decreased or increased PA, with two-sided *p* values and 95% confidence intervals (CI) for OR.

All statistical analyses were performed with SPSS (SPSS Inc., Chicago, IL) version 15.1.

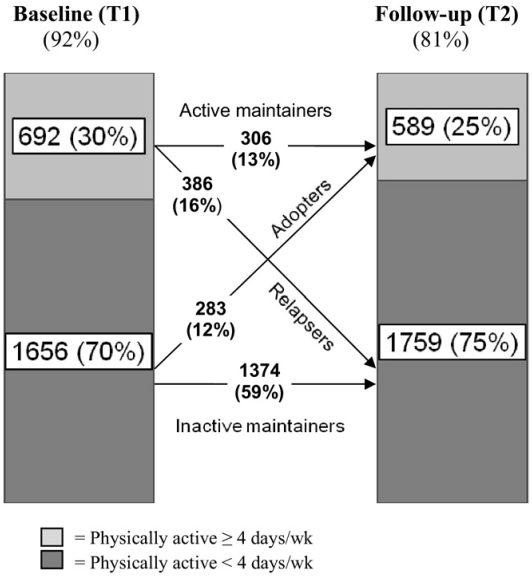

Figure 1. Changes in levels of physical activity from baseline to follow-up 4 years later (n = 2,348).

Results

A total of 2,348 adolescents (1,089 boys) were included. At Young-HUNT-1 (T1), 692 adolescents (30%) were classified as active and 1,656 adolescents as inactive (Figure 1). More boys (36%) than girls (24%) were physically active at T1. Four patterns of PA from T1 to T2 emerged: adolescents who remained active at both time points (active maintainers, boys: 18%, girls: 9%), adolescents who were inactive and became active at follow-up (adopters, boys: 13%, girls: 11%), those who were active and became inactive at follow-up (relapsers, boys: 18%, girls: 15%), and those who were inactive at both times (inactive maintainers, boys: 50%, girls: 66%) (Figure 1). This pattern differed by gender; boys were more likely to be active maintainers, and less likely to be inactive maintainers (significant differences on AM and IM) or relapsers as compared with girls.

Prevalence of predictors at baseline

Subjective pain was reported frequently, more in girls than in boys, but was not significantly different between active and inactive groups (Table 1). Sedentary activities such as playing or listening to music or watching television did not differ between active and inactive boys and girls. Almost twice as many inactive boys were overweight and characterized themselves as overweight compared with physically active boys. This was not observed in girls.

Increased physical activity (adopting)

Inactive girls reporting subjective pain occasionally or often at T1 had a reduced likelihood of becoming physically active at T2 (OR: .6, 95% CI: .4–.9). Inactive boys who perceived themselves as overweight had a reduced likelihood of becoming active as compared with boys having self-perceived "normal weight" (Table 2). Being overweight and being satisfied were not associated with increased PA in any gender (Table 2).

Adolescents who did not participate actively in sports and attended vocational subjects in high school had a lower likelihood of adopting PA as compared with those who were active in sports and attended academic subjects (Table 2). Leisure time recreational activities or life style factors did not influence changes in PA during adolescence.

Mothers with college and/or university educational attainment were associated with adoption of PA in boys compared with mothers having lower educational attainment (Table 2). This was not found in girls. Boys with a physically active father had reduced risk of adopting PA, whereas girls with a physically active father showed an increased chance of adopting PA (boys, OR: .6, 95% CI: .4–1.0; girls, OR: 1.8, 95% CI: 1.1–3.1) (Table 2). Fathers' educational level or physically active mothers were not predictors by gender.

Decreased physical activity (relapse)

Being overweight at baseline was associated with an increased risk of relapse of PA level among boys but not among girls (Table 3). However, both boys and girls who characterized themselves as being overweight at baseline had a significantly higher likelihood of decreasing their PA as compared with those who considered themselves as average. Dissatisfaction with life was also associated with decreased PA among boys. Subjective pain did not predict decreased PA (Table 3).

Leisure time recreational activities were associated with relapse among boys, whereas lifestyle factors, such as smoking and alcohol use, were important predictors of relapse for girls (Table

Table 1
Baseline (T1) differences in possible predictors of change in physical activity between physically active and inactive adolescents, by gender

Lifestyle factors	Active (n = 692)						Inactive (n = 1656)					
	Boys (n = 394)			Girls (n = 298)			Boys (n = 695)			Girls (n = 961)		
	Number	%	95% CI	Number	%	95% CI	Number	%	95% CI	Number	%	95% CI
Subjective pain												
Occasionally or often	145	38.3	33.5–43.1	171	58.8	53.2–64.4	286	42.4	38.7–46.1	556	60.5	57.4–63.6
Well-being												
Dissatisfied	25	6.3[a]	3.9–8.7	38	12.7[a]	8.9–16.5	81	11.6[a]	9.2–14.0	185	19.2[a]	16.7–21.7
Considering oneself as												
Overweight	49	12.6[a]	9.3–15.9	90	30.4	27.0–33.8	152	22.4[a]	19.3–25.5	282	29.7	27.5–31.9
BMI status												
Overweight	35	9.0[a]	6.2–11.8	47	16.3	12.1–20.5	135	19.7[a]	16.7–22.7	143	15.0	12.7–17.3
Playing or listen to music												
≥Four times/wk	222	56.6	51.7–61.5	194	65.3	59.9–70.7	363	52.2	48.5–55.9	638	66.4	63.4–69.4
Watching television/video												
≥Four times/wk	258	67.0	62.4–71.6	194	66.7	61.3–72.1	486	70.9	67.5–74.3	672	71.3	68.4–74.2
Participating actively in sports												
No	53	13.4[a]	10.0–16.8	31	10.3[a]	6.8–13.8	304	43.4[a]	39.7–47.1	413	42.7[a]	39.6–45.8
Smoking												
Smoking	21	5.3[a]	3.1–7.5	33	11.0	7.4–14.6	65	9.2[a]	7.1–11.3	126	13.0	10.9–15.1
Alcohol use/consumption												
Been drunk once or more	92	24.0	19.8–28.2	80	27.4	22.3–32.5	172	25.4	22.2–28.6	275	29.0	26.1–31.9
Mother's physical activity												
Active	211	64.7[a]	60.0–69.4	173	67.1[a]	61.8–72.4	314	57.7[a]	54.0–61.4	426	54.5[a]	51.4–57.6
Father's physical activity												
Active	209	74.4[a]	70.1–78.7	153	67.4	62.1–72.7	332	68.2[a]	64.7–71.7	447	68.3	65.4–71.2
Mother's education												
College and university	117	35.6[a]	30.9–40.3	83	31.6[a]	26.3–36.9	170	30.2[a]	26.8–33.6	205	25.7[a]	22.9–28.5
Father's education												
College and university	102	35.8	31.1–40.5	80	35.4[a]	30.0–40.8	154	31.4	27.9–34.9	192	28.8[a]	25.9–31.7
Type of education[b]												
Vocational subjects	95	25.5[a]	21.2–29.8	56	18.9[a]	14.5–23.3	256	40.1[a]	36.5–43.7	273	29.2[a]	26.3–32.1

[a] Significant difference between the active and inactive group by genders.
[b] Variable measured at follow-up.

3). Boys who listened to music or played an instrument four or more times a week and those who did not participate actively in sports had a greater risk of relapse, as did girls who were smokers, had been drunk once or more, or were studying vocational subjects in high school (Table 3).

Adolescents with highly educated parents had a lower risk of relapse than those with parents with low education (Table 3). Girls with highly educated mothers had a reduced risk of relapse, whereas boys with highly educated fathers had a 50% reduced risk of relapse. Girls who had a physically active mother had a 60% reduced risk of relapse.

Maintainers

Table 4 shows the ORs for remaining inactive, compared with those who maintained PA from baseline to follow-up. Dissatisfied boys, and boys who thought they were slim or overweight were significantly more likely to be inactive maintainers than boys who were satisfied or considered themselves in normal weight category. Both boys and girls who played "no sport" were 13–14 times more likely to remain inactive, compared with those who played sport. Smokers in both genders, and alcohol use for girls predicted greater rates of inactive maintainers.

Adolescents choosing vocational subjects in high school were more likely to remain inactive as compared with academic subjects' students (Table 4). The adolescents (both genders) whose mothers who had attained high school education were less likely to remain inactive compared with children of less educated mothers, but this was only true for fathers' education in relation to their male offspring. Maternal activity predicted girls not remaining inactive, but fathers' activity levels did not predict relapse or maintaining in either gender.

Discussion

The main purpose of this population-based longitudinal study was to investigate factors that predicted changes in PA during adolescence. The following four different patterns emerged: relapsers (active at T1 and becoming inactive at T2), adopters (inactive at T1 and becoming active at T2), active maintainers, and inactive maintainers. The largest group was inactive maintainers, and more than half of those who were active in early adolescence became inactive later leaving 75% of the population inactive at follow-up in late adolescence (17–19 years). More girls than boys were inactive maintainers or relapsers, whereas more boys than girls were active maintainers. However, no gender differences were found among those who were inactive at baseline and became active at follow-up (17%).

Predictors of changes in PA during adolescence also differed between boys and girls. Dissatisfaction with life, perceived overweight, lack of active participation in sports, and father's education were important predictors for decreased PA in boys, whereas lifestyle factors, risk behaviors, and their mother's PA and educational levels were important factors in girls. Nonparticipation in sport was a strong predictor of not becoming active, as was attending vocational subjects at high school. Subjective pain reported by girls and the physically active fathers of boys

Table 2
The likelihood of change from being physically inactive to active (adopters) from early to late adolescence associated with baseline predictors of change, by gender and age adjusted

Variables	Adopters (n = 283)							
	Boys				Girls			
	%	OR	95% CI	*p*	%	OR	95% CI	*p*
Subjective pain								
Never or seldom	13.3	1.0			14.0	1.0		
Occasionally or often	14.1	1.0	.7–1.5	.872	9.0	.6	.4–.9	.007
Well-being								
Satisfied	13.5	1.0			11.4	1.0		
Dissatisfied	12.4	.7	.4–1.4	.318	8.1	.6	.4–1.0	.062
Considering oneself as								
Normal, like others'	15.1	1.0			12.3	1.0		
Slim	12.2	.8	.5–1.3	.372	8.6	.6	.3–1.2	.137
Overweight	10.2	.5	.3–.8	.005	9.2	.7	.5–1.1	.125
BMI status								
Normal weight	13.7	1.0			10.9	1.0		
Overweight	12.6	.6	.4–1.1	.085	10.2	.9	.6–1.6	.801
Playing or listening to music								
<Four times/wk	13.9	1.0			10.4	1.0		
≥Four times/wk	13.1	1.0	.7–1.5	.803	11.0	1.1	.7–1.6	.634
Watching television/video								
<Four times/wk	14.2	1.0			10.9	1.0		
≥Four times/wk	13.4	.8	.6–1.3	.507	10.8	.9	.6–1.4	.679
Participating actively in sports								
Yes	14.1	1.0			12.5	1.0		
No	12.0	.5	.3–.7	<.000	7.7	.4	.3–.6	<.000
Smoking								
Nonsmoking	13.4	1.0			11.3	1.0		
Smoking	14.1	.9	.5–1.9	.877	7.6	.6	.3–1.2	.180
Alcohol use/consumption								
Never been drunk	14.1	1.0			11.1	1.0		
Drunk once or more	12.2	.9	.6–1.4	.645	10.2	1.0	.6–1.6	.990
Type of education[a]								
Academic subjects	16.4	1.0			12.3	1.0		
Vocational subjects	9.9	.4	.3–.6	<.000	7.3	.4	.3–.7	.001
Mother's education								
Primary school	8.4	1.0			9.5	1.0		
High school	12.3	1.7	.9–3.2	.106	11.8	1.3	.8–2.3	.292
College and university	13.3	2.0	1.0–3.9	.039	10.2	1.2	.6–2.2	.571
Father's education								
Primary school	13.8	1.0			8.2	1.0		
High school	11.4	.8	.5–1.5	.559	12.6	1.8	1.0–3.3	.067
College and university	14.1	1.2	.6–2.2	.606	10.3	1.5	.8–3.0	.248
Mother's physical activity								
Inactive	14.5	1.0			9.6	1.0		
Active	10.3	.8	.5–1.2	.203	11.6	1.4	1.0–2.2	.080
Father's physical activity								
Inactive	17.9	1.0			7.5	1.0		
Active	10.8	.6	.4–1.0	.034	12.8	1.8	1.1–3.1	.021

[a] Variable measured at follow-up.

also reduced this chance, whereas physically active mothers and fathers increased the chance of inactive girls becoming physically active.

In the present study, 30% of the adolescents (boys: 36%, girls: 24%) met the PA recommendations (60 minutes MVPA least 7 d/wk) at T1. In the Health Behavior in School-Aged Children study, the prevalence rates varied across countries; the number of boys reporting MVPA four or more times a week varied from 37% to 57%, girls from 20% to 32% [17]. Data from Norway show that among youths aged 15 years, 27% of boys and 20% of girls were physically active ≥60 min/d ≥5 d/wk [18]. Thus, the adolescents in our study were slightly more active. The decreased MVPA over time is in line with other studies of PA during adolescence [19,20].

Predictors of changes in physical activity level

In general, similar, but inverse, predictors were noted for both relapse and adoption risk. This is noteworthy when the predictors are also important risk factors for PA maintenance.

Boys dissatisfied with life, who considered themselves as overweight or being overweight had a high risk of relapse and maintaining inactivity. This pattern was not evident among girls. Testing for interaction between genders, the interactions were significant, indicating a substantial gender difference in the importance of BMI for decreased PA among adolescents. Gender differences related to overweight and physical inactivity have been observed in other studies [21]. Some studies show the opposite relationship between PA and obesity [22], whereas oth-

Table 3
The likelihood of change from being physically active to inactive (relapsers) from early to late adolescence associated with baseline predictors of change, by gender and age adjusted

Variables	Relapsers (n = 386)							
	Boys				Girls			
	%	OR	95% CI	*p*	%	OR	95% CI	*p*
Subjective pain								
Never or seldom	18.1	1.0			15.6	1.0		
Occasionally or often	17.8	1.2	.8–1.9	.338	14.7	1.1	.7–1.7	.815
Well-being								
Satisfied	18.3	1.0			16.0	1.0		
Dissatisfied	18.1	3.4	1.3–8.8	.010	10.4	.9	.4–1.9	.809
Considering oneself as								
Normal, like others'	19.0	1.0			14.3	1.0		
Slim	17.0	.8	.5–1.4	.441	12.3	1.1	.5–2.3	.869
Overweight	17.3	2.6	1.3–5.0	.006	17.1	1.7	1.0–3.0	.050
BMI status								
Normal weight	18.6	1.0			14.7	1.0		
Overweight	16.2	3.8	1.7–8.6	.001	15.5	1.0	.5–2.0	.991
Playing or listening to music								
<Four times/wk	14.7	1.0			13.5	1.0		
≥Four times/wk	20.8	1.7	1.1–2.5	.015	15.5	1.6	1.0–2.7	.052
Watching television/video								
<Four times/wk	21.4	1.0			15.3	1.0		
≥Four times/wk	16.1	.7	.5–1.1	.135	14.6	1.3	.8–2.2	.247
Participating actively in sports								
Yes	21.4	1.0			20.2	1.0		
No	11.4	4.0	2.0–7.9	<.000	5.2	2.0	.8–4.8	.126
Smoking								
Nonsmoking	18.3	1.0			14.5	1.0		
Smoking	16.5	2.1	.8–5.5	.110	17.7	4.4	1.6–12.1	.004
Alcohol use/consumption								
Never been drunk	18.2	1.0			14.0	1.0		
Drunk once or more	17.6	1.1	.7–1.9	.652	16.4	2.7	1.4–5.2	.002
Type of education[a]								
Academic subjects	16.3	1.0			16.0	1.0		
Vocational subjects	21.3	5.6	3.2–9.8	<.000	12.8	1.6	.9–3.6	.071
Mother's education								
Primary school	16.9	1.0			16.2	1.0		
High school	19.1	1.0	.5–1.8	.977	15.2	.5	.2–1.0	.055
College and university	17.8	.7	.4–1.3	.281	17.5	.4	.2–.9	.035
Father's education								
Primary school	19.3	1.0			10.5	1.0		
High school	19.2	.8	.4–1.5	.414	16.7	1.9	.9–4.2	.106
College and university	16.5	.5	.3–1.0	.044	17.3	1.3	.6–3.0	.495
Mother's physical activity								
Inactive	17.4	1.0			15.0	1.0		
Active	18.8	.8	.5–1.3	.317	16.7	.4	.2–.7	.003
Father's physical activity								
Inactive	17.4	1.0			16.8	1.0		
Active	18.4	.7	.4–1.3	.287	15.7	.9	.5–1.7	.904

[a] Variable measured at follow-up.

ers report no association [23]. Some studies have reported this in the context of gender differences related to the fact that girls are less active than boys [22]. In the present study, decreased PA was associated with perceived body image in both genders, but with the objective measures of BMI in boys only. Some of the disagreement concerning weight and PA might relate to this gender difference. Weight dissatisfaction has been associated with perceived under- and overweight (body image), and longitudinal studies show a significant increase in body weight dissatisfaction during early adolescence, especially among girls [24,25]. This may be an explanatory factor for reduction in PA during adolescence, also in girls. Thus, it is important to consider both body image of overweight as well as objectively measured overweight status in promoting PA.

Sedentary leisure time activities in children and adolescents, especially television and video game time have been strongly associated with obesity [23], and perhaps inactive time replaces active time [26]. Some studies do not support this association [27], whereas others reported that low PA replaced PA, but had no effect on vigorous PA [28]. We found a relationship between decreased PA and frequent listening to music or playing an instrument among boys, but not in girls. Gender differences might partly explain reported differences between studies. In our study, musical activity was the only sedentary activity measured and other sedentary activities might yield different associations with PA. In contrast to sedentary activities, we noted the importance of young adolescents being active in sports in relation to changes in PA level in late adolescence. Not participating actively in sports is a risk factor in both genders for being an inactive maintainer. This supports the relationship between participation in sports during adolescence and increased PA later in life [29], but there is a lack of data that show gender differences for this

Table 4
The likelihood of IM versus AM associated with baseline predictors, by gender and age adjusted

Variables	AM vs. IM (n = 1680)									
	Boys (n = 744)					Girls (n = 935)				
	AM (%)	IM (%)	OR	95% CI	*p*	AM (%)	IM (%)	OR	95% CI	*p*
Subjective pain										
Never or seldom	19.4	49.2	1.0			9.4	61.0	1.0		
Occasionally or often	16.0	52.1	1.3	.9–1.9	.130	8.8	67.5	1.2	.8–1.9	.330
Well-being										
Satisfied	19.4	48.7	1.0			9.2	63.4	1.0		
Dissatisfied	5.7	63.8	4.5	1.9–10.6	.001	6.3	75.1	1.7	1.0–3.1	.069
Considering oneself as										
Normal, like others'	20.3	45.8	1.0			10.2	63.2	1.0		
Slim	22.3	48.4	4.1	2.3–7.3	<.000	8.0	71.0	1.6	.9–2.6	.054
Overweight	7.1	65.5	4.2	2.2–8.2	<.000	6.8	66.9	1.1	.5–2.3	.757
BMI status										
Normal weight	20.6	47.0	1.0			8.5	65.9	1.0		
Overweight	4.8	66.5	6.1	2.9–12.7	<.000	8.6	65.8	1.0	.6–1.8	.991
Playing or listening to music										
<Four times/wk	19.3	52.1	1.0			10.6	65.5	1.0		
≥Four times/wk	17.2	48.9	1.1	.8–1.5	.685	7.9	65.6	1.4	.9–2.1	.111
Watching television/video										
<Four times/wk	17.6	46.7	1.0			10.9	62.8	1.0		
≥Four times/wk	18.7	51.7	1.0	.7–1.5	.811	7.9	66.7	1.5	.9–2.2	.082
Participating actively in sports										
Yes	25.0	39.5	1.0			12.6	65.0	1.0		
No	3.4	73.1	14.1	7.6–25.9	<.000	1.6	35.0	13.4	6.1–29.2	<.000
Smoking										
Nonsmoking	18.8	49.4	1.0			9.5	64.7	1.0		
Smoking	8.2	61.2	3.1	1.4–7.0	.007	3.2	71.5	3.6	1.4–9.1	.007
Alcohol use/consumption										
Never been drunk	18.5	49.2	1.0			9.9	65.0	1.0		
Drunk once or more	17.2	53.1	1.2	.8–1.9	.319	6.2	67.2	2.0	1.8–3.5	.011
Type of education[a]										
Academic subjects	25.8	41.5	1.0			10.7	61.0	1.0		
Vocational subjects	5.8	62.9	6.6	4.0–10.8	<.000	4.3	75.6	3.0	1.7–5.5	<.000
Mother's education										
Primary school	15.1	59.6	1.0			4.3	70.0	1.0		
High school	17.4	51.2	.5	.3–.9	.013	8.9	64.0	.3	.2–.7	.003
College and university	22.7	46.2	.7	.5–1.0	.068	11.6	60.7	.7	.5–1.2	.185
Father's education										
Primary school	13.1	53.8	1.0			9.4	71.9	1.0		
High school	17.3	52.2	.5	.3–.9	.016	8.1	62.5	.6	.3–1.2	.168
College and university	23.1	46.3	.7	.4–1.0	.056	12.2	60.1	.6	.4–1.1	.079
Mother's physical activity										
Inactive	15.9	52.2	1.0			4.3	71.1	1.0		
Active	21.5	49.4	.7	.5–1.0	.066	12.1	59.5	.3	.2–.5	<.000
Father's physical activity										
Inactive	14.3	50.4	1.0			9.6	66.1	1.0		
Active	20.3	50.6	.7	.4–1.1	.131	9.8	61.8	.9	.6–1.5	.763

IM = inactive maintaining; AM = active maintaining.
[a] Variable measured at follow-up.

association. The gender difference in our data might be related to dropout in sports participation, with girls possibly dropping out earlier. The hypothesis that girls drop out of sport earlier is supported by studies concerning gender differences in maturity and PA, where average maturity of the girls occur 2 years before boys [30]. Thompson et al reported that gender differences in PA level disappeared among adolescents (9–18 year olds) when adjusted for maturity. This is important in a public health perspective, and shows the importance of early intervention to maintain PA in adolescence.

We found that risk-taking girls (smoking, having been drunk) predicted increased relapse, with "not smoking or never drunk" as protective factors in maintaining PA. This was consistent with other studies on smoking and PA showing that smokers are less physically active and less active in sports than nonsmokers [31].

Girls who had been drunk once or more also had a higher risk of decreasing PA, but this was not observed among boys. According to the published data, although alcohol use and PA is incompatible, there is a trend in which several studies have reported a positive correlation between physical inactivity and alcohol use [32]. This is in agreement with our results for girls. Korhonen et al observed differences between genders, alcohol use, and sedentary lifestyle being stronger among young women than among men [33].

Parents' education and their PA level seemed to influence PA in adolescents. Although mother's education and PA level might influence PA in girls, it seemed from our data that boys are more influenced by their fathers. The need for gender-specific role modeling might be an explanatory factor. Previous studies have reported that parents influence the PA of

children and young people [34], but this relationship might be complex [35].

This study has some limitations, as several of the variables used in the study are self-reported. There has been much debate over the use of self-report PA measurements. However, the questions of World Health Organization Health Behavior in School-Aged Children survey used in this study have been previously validated in different studies, and also by us in the Young-HUNT population [13,14]. This validation study showed substantial reliability and acceptable validity for the question that measures the frequency of PA in the past week, outside school hours. In Norway, the legal requirement is 2 hours of PA a week, at school.

The main strength of this study is the prospective longitudinal design from early to late adolescents, with a large sample size. Another strength is the variety of predictors. This variation is important to help researchers to identify potential predictors of behavior change that could have implications for health promotion and preventions programs.

Conclusion

From a public health perspective, this study suggests that more than half of young people remain inactive, and that a large proportion of those who are active relapse during adolescence.

Predictors for change or maintenance of PA status during adolescences differed between boys and girls.

Dissatisfaction with life, being overweight, and not participating actively in sports were the strongest predictors for decreased PA among boys. For girls; hazardous risk behaviors like smoking and drinking, low maternal education, and physical inactivity were the strongest determinants of decreased PA. Higher levels of education and more physically active parents seemed to protect against decreased PA at follow-up.

The possibility of adolescents who were physically inactive at 13–15 years, and did not participate actively in sports or chose vocational subjects in high school, to change from inactive to active (adopters) was very low. This was also the case for physically inactive girls who occasionally or often reported subjective pain compared with girls without subjective pain.

Community-wide programs that emphasize PA for inactive adolescents and maintenance of PA among those already active are required to influence our sedentary society to be more physically active.

Population-wide interventions should consider the various factors that might influence the change or maintenance of PA through adolescence and that these might be different for boys and girls. The results from this study emphasize that both leisure-time activities and school environments should be targeted, with a special focus on stimulating adolescents to start participating in sports and to maintain participation.

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Paper III

Rangul et al. International Journal of Behavioral Nutrition and Physical Activity 2012, 9:144
http://www.ijbnpa.org/content/9/1/144

INTERNATIONAL JOURNAL OF BEHAVIORAL NUTRITION AND PHYSICAL ACTIVITY

RESEARCH Open Access

Is physical activity maintenance from adolescence to young adulthood associated with reduced CVD risk factors, improved mental health and satisfaction with life: the HUNT Study, Norway

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Abstract

Background: Little is known about the effect maintaining physical activity throughout adolescence has on cardiovascular risk factors and health status in early adulthood. This ten-year prospective longitudinal study investigated whether differences in physical activity patterns from adolescence to young-adulthood showed different associations with subsequent cardio-metabolic risk factors and mental health in young-adulthood.

Methods: Based on the second and third Norwegian Nord-Trøndelag Health Surveys (HUNT2 and 3), we included 1869 individuals (838 males) participating in Young-HUNT (1995–97), aged 13–19 years and followed-up at HUNT3 (2006–08), aged 23–31. Self-reported physical activity (PA), mental health and perceived health were recorded, along with measurements of body mass index (BMI), waist circumference (WC), total cholesterol (TC), HDL cholesterol, glucose, triglycerides, resting heart rate (HR) and blood pressure. We used separate linear regressions models to investigate associations between physical activity and each CVD risk factor, and logistic regression analysis to examine PA patterns and subsequent mental health. Physically active maintainers were compared to inactive maintainers. Adopters (inactive as adolescents and physically active as young adults) were compared to inactive maintainers and to those who discontinued activity (relapsers).

Results: Active maintainers had significantly lower HR, compared to all other PA patterns. Active maintaining men had significantly lower WC than relapsers and inactive maintainers. When adjusted for age and gender, WC, BMI, HR, diastolic blood pressure and HDL-C showed significant differences comparing active maintaining to other PA patterns. Comparing inactive maintainers against adopters, only HR was significantly lower. Male adopters did not differ significantly in CVD risk compared to inactive maintainers and relapsers. Among females adopting was associated with lower HR and TC compared to inactive maintainers. Active maintainers showed better mental health than inactive maintainers. Active maintaining males had an increased likelihood of good mental health compared to adopters. Active maintaining females reported greater satisfaction with life compared to adopters.

Conclusions: Those who maintained their physical activity from adolescence to young adulthood demonstrated a significantly lower CVD risk and better mental health, compared to inactive maintainers. Compared to inactivity maintainers and relapsers, adopting physical activity was not significantly associated with lowered CVD risk. Adopting physical activity between adolescence and young adulthood may not necessarily protect against mental distress.

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Background

It is well documented that physical activity is associated with numerous health benefits, both in youth and adulthood. Several observational studies suggest that being physically active is associated with lowered risk for cardiovascular disease (CVD), certain cancers and improved mental health and quality of life [1]. There is also evidence for a dose–response relationship between physical activity and health outcomes [2]. The literature shows a consistent, but moderate association between physical activity in adolescence and adulthood [3]. This modest association is partly due to the complex nature of physical activity behaviour, and also due to a paucity of population tracking studies.

Physical activity is important in cardiovascular disease prevention, mediated through a direct disease protective effect, and through its association with favourable cardiovascular risk factor profiles [4,5]. Cardiovascular disease (CVD) is the leading cause for morbidity and mortality worldwide [6], and risk factors for CVD include obesity, smoking, low levels of high-density lipoprotein (HDL-C), high level of total cholesterol (TC), triglycerides and high blood pressure (BP) [7,8]. In addition, physical activity has a role in psychosocial health and in promoting good mental health [9], although much of this prospective epidemiological evidence was established in adult populations [10].

The present study focuses on adolescence, as an important period for healthy lifestyle habit development, and for maintaining low risk cardiovascular profiles and improving mental health [11-13]. Physical activity habits may decline in adolescence and in the transition to adulthood, and the health implications of this are important for chronic disease prevention efforts [14,15].

To date, few studies have examined the relationship between physical activity in adolescence and subsequent CVD risk and mental health in adulthood. Previous studies examining physical activity and physical fitness, found that physical fitness, but not physical activity was associated with lowered CVD risk, but often used small non-representative samples [7,16,17]. Sassen at al. reported that physical fitness and to a smaller degree physical activity were inversely associated with CVD risk (clustering) [18]. The health benefits of physical activity, not just fitness, on adolescent and young adult health risk factors require further investigation [19].

For mental health, most studies report relationships between physical activity and mental health using short follow-up periods. Little is known about the long-term effects of adolescent physical activity on adult mental health. Physical activity reported at least of moderate intensity seems to be associated with better mental health [20].

To our knowledge, no previous longitudinal population based studies have studied the physical activity pattern from adolescence to young adulthood as predictor of cardiovascular disease risk factors and poor mental health in young adulthood. This information is important from a preventive health perspective.

The purpose of this ten-year prospective longitudinal study analysis was to investigate:

- Are those who maintain physically active behaviour (active maintainers) different in terms of (i) cardio-metabolic risk factors, and (ii) mental health outcomes compared to those that maintained an inactive behaviour (inactive maintainers)?
- Are active maintainers (AM) different to all other groups: those who maintained an inactive behaviour (IM), those who adopted more physical activity behaviour (adopters), or those who relapsed to a low active state (relapsers)?
- Specifically; is adopting physical activity health-enhancing, by comparing cardio-metabolic risk and mental health between adopters and active maintainers; and between adopters and less active patterns (relapsers and inactive maintainers)?

Material and methods

Study population

In 1995–97 all inhabitants (approximately $n = 127\ 000$) aged 13 years and older were invited to participate in the second population survey in the county of Nord-Trøndelag in Norway, the Nord-Trøndelag Health Study (HUNT), http://www.ntnu.no/hunt/english.

A total of 8983 adolescents (90% response rate) participated in the youth component (13–19 years old) of the study (Young-HUNT1). These participants were also invited 10 years later to participate in the adult part of the HUNT3 survey which was carried out in 2006–08. We followed a sub-sample of 2172 who had participated in both surveys. We excluded 303 persons from the analysis because they had insufficient blood for analysis. In the present analysis, the study cohort sample comprised 1869 individuals (n = 838 male) who participated in both Young-HUNT1, aged 13–19 years old (baseline, T1) and HUNT3, aged 23–31 (follow-up, T2).

The population is stable, and the sex and age distribution fairly similar to that of Norway as a whole, except slightly lower average income and education [21].

Measures

In Young-HUNT1 participants completed a self-administrated questionnaire during one school session and participated in a clinical examination that included measurement of height and weight at school. In HUNT3, they completed the questionnaires at home

and had a clinical examination and collection of blood samples at screening stations. A detailed description of the HUNT Study is reported elsewhere [21,22].

Physical activity

Physical activity in adolescence was assessed by questions used in the World Health Organization Health Behaviour in School-Aged Children (WHO HBSC) Surveys [5], and in adulthood by leisure time PA questionnaire. The questions record the responder's PA in sports or exercise, asking the number of days a week they were physically active at a moderate to vigorous intensity (MVPA) in their leisure time. The question was: "Outside school hours: How many days a week do you play sports or exercise so that you get out of breath or sweat?". The response alternatives were: "every day", "4-6 days a week", "2-3 days a week", "one day a week", "not every week, but at least once every 14th day", "not every 14th day, but at least once a month", "less than once a month" and "never" [23]. The adults question asks "How often do you exercise?". The response alternatives were: "never", "less than once a week", "once a week", "2–3 times a week" and "nearly every day". Both questionnaires were dichotomised into; "inactive" if response was <2-3 days/week (adolescence) or <2-3 times a week (adulthood) and "active" if response was ≥2-3 days/week or ≥2-3 times a week. Both questionnaires have been validated against physical fitness (VO_{2peak}) and PA level (by ActiReg®), among adolescents and men between 20–39 years old in Nord-Trøndelag [24-26].

Based on these physical activity categories, we constructed a measure of the pattern of physical activity from adolescence to young adulthood. Those who were active at both time points, were "active maintainers" (AMs), those who had been active and became inactive were described as "relapsers". Those who moved from being inactive to active, were classified as "adopters", and those who were inactive during adolescence and still inactive at young adulthood were "inactive maintainers" (IMs) [13].

Metabolic measures (CVD risk factors)

A non-fasting blood sample was drawn from all participants at follow-up (HUNT3). Serum samples were analysed for total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), glucose and triglycerides. The TC was analysed by enzymatic cholesterol esterase methodology, applying Reagent kit 7D62-20 cholesterol. HDL-C was analysed by accelerator selective detergent methodology, applying Reagent kit 3 K33-20 Ultra HDL. Non-fasting glucose was analysed by Hexokinase/G-G-PDH methodology, applying Reagent kit 3 L82-20 Glucose. Triglycerides was analysed by Glycerol Phosphate Oxidase methodology, Reagent kit 7D74 Triglyceride. All reagent kits were from Abbott (Clinical Chemistry, USA) and the samples were measured in mmol/L.

Waist circumference and body mass index

Both in Young-HUNT1 and HUNT3, trained nurses measured the participants' height and weight following the same standardised procedures, participants wearing light clothes and without shoes. Body mass index (BMI) was calculated as weight divided by height squared (kg/m^2). Waist circumference was measured to the nearest 1.0 cm using a non-elastic measuring tape, assessed after maximal expiration, and measured at the umbilicus or midway between the subcostal margin and the iliac crest if the latter was largest.

Blood pressure and heart rate

In HUNT3, trained nurses measured blood pressure (BP) in seated participants, with a Dinamap 845XT (Criticon, Florida, USA) based on oscillometry. Blood pressure was measured automatically three times at one minute intervals. The arithmetic mean of the second and third systolic and diastolic blood pressure readings were used in this study. The resting heart rate (HR) was measured by the Dinamap, and expressed as beats/min.

Mental health and perceived health status/satisfaction with life

Mental health was measured with the Cohort of Norway Mental Health Index (CONOR-MHI). The CONOR-MHI includes seven questions asking about psychosocial distress, and is modified from the General Health Questionnaire [27] and the Hopkins Symptom Checklist [28]. The CONOR-MHI has been shown to be a valid measure of mental health status encompassing both anxiety and depression [29]. The 7 questions in the CONOR-MHI were: "Have you, in the last 2 weeks, felt; 1) nervous and restless; 2) troubled by anxiety; 3) confident and calm; 4) irritable; 5) happy and optimistic; 6) down/depressed; or 7) lonely?" Each item has four answer categories, ranging from "no", "a little, "moderately" and "very much", given the values 1–4. Data on items 3 and 5 were reversed in the analysis. The index is based on means of the questions and calculated by dividing the total score on seven (number of items) and 4 (4-point scale). The CONOR-MHI results were analyzed as both continuous and categorical variables. As a categorical score, we divided the summary score distribution into tertiles (scores of 1.00–1.79, 1.80–2.29 and 2.30–6.00 respectively). Five of the 7 questions (item 1, 2, 4, 6 and 7) were also analyzed separately in logistic regression models. The answers were recorded into two categories, and the outcomes were "no" and "a little, moderately and very much".

Current subjective health was self-rated as "poor", not so good", "good" or "very good". In logistic regression analysis this variable was recorded into two categories, combining "poor and not so good health" and "good and very good health". The participants reported their 'satisfaction with life', measured by a question asking: "Thinking about your life at the moment, would you say that you by and large are satisfied with life, or are you mostly dissatisfied?". Responses were recorded into two categories, 1 "dissatisfied", including "a bit of both", "somewhat dissatisfied", "dissatisfied" and "very dissatisfied" and 2 "satisfied" including "satisfied" and "very satisfied".

Ethics

Participants and the parents or legal guardians of adolescents under the age of 16 years, signed a written consent to take part in the study. The study was approved by the Regional Committee for Medical Research Ethics and the Norwegian Data Inspectorate Board.

Statistical analysis

The participants' characteristics were calculated as means (±standard deviation) and percentages. We applied ANOVA with Scheffé's method for post-hoc contrasts to test the differences between means. We present p-values (significance level $p < 0.05$) and F-statistics from these analyses. This is a flexible and conservative post hoc procedure, and is a preferable method for comparisons that involve contrasts of more than two means at a time. We used separate linear regression models to investigate associations between physical activity and each of the different CVD risk factors. First, physically active maintainers (AMs) were compared to inactive maintainers (IMs), unadjusted and adjusted for age and gender, to examine the linear relationships between CVD risk factors and physical activity maintenance. Second, we grouped relapsers, adopters and IMs by comparing them against AMs to investigate the relationship with CVD risk factors. In addition, we also separately examined the linear relationships by comparing adopters against AMs and adopters against the common group of IMs and relapsers. We also combined IMs and relapsers, and compared them with AMs and investigated the associations with CVD risks factors and mental health (not shown in tables). On the basis of these analyses, we stratified analyses by gender and did the same analyses stratified by gender.

In our linear regression models, we compared those who became physically active (adopters) against those who were physically inactive (inactive maintainers), to test the hypothesis that increasing physical activity is associated with health benefits compared to those remaining inactive. We also combined IMs and relapsers and compared them with adopters to further investigate these associations.

To examine the relationship between physical activity patterns and mental health and satisfaction with life we used multiple binary logistic regression analyses, in separate models. The analysis compared physical activity patterns from adolescence to young adulthood (inactive maintainers (IMs) vs. active maintainers (AMs) and IM vs. adopters) and outcome (perceived health, satisfaction with health and mental health status) at follow-up. We also combined IMs and relapsers and compared them with AMs (not shown in tables). Gender specific analyses were performed, and all analyses were age adjusted. All statistical analyses were performed with IBM SPSS (SPSS Inc., Chicago IL, USA) version 19.1.

Results

A total of 1869 participated (males 42.8%), with a mean age of 16 years at baseline (adolescence) and 27 years at follow-up (adulthood). Participants' characteristics are listed in Table 1, stratified by gender. Four patterns of physical activity from adolescence to young adulthood emerged: active maintainers (AMs)(42.3%, males 38.1%, females 45.4%), reporting high PA both in adolescence and early adulthood; relapsers (25.4%, males 31.4%, females 21.3%), showing high PA in adolescence, but low PA in adulthood; adopters (14.2%, males 11.4%, females 16.3%), changing from low PA in adulthood to high PA as young adults; and inactive maintainers (IMs)(18%, males 17%, females 19.1%), classified with low PA at both time points.

Differences by gender were significant for AMs and relapsers.

The mean age was significantly higher, for both genders, among inactive maintainers (IMs) compared to relapsers and active maintainers at follow-up (Table 1). The same pattern was seen at baseline in women.

Mean resting heart rate was significantly lower in the AM group, compared to the three other PA patterns, for both genders. Among men, the AM had significantly lower waist circumference than relapsers and IM, and the AM group had significantly higher HDL-C compared to relapsers. Among females, the AMs had significantly lower total cholesterol (TC) than adopters.

Linear regression analysis in Additional file 1 shows the relationship between the patterns of PA and CVD risk factors. Unadjusted, all variables except systolic blood pressure and glucose were significantly better in the AMs than the IMs group (Additional file 1). When adjusted for age and gender, the AM showed significant, slightly smaller waist circumference (WC), lower resting HR and higher HDL-C compared to the IMs (Additional file 1). In the additional analysis, comparing the remaining groups (combined IM + relapsers + adopters)

Table 1 Participants characteristics at baseline and follow up (N = 1869)

Variables	Males (*n* = 799)							Females (*n* = 1070)						
	AM *n* = 304 (38.1%)	Relapsers *n* = 251 (31.4%)	Adopter *n* = 91 (11.4%)	IM *n* = 153 (19.1%)				AM *n* = 486 (45.4%)	Relapsers *n* = 228 (21.3%)	Adopter *n* = 174 (16.3%)	IM *n* = 182 (17.0%)			
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	*F*	*p*	Scheffe Post hoc test	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	*F*	*p*	Scheffe Post hoc test
Baseline measures														
Age	15.8 (1.84)	15.8 (1.77)	16.1 (1.81)	16.3 (1.79)	3.17	.024		15.8 (1.83)	15.8 (1.75)	16.1 (1.85)	16.5 (1.83)	6.02	.000	IM > rel., AM
BMI	20.8 (2.96)	20.9 (3.29)	21.7 (3.41)	21.4 (3.47)	2.47	.061		21.4 (3.20)	21.3 (2.94)	21.6 (3.20)	21.5 (3.39)	.20	.896	
Follow-up measures														
Age	27.0 (1.92)	27.0 (1.88)	27.5 (1.94)	27.6 (1.96)	4.29	.005	IM > rel., AM	27.0 (1.94)	27.0 (1.79)	27.3 (1.99)	27.7 (1.90)	5.59	.001	IM > rel., AM
Sitting time (hour/day)	6.0 (2.92)	6.1 (3.13)	6.5 (3.16)	5.9 (3.07)	.77	.509		5.7 (2.45)	5.1 (2.65)	5.7 (2.71)	5.8 (2.81)	2.50	.059	
Waist circumference (cm)	89.7 (9.70)	92.7 (12.28)	91.8 (11.21)	93.4 (12.38)	4.84	.002	AM < rel., IM	84.8 (12.90)	85.9 (12.97)	87.0 (13.42)	87.3 (13.20)	2.03	.108	
BMI	25.8 (3.70)	26.4 (4.90)	26.5 (4.02)	26.4 (4.49)	1.49	.217		25.0 (4.72)	25.3 (4.74)	25.8 (5.07)	25.6 (4.91)	1.18	.316	
Resting heart rate	66.1 (10.74)	71.0 (11.47)	72.3 (12.67)	71.6 (10.43)	14.32	.000	AM < IM, rel., adopt.	70.2 (10.19)	74.8 (11.08)	73.2 (9.97)	76.7 (10.43)	21.10	.000	AM < IM, rel., adopt.
Diastolic blood pressure (mmHg)	67.1 (8.74)	68.4 (8.64)	68.6 (8.51)	67.5 (9.54)	1.17	.320		64.1 (7.92)	63.9 (7.90)	66.0 (7.68)	66.1 (7.75)	4.53	.004	AM < IM
Systolic blood pressure (mmHg)	127.0 (10.00)	127.6 (11.44)	128.0 (11.93)	125.6 (11.09)	1.13	.336		114.6 (10.52)	114.7 (9.03)	116.1 (10.14)	115.9 (10.92)	1.34	.259	
HDL-cholesterol (mmol/l)	1.20 (.25)	1.13 (.26)	1.13 (.25)	1.14 (.24)	5.05	.002	AM > rel.	1.45 (.32)	1.43 (.35)	1.42 (.33)	1.38 (.30)	1.62	.184	
Cholesterol (total) (mmol/l)	4.66 (.92)	4.87 (1.00)	4.68 (1.03)	4.90 (1.02)	3.18	.023		4.70 (.88)	4.90 (1.19)	5.01 (1.05)	4.74 (.96)	4.96	.002	AM < adopt.
Glucose (mmol/l)	5.02 (.91)	5.17 (1.13)	5.37 (3.03)	5.07 (.88)	1.64	.179		4.99 (1.41)	4.83 (.73)	4.80 (.59)	4.86 (.65)	1.91	.126	
Triglycerides	1.55 (1.01)	1.81 (1.19)	1.73 (1.05)	1.70 (1.11)	2.06	.104		1.13 (.72)	1.23 (.66)	1.24 (.77)	1.21 (.58)	1.37	.250	

IM = inactive maintainers, *AM* = active maintainers, *rel* = relapsers, *adopt* = adopters.

Table 2 CVD risk in inactive maintainers and adopters compared to active maintainers in young adulthood

Variables	IMs against AMs*			IMs against AMs*			Adopters against AMs#			Adopters against AMs#		
	Males			Females			Males			Females		
	B	*P*	95% CI	B	*P*	95% CI	B	*P*	95% CI	B	*P*	95% CI
BMI	-.58	.146	−1.37, 0.20	-.34	.418	−1.16, 0.48	-.69	.129	−1.59, 0.20	-.66	.123	−1.49, 0.18
Waist circumference (cm)	−3.54	.001	−5.64, -1.43	−1.89	.103	−4.17, 0.38	−1.87	.124	−4.25, 0.51	−1.90	.102	−4.19, 0.39
Resting heart rate (HR)	−5.66	.000	−7.75, -3.56	−6.25	.000	−8.02, -4.48	−6.21	.000	−8.87, -3.54	−2.82	.002	−4.57, -1.07
Diastolic blood pressure (mmHg)	.03	.971	−1.85, 1.92	−1.77	.016	−3.20, -0.33	−1.17	.285	−3.33, 0.98	−1.79	.017	−3.25, -0.33
Systolic blood pressure (mmHg)	1.65	.144	−0.57, 3.86	−1.22	.218	−3.17, 0.72	-.80	.551	−3.43, 1.84	−1.51	.127	−3.46, 0.43
HDL-cholesterol (mmol/l)	.06	.018	0.01, 0.11	.05	.069	−0.00, 0.11	.07	.020	0.01, 0.13	.02	.423	−0.03, 0.08
Cholesterol (total) (mmol/l)	-.19	.046	−0.38, -0.00	-.03	.706	−0.19, 0.13	.01	.967	−0.22, 0.23	-.30	.000	−0.46, -0.14
Glucose (mmol/l)	-.03	.751	−0.21, 0.15	.16	.156	−0.06, 0.38	-.33	.108	−0.72, 0.07	.21	.070	−0.02, 0.43
Triglycerides	-.12	.308	−0.36, 0.11	-.09	.224	−0.23, 0.05	-.17	.256	−0.45, 0.12	-.11	.161	−0.27, 0.04

Adjusted for age.
* Inactive maintainers (IMs) vs active maintainers (AMs).
# adopters vs active maintainers (AM).

against the AM, we found additional significant differences for TC, triglyceride levels and BMI (right hand column, Additional file 1)

Additional file 2 presents data on those who adopted physical activity, compared to active maintainers (AMs) in the left hand column, and against all hypothetically 'less active categories', relapsers and inactive maintainers (IMs), shown in the right hand columns. Compared to adopters, the adjusted analyses showed that AMs had a significantly lower waist circumference, heart rate, diastolic BP and total cholesterol. However, compared to the IM + relapsers, the adopters showed no significant differences on any of the cardiovascular risk parameters.

Table 2 shows the gender specific associations between patterns of physical activity and cardiovascular risk factors. For males, AMs had more favourable risk factor profiles for WC, HR and HDL-C, compared to inactive maintainers. Among females, only HR was significantly lower in this comparison. Comparing adopters against AMs, for males, the AM had a lower HR, and higher HDL-C, and for women the AM had a lower HR and diastolic BP. Examining the AM against all others (Table 3), males showed significantly favourable BMI, WC, HR and HDL-C, and females showed favourable WC, HR and diastolic BP. Adopters did not show a favourable profile compared to inactive maintainers and relapsers for males, and only HR was lower among adopting females (right hand columns, Table 3).

Mental health associations are shown in Table 4. The AMs reported better self-rated health status and lower mental health CONOR scores than IMs. In addition, female AMs showed a twofold likelihood of being satisfied with life, and a reduced risk of feeling nervous or troubled by anxiety compared to IM. Compared to

Table 3 Different physical activity patterns in relation to CVD risk in Young adulthood

Variables	IMs + relap + adopt against AMs *			IMs + relap + adopt against AMs *			Adopters against IMs + relap #			Adopters against IMs + relap #		
	Males			Females			Males			Females		
	B	*P*	95% CI	B	*P*	95% CI	B	P	95% CI	B	P	95% CI
BMI	-.64	.042	−1.26, 0.02	-.45	.130	−1.04, 0.13	-.11	.838	−1.17, 0.95	-.33	.455	−1.21, 0.54
Waist circumference (cm)	−2.95	.000	−4.56, -1.33	−1.63	.047	−3.24, -0.02	1.22	.389	−1.56, 4.00	-.51	.675	−2.91, 1.89
Resting heart rate (HR)	−5.31	.000	−6.91, -3.71	−4.66	.000	−5.93, -3.39	−1.03	.441	−3.64, 1.59	2.44	.011	0.55, -4.32
Diastolic blood pressure (mmHg)	-.89	.188	−2.21, 0.44	−1.05	.045	−2.07, 0.03	-.32	.768	−2.46, 1.81	−1.06	.162	−2.55, 0.43
Systolic blood pressure (mmHg)	.08	.929	−1.59, 1.75	-.91	.180	−2.24, 0.42	−1.09	.443	−3.89, 1.70	-.87	.368	−2.77, 1.03
HDL-cholesterol (mmol/l)	.07	.000	0.04, 0.11	.03	.123	−0.01, 0.07	.01	.874	−0.05, 0.06	-.01	.757	−0.07, 0.05
Cholesterol (total) (mmol/l)	-.17	.021	−0.31, -0.03	-.18	.004	−0.30, -0.06	.21	.083	−0.03, 0.44	-.17	.087	−0.37, 0.03
Glucose (mmol/l)	-.15	.152	−0.35, 0.05	.17	.013	0.04, 0.30	-.23	.230	−0.60, 0.15	.05	.429	−0.07, 0.17
Triglycerides	-.21	.025	−0.39, -0.03	-.11	.038	−0.20, 0.01	.05	.774	−0.26, 0.36	-.01	.850	−0.16, 0.13

Adjusted for age.
*Active maintainers (AMs) vs inactive maintainers (IMs) + relapsers + adopters.
Adopters vs inactive maintainers (IMs) + relapsers.

Table 4 Satisfaction with life and mental health in inactive maintainers and adopters against active maintainers

Variables	IMs against AMs						Adopters against AMs					
	Males			Females			Males			Females		
	OR	95% CI	*P*	OR	95% CI	*P*	OR	95% CI	*P*	OR	95% CI	*P*
Perceived health												
Not so good	1.0			1.0			1.0			1.0		
Good/very good	2.87	1.32, 6.23	.008	2.59	1.51, 4.46	.001	3.60	1.54, 8.41	.003	1.59	.86, 2.91	.138
Satisfaction with life												
Dissatisfied	1.0			1.0			1.0			1.0		
Satisfied	1.81	.98, 3.38	.060	1.96	1.22, 3.14	.005	2.15	1.08, 4.29	.029	1.88	1.17, 3.01	.009
Mental health status (CONOR-MHI)*												
First tertile (1.00-1.79)	1.0			1.0			1.0			1.0		
Second tertile (1.80-2.29)	.44	.27, .73	.001	.47	.30, .75	.001	1.06	.59, 1 .88	.857	.98	.65, 1.48	.919
Third tertile (2.30-6.00)	.26	.15, .48	.000	.42	.26, .70	.001	.39	.21, .74	.004	1.01	.63, 1.62	.960
Feel Nervous/restless												
No	1.0			1.0			1.0			1.0		
Little, good amount, very much	.25	.52, 1.19	.252	.62	.44, .88	.007	.63	.39, 1.03	.066	.95	.66, 1.36	.775
Felt troubled by anxiety												
No	1.0			1.0			1.0			1.0		
Little, good amount, very much	.59	.33, 1.06	.079	.47	.29, .75	.002	.64	.32, 1.30	.218	.52	.49, 1.44	.519
Felt down/depressed												
No	1.0			1.0			1.0			1.0		
Little, good amount, very much	.73	.47, 1.14	.162	.70	.49, 1.00	.054	.53	.32, .88	.014	1.23	.84, 1.81	.282

Adjusted for age.
*CONOR-MHI (Cohort of Norway Mental Index) score in tertiles.

adopters (Table 4, right columns), male AMs showed an increased likelihood of good health status, satisfaction with life, and a lower likelihood of reporting high CONOR scores or depression. For females, AM only showed greater life satisfaction, compared to adopters.

Table 5 shows the comparisons between AMs and all less active patterns, and showed mental health advantage for AMs, especially for males. These were less strong among females, but AMs showed reduced anxiety compared to other patterns. There was very little difference between adopters and the less active patterns (right hand columns), except for the middle CONOR category, for males.

In linear regression models using the CONOR score as continuous, we found similar associations where the AM had a significant lower CONOR-MHI score than the IMs, in both genders (males $\beta = -0.26$; 95%CI:-0.39- 0.13; $p < .000$, females $\beta = -0.25$; 95%CI:-0.37--0.12; $p < .000$).

We also conducted two additional analyses. First, to test the PA change with a higher cut off for physical activity, and the second we analysed when change of PA among adopters and relapses occurred.

We re-analysed the data with a higher cut off for physical activity; "≥4-6 days/week or nearly every day" instead of "≥2-3 days/week or ≥2-3 times a week". This did not change our findings. Measuring physical activity four years after baseline, thus being able to see when the change of PA behaviour occurred both for adopters and relapsers, revealed that nearly the same number of people changed their PA early and late in this ten-year period.

The difference was less than 6%, while among adopters 44% became active between years five and ten, and 51% of relapsers became inactive between years five and ten.

Discussion

This population based longitudinal study explored differences in physical activity patterns between adolescence and young adulthood were associated with cardiovascular disease (CVD) risk factors and mental health in young adulthood. To our knowledge no other study of this size has previously examined tracking of PA associated with CVD risk factors and mental health.

To characterize participants, we compared four physical activity patterns; active maintainers (AMs), adopters, relapsers and inactive maintainers (IMs), observed over a ten-year period. In adolescence (baseline) and in young adulthood (follow-up) there were no significant differences (mean) among these physical activity groups and

Table 5 The likelihood of physical activity patterns associated with satisfaction with life and mental health

Variables	IMs + relapsers + adopters against AMs						Adopters against IMs + relapsers					
	Males			Females			Males			Females		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Perceived health												
Not so good	1.0			1.0			1.0			1.0		
Good	3.07	1.62, 5.84	.001	2.04	1.32, 3.16	.001	1.27	.64, 2.52	.494	.75	.42, 1.31	.308
Satisfaction with life												
Dissatisfied	1.0			1.0			1.0			1.0		
Satisfied	1.77	1.10, 2.86	.019	1.75	1.23, 2.50	.002	1.29	.69, 2.42	.420	1.14	.72, 1.81	.578
Mental health status (CONOR-MHI)*												
First tertile (1.00-1.79)	1.0			1.0			1.0			1.0		
Second tertile (1.80-2.29)	.55	.39, .76	.000	.78	.58, 1.04	.088	2.23	1.26, 3.94	.006	1.39	.91, 2.13	.132
Third tertile (2.30-6.00)	.38	.25, .58	.000	.72	.52, 1.00	.050	1.04	.57, 1.89	.895	1.62	1.00, 2.65	.052
Feel Nervous/restless												
No	1.0			1.0			1.0			1.0		
Little, good amount, very much	.76	.56, 1.03	.074	.80	.63, 1.03	.087	.81	.51, 1.29	.376	1.24	.86, 1.79	.253
Felt troubled by anxiety												
No	1.0			1.0			1.0			1.0		
Little, good amount, very much	.79	.50, 1.26	.322	.63	.44, .92	.016	.80	.41, 1.56	.515	1.44	.85, 2.44	.180
Felt down/depressed												
No	1.0			1.0			1.0			1.0		
Little, good amount, very much	.70	.50, .97	.034	.78	.75, 1.25	.784	.67	.42, 1.10	.112	1.40	.95, 2.06	.091

Adjusted for age.
*CONOR-MHI (Cohort of Norway Mental Index) score in tertiles.

overweight/obesity measured as BMI. This is in accordance with studies on the relationship between physical activity and obesity measured as BMI, who reported that the relationship may be more strongly related to cardiorespiratory fitness or screen activities (watching television, computer use) than physical activity [30,31]. But the obesity-related indicator, waist circumference (WC) was lower among AM males than relapsers and IMs. This is supported by Lakerveld et al., who found that abdominal obesity was associated with reduced physical activity over a period of five years [32]. Analyses stratified by gender showed that the association between PA and WC was only significant in males. An inverse relationship between physical activity and overweight/obesity is well known [33,34], although few studies have examined males and females separately.

We found no association between PA behaviour and WC, comparing adopters and IMs + relapsers, even in an unadjusted analysis. Overweight/obesity in adulthood has been associated with decreased probability of being physically active [35]. The lack of association between the adopters and WC in our study, contrasts with the assumption that improvement in physical activity during this time period reduces subsequent obesity and CVD risk [36].

Physical inactivity is a well-known CVD risk factor in adolescence [37], and patterns of physical activity maintenance may be protective in longitudinal studies. This was confirmed when we compared the two extreme groups (IMs compared to AMs); AMs had a much better CVD risk profile in adulthood than the IMs, both in the unadjusted and adjusted analyses, and supporting other studies reporting that physical activity and physical fitness may protect against CVD risk [17]. We found a significant gender difference in the relationship between PA and CVD risk factors. Resting heart rate was lower for AMs in both sexes, but AM males had a considerably smaller waist circumference (WC), lower TC (triglyceride concentration) and higher HDL cholesterol (HDL-C) than the IMs. The gender difference could be anticipated for TC, where previous population studies have found a higher TC in men compared women in the first fifty years [38]. There is also some evidence that a high level of TC is a significant independent risk factor for CVD for both genders [38]. HDL-C is an independent predictor of CVD, both in males and females, but females may have a lower HDL-C than males [39]. Our results show an opposite gender difference, female IMs did not have a higher risk for low HDL-C than AMs. However, it is still important to focus on TC and HDL-C

level, in both sexes among those who are not physically active.

The PA behaviour and CVD risk may be confounded by obesity, which we know is associated with higher triglyceride levels and cholesterol. But our descriptive data (Table 1) indicated no significant differences in BMI between our four physical activity patterns. This lack of difference in BMI between the different PA patterns is interesting, especially when the patterns did show differences for CVD risks. Additional analyses examined how obesity affected the associations, by adjusting for obesity measured as BMI, both at baseline and follow-up (data not shown). These analyses did not attenuate the results presented in the tables, indicating that physical activity patterns and subsequent CVD risk are likely to be independent of obesity.

Several cross-sectional studies have shown a positive effect by physical activity on mental health in general, and in particularly on self-perception and self-esteem [40]. Physical activity has also been recommended as a tool in therapy for depression and anxiety [41], but information on how different physical activity behaviours from adolescence to young adulthood affects mental health and satisfaction with life in adulthood is sparse. Our longitudinal data indicate that the AMs had better life satisfactions and mental health status than inactive maintainers. In addition, there were gender differences, with female AMs having a lower likelihood of feeling nervous/restless and being troubled by anxiety, compared to inactive maintainers. We did not see this in males, but the odds ratios indicate the same trend also for males. This is in accordance with previous studies, where physically active adults' reports fewer symptoms of anxiety than physically inactive persons [42]. Some longitudinal studies have also found negative associations between sedentary behaviour and mental health, while sedentary behaviour as TV viewing was associated with increased odds of mental distress [43].

Physical activity is important for maintaining good health, and physically inactive people have a higher incidence of cardiovascular disease [36]. In addition to its preventive effect, physical activity is also recommended in treatment of several chronic diseases [3]. It could therefore be expected that those who increased their physical activity from adolescence to adulthood (adopters) might have a lowered CVD risk and better mental health than those who stayed inactive (IMs) or relapsed to lower physical activity. Our data indicated, however, that the adopters had no metabolic or mental health advantages compared to IMs and relapsers. This is rather surprising, because we would expect that increased physical activity would have a positive effect on risk factors. One explanation could be that their PA increase was minor and occurred late in the measured period. According to the literature [44], we expected that the change of PA would take place in adolescence (years zero to four in the ten-year period) but our data on adopters and relapsers did not support this. In additional analyses we also compared these two groups (adopters and relapsers) according to when they changed the PA in this period. They did not differ in CVD risk factors. The higher cut point for physical activity did not change our findings.

The unexpected findings on adopters compared to inactive maintainers and relapsers (Table 4–5), became more apparent when we compared adopters with AMs. The active maintainers had a better CVD risk profile in adulthood than the adopters, allowing us to combine the adopters, IMs and relapsers in one group. AMs differed from the other groups concerning association with CVD risk factors. We also revealed the same tendency on the likelihood of physical activity patterns associated with mental health and satisfaction with life. A physiologically plausible explanation could be that adopters altered their physical activity pattern late in the period, and we therefore cannot distinguish them from IMs. Our additional analysis shows, however that it mainly changed early in the adolescence in our 10-year follow-up. The adopter group was also smaller than the other groups, which could also be an explanation for the unexpected absence of positive outcome of adopting PA. But, in the descriptive data the adopter group is quite similar to the IMs and relapsers (Table 1).

Our longitudinal data indicate that AMs are more likely to have better mental health than IMs, relapsers and adopters. This also applies perceived health and satisfaction with life, where AMs had higher odds for subjective good health and are more satisfied with their life compared to the other physical activity patterns.

The main strength of the present study is the ten-year follow-up from adolescence to young adulthood in a representative population-based sample. The study is also unique looking at ten-year physical activity patterns, the change of physical activity, assessing physical activity over several time points, and its impact on subsequent cardio-metabolic risk factors and mental health. However, we acknowledge there are some limitations. Physical activity is measured using validated questions, but relies on self-report, rather than objective measures. These physical activity questions have shown high reliability and acceptable validity [13,26], and dichotomisation as "active" and "inactive" provides good information on physical activity patterns. Another limitation could be that PA behavior might have changed very early in the ten-year period studied, obscuring the classification in some of the participants. Measuring physical activity four years after baseline, thus being able to see when the change of PA behaviour occurred both for adopters and

relapsers (see Results section), revealed that nearly the same number of people changed their PA early and late in this ten-year period. We thus believe that this limitation is of minor importance.

Not having basal metabolic measurements in adolescence is a limitation because some of the participants could have CVD risk or mental distress at baseline, independent of their physical activity. Another limitation to our study may be the low participation rate at follow-up. HUNT Studies are based on repeated cross sectional studies, but as HUNT is a study of a total population longitudinal studies, as the follow-up from Young-HUNT1 to HUNT3, are possible. Although the participation rate in Young-HUNT 1 was high, the participation rate in HUNT 3 in the age group 20–29 years was low (31.5%). Many people in this age group had moved out of the county for further education or work and were not eligible for in vitiation to the HUNT 3 survey. Of the invited (5353 people), 42% of the women and 30% of the men participated. There were no significant differences between Young-HUNT1 participants who also participated at HUNT3 (follow-up) and those who did not regarding mean BMI, systolic and diastolic blood pressure, heart rate and physical activity. We therefore have strong reasons to believe that there are no major selection effects on physical activity or health behaviors between the two groups.

Conclusion

Our study revealed a strong association between low physical activity and CVD risk and impaired mental health; those who maintained high physical activity from adolescence to young adulthood had a better CVD risk profile and better mental health status compared to people with physically inactive behaviour. Active maintainers had a significantly lower CVD risk, and less mental distress than those with other physical activity behaviours.

Adopting physical activity from adolescence to young adulthood may not necessarily confer a lower CVD risk, compared to inactive maintainers and relapsers, and may not be associated with better mental health outcomes. These data suggest that the multiple health benefits are attributable to behavioural maintenance of activity in adolescence, rather than any other pattern, such as behavioural adoption. These findings suggest that interventions on physical activity should start early in adolescence, and focus on maintaining physical activity to maximise health benefits a decade later. A key factor in public health strategies is that the promotion of physical activity needs to be kept a public health priority in the whole lifespan and with a special focus in the first 15 years of life.

Additional files

Additional file 1: Table S1. Different physical activity patterns in relation to CVD risk in young adulthood (n=1869).

Additional file 2: Table S2. Different physical activity patterns in relation to subsequent CVD risk (n=1072): comparing "adopters" to other Groups.

Competing interests

The authors declare that they have no competing interest.

Authors' contributions

VR made a substantial contribution to the initial conception of the research reported in this paper, designing this study, analyzing, interpreting data and writing the manuscript. AB, KM and TLH made a substantial contribution to the conception of the research reported in this paper, reviewing drafts and interpreting data. The writing of the manuscript was led by VR, but all authors provided comments and contributed to the manuscript writing. All authors reviewed the manuscript critically and gave the final approval of the manuscript.

Acknowledgements

The Nord-Trøndelag University College (HiNT) and the Norwegian University of Science and Technology (NTNU) supported this study by a doctoral research fellowship.

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Received: 27 April 2012 Accepted: 11 December 2012
Published: 14 December 2012

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doi:10.1186/1479-5868-9-144
Cite this article as: Rangul *et al.*: Is physical activity maintenance from adolescence to young adulthood associated with reduced CVD risk factors, improved mental health and satisfaction with life: the HUNT Study, Norway. *International Journal of Behavioral Nutrition and Physical Activity* 2012 **9**:144.

Additional file 1. Different physical activity patterns in relation to CVD risk in young adulthood (n=1869)

Variables	IMs against AMs*			IMs against AMs*			IM+relap+adopt against AMs#			IM+relap+adopt against AMs#		
	Unadjusted			Adjusted for age and gender			Unadjusted			Adjusted for age and gender		
	B	*P*	95% CI	B	*P*	95% CI	B	*P*	95% CI	B	*P*	95% CI
BMI	-.62	.035	-1.19, -0.5	-.44	.135	-1.02, 0.14	-.62	.004	-1.05, - 0.20	-.53	.015	-0.96, -0.10
Waist Circumference (cm)	-3.35	.000	-4.95, -1.75	-2.61	.001	-4.19, -1.03	-2.76	.000	-3.93, -1.59	-2.19	.000	-3.34, -1.04
Resting heart rate (HR)	-5.72	.000	-7.08, -4.35	-5.98	.000	-7.33, -4.63	-4.67	.000	-5.67, -3.66	-4.93	.000	-5.93, -3.93
Diastolic blood pressure (mmHg)	-1.47	.013	-2.62, -0.31	-1.00	.086	-2.15, 0.14	-1.30	.002	-2.13, -0.47	-.98	.019	-1.79, -0.16
Systolic blood pressure (mmHg)	-.68	.416	-2.32, 0.96	-.01	.994	-1.47, 1.46	-1.28	.035	-2.47, -0.09	-.50	.352	-1.54, 0.55
HDL-cholesterol (mmol/l)	.08	.000	0.04, 0.12	.06	.005	0.02, 0.09	.07	.000	0.04, 0.10	.05	.001	0.02, 0.08
Cholesterol (total) (mmol/l)	-.13	.031	-0.25, -0.01	-.10	.100	-0.22, 0.02	-.18	.000	-0.28, -0.09	-.18	.000	-0.27, -0.08
Glucose (mmol/l)	.04	.554	0.10, 0.19	.08	.308	-0.07, 0.23	.01	.853	-0.10, 0.13	.04	.533	-0.08, 0.15
Triglycerides	-.14	.035	-0.27, -0.01	-.10	.124	-0.23, 0.03	-.18	.000	-0.28, -0.08	-.15	.003	-0.25, -0.05

* Inactive maintainers (IMs) against active maintainers (AMs)

inactive maintainers(IMs) + relapsers + adopters against active maintainers(AMs)

B = unstandardized regression coefficients

Additional file 2. Different physical activity patterns in relation to subsequent CVD risk (n=1072): comparing "adopters" to other groups

Variables	Adopters against AMs*			Adopters against AMs*			Adopters against IMs + rel.#			Adopters against IMs + rel. #		
	Unadjusted			Adjusted for age and gender			Unadjusted			Adjusted for age and gender		
	B	*P*	95% CI	B	*P*	95% CI	B	P	95% CI	B	P	95% CI
BMI	-.70	.027	-1.33, -0.80	-.66	.036	-1.29, -0.04	-.11	.748	-0.78, 0.56	-.25	.465	-0.92, 0.42
Waist circumference (cm)	-1.90	.031	-3.62, -0.18	-1.87	.030	-3.56, -0.19	1.14	.222	-0.69, 2.98	.16	.861	-1.64, 1.97
Resting heart rate (HR)	-4.25	.000	-5.74, -2.76	-3.99	.000	-5.46, -2.51	.56	.482	-0.99, 2.10	1.12	.155	-0.42, 2.66
Diastolic blood pressure (mmHg)	-1.60	.011	-2.84, -0.37	-1.59	.011	-2.80, 0.37	-.40	.532	-1.65, 0.86	-.82	.196	-2.06, 0.42
Systolic blood pressure (mmHg)	-.73	.424	-2.53, 1.06	-1.27	.112	-2.83, 0.29	.73	.425	-1.07, 2.53	-.99	.225	-2.59, 0.61
HDL-cholesterol (mmol/l)	.03	.172	-0.01, 0.08	.04	.065	-0.00, 0.08	-.05	.036	-0.10, -0.00	-.00	.841	-0.05, 0.04
Cholesterol (total) (mmol/l)	-.21	.002	-0.35, -0.08	-.19	.004	-0.33, -0.06	-.04	.612	-0.19, 0.11	-.03	.690	-0.19, 0.12
Glucose (mmol/l)	.01	.929	-0.19, 0.21	.02	.857	-0.18, 0.22	-.00	.980	-0.17, 0.17	.06	.519	-0.23, 0.12
Triglycerides	-.12	.118	-0.27, 0.03	-.13	.073	-0.28, 0.01	.08	.297	-0.07, 0.24	.00	.938	-0.15, 0.16

Linear regression in separate models for each outcome

* Adopters against active maintainers (AMs)

Adopters against inactive maintainers (IMs) + relapsers

B = unstandardized regression coefficients

Appendices

Appendix 1 Questionnaires used in paper 1

Appendix 2 Questionnaires used in HUNT2, Young-HUNT1 and Young-HUNT2 (paper 2 and 3)

Appendix 3 Questionnaires used in HUNT3 and Young-HUNT3 (paper 3)

Appendix 4 Information and declaration of consent from paper 1

Appendix 5 Information and declaration of consent HUNT

Appendix 1

Questionnaires used in paper 1

NTNU
HUNT forskningssenter

HØGSKOLEN I NORD-TRØNDELAG

Spørreskjema til undersøkelsen om fysisk aktivitet

Fyll ut ved å sett kryss i rutene☒ du synes passer for deg. Svar så godt du kan! Alle svarene dine blir behandlet med taushetsplikt.
Noen spørsmål er like, men vi ber om at du fyller ut alle så godt du kan. Dette er viktig for at vi kan se hvilke spørsmål som er best

Lykke til og tusen takk!

Vennlig hilsen

_____
Prosjektleder, Dr.gradsstipendiat
Vegar Rangul

OM IDRETT OG MOSJON

1. Utenom skoletida: **Hvor mange <u>dager</u> i uka driver du idrett, eller mosjonerer du så mye at du blir andpusten og/eller svett?** (Sett bare ett kryss)

Hver dag……..	☐	Ikke hver uke, men minst en dag hver 14. dag….	☐
4-6 dager i uka….	☐	Ikke hver 14.dag, men minst en dag i måneden...	☐
2-3 dager i uka….	☐	Sjeldnere enn en dag i måneden……	☐
1 dag i uka……..	☐	Aldri……..	☐

2. Utenom skoletida**: Til sammen hvor mange <u>timer</u> i uka driver du idrett, eller mosjonerer du så mye at du blir andpusten og/eller svett?** (Sett bare ett kryss)

Ingen……..…	☐	Omtrent 2-3 timer…….	☐
Omtrent ½ time…	☐	Omtrent 4-6 timer…….	☐
Omtrent 1 time….	☐	7 timer eller mer……	☐

3. **Bruker du astma-medisin før mosjon, trening eller idrettskonkurranser?**

Ja ☐ Nei ☐

4. **Driver du aktivt idrett?**

Ja ☐ Nei, men jeg drev med aktiv idrett før ☐ Nei ☐

HVIS DU HAR SVART "NEI" (aldri drevet aktiv idrett): GÅ TIL SPØRSMÅL 10

5. Hvis du har sluttet: **Hvor gammel var du da du sluttet med aktiv idrett?**
____ år

6. **Hvilke(n) idrett(er) er/var du med i?** (Sett ett eller flere kryss)

A Ski (langrenn, skiskyting)….	☐	**H** Bodybuilding…….	☐
B Ski (slalåm, hopp)…….	☐	**I** Sykling……	☐
C Fotball……	☐	**J** Styrkeløft/vektløfting….	☐
D Ridning……..	☐	**K** Friidrett/løp/orientering	☐
E Skøyter, ishockey……..	☐	**L** Svømming…….	☐
F Håndball, basket, volleyball..	☐	**M** Gymnastikk/turn……	☐
G Kampidrett, boksing…….	☐	**N** Annet, ……	☐
		Hva?.....	

7. **Deltar du i idrettskonkurranser, kamper?** (sett ett kryss)

Ja ☐ Nei, men jeg deltok før ☐ Nei ☐

HVIS DU HAR SVART "NEI" (aldri deltatt i konkurranse, kamper): GÅ TIL SPØRSMÅL **10**

8. **På hvilket nivå deltok/deltar du i idrettskonkurranser?**(Angi høyeste nivå)

Lokalt nivå (klubbmesterskap, serier etc.)..	☐	Nasjonalt nivå (landsstevne, norgesmesterskap)	☐
Kretsnivå……..	☐		

9. **Hvilke(n) idrett(er) var/er dette?** (skriv inntil 3 idretter du er/var mest med på)

Jeg er/har vært mest aktiv i…… og har holdt på med dette i ……. år

Jeg er/har vært nest mest aktiv i……. og har holdt på med dette i ……. år

Jeg er/har vært 3. mest aktiv i……. og har holdt på med dette i ……. år

FYSISK AKTIVITET (Med fysisk aktivitet mener vi at du f. eks går tur, går på ski, svømmer sykler eller driver annen form for mosjon/trening/idrett)

10. **Hvor ofte driver du vanligvis fysisk aktivitet?**
(Ta et gjennomsnitt for en vanlig uke, sett bare ett kryss)

Aldri ……... ☐

1-2 ganger pr. uke …….. ☐

3-4 ganger pr. uke …….. ☐

5-6 ganger pr. uke ……... ☐

7 ganger pr. uke eller mer ……... ☐

Dersom du driver fysisk aktivitet så ofte som en eller flere ganger i uka:

11. **Hvor hardt driver du fysisk aktivitet?**
(Ta et gjennomsnitt for hver gang du driver fysisk aktivitet, sett bare ett kryss)

Tar det rolig uten å bli andpusten og/eller svett …… ☐

Tar det så hardt at jeg blir andpusten og/eller svett..…. ☐

Tar meg nesten helt ut …… ☐

12. **Hvor lenge holder du på hver gang?**
(Ta et gjennomsnitt for hver gang du driver fysisk aktivitet, sett bare ett kryss)

Mindre enn 30 minutter ……. ☐

30 minutter – 1 time ……...…… ☐

Mer enn 1 time …..…… ☐

FYSISK AKTIVITET

Vi er interessert i informasjon om ulike former for fysisk aktivitet som folk driver med i dagliglivet. Spørsmålene gjelder tiden du har brukt på fysisk aktivitet de **siste 7 dagene.** Vennligst svar på alle spørsmålene uansett hvor fysisk aktiv du selv synes du er. Tenk på aktiviteter du gjør på skole/jobb, som en del av hus- og hagearbeid, for å komme deg fra et sted til et annet og aktiviteter på fritiden (rekreasjon, mosjon og sport).

Tenk på all **meget anstrengende** aktivitet du har drevet de **siste 7 dagene.**
Meget anstrengende aktivitet er aktivitet som krever hard innsats og får deg til å puste mye mer enn vanlig. Ta bare med aktiviteter som varer minst 10 minutter i strekk.

13. Hvor mange dager i løpet av de **siste 7 dagene** har du drevet med **meget anstrengende** fysisk aktivitet som tunge løft, gravearbeid, aerobics, løp eller rask sykling?

    ___ **dager**

    ☐ Ingen meget anstrengende aktivitet *Gå til spørsmål 15*

14. Hvor lang tid brukte du vanligvis på **meget anstrengede** fysisk aktivitet på en av disse dagene?

    ____ **timer per dag**

    ____ **minutter per dag**

    ☐ Vet ikke/usikker

Tenk på all **middels anstrengende** aktivitet du har drevet med de **siste 7 dagene.**
Middels anstrengende aktivitet er aktivitet som krever moderat innsats og får deg til å puste litt mer enn vanlig. Ta bare med aktiviteter som varer minst 10 minutter i strekk.

15. Hvor mange dager i løpet av de **siste 7 dagene** har du drevet med **middels anstrengende** fysisk aktivitet som å bære lette ting, jogge eller sykle i moderat tempo? Ikke ta med gange.

    ____ **dager**

    ☐ Ingen middels anstrengende aktivitet *Gå til spørsmål 17*

16. Hvor lang tid brukte du vanligvis på **middels anstrengende** fysisk aktivitet på en av disse dagene?

____ **timer per dag**

____ **minutter per dag**

☐ Vet ikke/usikker

Tenk på tiden du har brukt på **å gå** de **siste 7 dagene.** Dette inkluderer gange på skole/jobb og hjemme, gange fra et sted til et annet eller gange som du gjør på tur eller som trening på fritiden.

17. Hvor mange dager i løpet av de **siste 7 dagene gikk** du i minst 10 minutter i strekk?

____ **dager**

☐ Ingen, *Gå til spørsmål 19*

18. Hvor lang tid brukte du vanligvis på **å gå** på en av disse dagene?

____ **timer per dag**

____ **minutter per dag**

☐ Vet ikke/usikker

Det neste spørsmålet omfatter alt du tilbrakte **sittende** på ukedagene i løpet av de **siste 7 dagene.** Inkluder tid du har brukt på å sitte på skole/jobb, hjemme, på kurs og på fritiden. Dette kan tilsvare tiden du sitter ved et arbeidsbord, gjør lekser, hos venner, mens du leser eller sitter eller ligger for å se på TV.

19. Hvor lang tid brukte du på å **sitte** på en **vanlig hverdag** i løpet av de **siste 7 dagene?**

____ **timer per dag**

____ **minutter per dag**

☐ Vet ikke/usikker

Appendix 2

Questionnaires used in HUNT2, Young-HUNT1 and Young-HUNT2 (paper 2 and 3)

HUNT 2 Questionnaire 1

For people 20 years old and over, both sexes

Page 1

Page one is a personal invitation to the screening with information on where and when to attend. The participants were asked to fill in the questionnaire at home and bring it with them to their examination. The screening nurse at the examination location was to ensure that all questions on page two were filled in, explain misunderstandings if necessary and help participants complete and correct the questionnaire.

Page 2

This questionnaire is an important part of the Health Study. Here you will find questions about previous illnesses and other important conditions regarding your health. Please complete the form and take it with you to the health examination.

If any questions are not clear, leave them unanswered until you come to the examination where you can discuss them with the person on staff who examines you. All information you give will be treated in the strictest confidence.

Several places on this questionnaire we ask you to give your age when an illness occurred. If you do not know exactly how old you were, give the age that is closest to what you think may be correct.

When the results of the examination are available, there will be some people who need to be re-examined by their own doctor. If this is the case for you, you will be informed of this in a letter that we will send with your results. At the same time, your doctor will be sent your results. This is why in the section at the end of the questionnaire you are asked to give the name of your general practitioner, community doctor or health care centre where results are to be sent and possible follow-up examination are to be carried out.

Sincerely,
The Nord-Trøndelag Health Service - The State Health Examiners - The State Institute for Public Health

THIS IS ABOUT YOUR HEALTH

How is your health at the moment? (Put an X in only one box)
Poor
Not so good
Good
Very good

RESPIRATORY DISORDERS

Do you cough daily during periods of the year? <yes, no>

If YES, answer the next two questions.
Do you usually bring up phlegm when coughing? <yes, no>
Have you had a cough with phlegm for periods of at least 3 months during each of the last two years? <yes, no>

Have you had attacks of wheezing or breathlessness during the last 12 months? <yes, no>

Do you have or have you had asthma? <yes, no> Age first time ____

Do you use or have you used asthma medication? <yes, no>

CARDIOVASCULAR DISEASES, DIABETES

Have you had or do you have:
Myocardial infarction (heart attack) <yes, no> Age first time ____
Angina pectoris (chest pain) <yes, no> Age first time ____
Stroke/brain haemorrhage <yes, no> Age first time ____
Diabetes <yes, no> Age first time ____

What was the result the last time your blood pressure was measured? (Put an X in only one box)
Start or continue taking medicine for high blood pressure
Go in for a follow-up examination, but not take medicine
No follow-up examination and no medication necessary
Have never had blood pressure measured

Are you taking medication for high blood pressure? (Put an X in only one box)
Currently taking medication
Previously, but not now
Have never taken it

Has one or more of your parents or siblings had a myocardial infarction (heart attack) or angina pectoris (chest pains)? <yes, no, don't know>

METABOLISM

Have you ever had:
Hyperthyroidism (too high metabolism) <yes, no> Age first time ____
Hypothyroidism (too low metabolism) <yes, no> Age first time ____
Goitre <yes, no> Age first time ____
Other disease of the thyroid gland <yes, no> Age first time ____

Do you take or have you ever taken either of these medicines:

Thyroxin <yes, no> Age first time ____
NeoMercazole <yes, no> Age first time ____

Have you had a thyroid gland operation? <yes, no> Age first time ____

Have you had radioiodine treatment? <yes, no> Age first time ____

MUSCULOSKELETAL DISORDERS

During the last year, have you had pain and/or stiffness in your muscles and limbs that has lasted for at least 3 consecutive months? <yes, no>
If NO, go on to the next section.
If YES, answer the following questions:

Where did you have pain and/or stiffness? <yes, no>
Neck
Shoulders
Elbows
Wrists, hands
Chest/stomach
Upper part of back
Lumbar region
Hips
Knees
Ankles, feet

(If you had complaints in several areas for at least 3 months in the last year, put a circle around the yes-X for the complaint that lasted longest.)

How long did the pain and/or stiffness last? (Answer for the area where it lasted the longest)
If less than 1 year, give the number of months. ____ Number of months
If 1 year or more, give the number of years. ____ Number of years

Have these complaints reduced your ability to work during the last year? (Also applies to those working at home. Put an X in only one box.)
No, not significantly
To some degree
Significantly
Don't know

Have you been on sick leave due to these complaints during the last year?
<yes, no, not working>

Have the complaints caused you to reduce your leisure activities? <yes, no>

Page 3

Has a doctor ever said that you have/have had any of the following diseases?
<yes, no>
Osteoporosis
Fibromyalgia (fibrositis/chronic pain syndrome)
Arthritis (rheumatoid arthritis)
Degenerative joint disease (osteoarthritis)
Bechterew's disease (AS)
Other long-term skeletal or muscular diseases

Have you ever had: <yes, no> Age last time ____

A fractured femur
A fractured wrist or forearm
Neck injury (whiplash)
Injury that led to hospitalisation

OTHER COMPLAINTS

To what degree have you had the following complaints in the last 12 months? <not at all, slightly, very much>
Nausea
Heartburn/ acid regurgitation
Diarrhoea
Constipation
Palpitations
Breathlessness

OTHER DISEASES

Do you have or have you ever had: <yes, no> Age first time ____
Epilepsy
Mental health problems for which you sought help
Cancer
Other long-term disease

EVERYDAY TASKS

Do you suffer from any long-term illness or injury of a physical or psychological nature that impairs your functioning in your everyday life? <yes, no>
(Long-term means at least one year.)
If YES, would you describe your impairment as slight, moderate or severe? <slight, moderate, severe>
Motor ability impairment
Vision impairment
Hearing impairment
Impairment due to physical illness
Impairment due to mental health problems

MEN continue after this section

TO BE ANSWERED BY WOMEN ONLY

How many children have you had? <_____ Number of children>
(Put 0 if you have had no children)

If you have had children, answer these questions:
How old were you when you had your first child? <Age _____>
How old were you when you had your last child? <Age _____>
(Do not answer if you have only had one child)

How old were you when you started menstruating? <Age ____>
(Put 0 if you have never menstruated)

Continue to the next section

SMOKING

Did any of the adults where you grew up smoke indoors? <yes, no>

After you were 20 years old, do you live or have you lived with a daily smoker(s)? <yes, no>

How long are you usually in a smoky room each day? <Number of hours ____>
(Put 0 if you are not usually in a smoky room)

Do you smoke? <yes, no>
Daily cigarette smoker?
Daily cigar/cigarillo smoker?
Daily pipe smoker?
Have never smoked daily (Put an X) □

If you previously smoked, how long has it been since you stopped? <Number of years ____>

If you, now or previously, smoke(d) daily, answer these questions:

How many cigarettes do you or did you usually smoke daily? <Number of cigarettes - ____>
How old were you when you started smoking? <Age ____>
How many years in total have you smoked daily? <Number of years ____>

COFFEE/TEA/ALCOHOL

How many cups of coffee/tea do you drink daily? <Number of cups ____>
(Put 0 if you do not drink coffee/tea daily)
Brewed coffee
Other coffee
Tea

Concerning alcohol, are you a non-drinker? <yes, no>

How many times a month do you normally drink alcohol? <Number of times ____> (Do not include low-alcohol beer. Put 0 if less than once a month.)

How many glasses of beer, wine or spirits do you usually drink in the course of two weeks? (Do not include low-alcohol beer. Put 0 if less than once a month.)

Beer <Number of glasses ____>
Wine <Number of glasses ____>
Spirits <Number of glasses ____>

PHYSICAL ACTIVITY

DURING LEISURE TIME

How much of your leisure time have you been physically active during the last year? (Think of a weekly average for the year. Your commute to work counts as leisure time.)
<Hours per week: None, Less than 1, 1-2, 3 or more>
Low physical activity (no sweating/not out of breath)
Vigorous physical activity (sweating/out of breath)

AT WORK

(For both paid or unpaid work)
How would you describe your work? (Put an X in only one box)
Mostly sedentary work (e.g. at a desk, on an assembly line)
Much walking at work (e.g. delivery work, light industrial work, teaching)
Much walking or lifting at work (e.g. postman, nurse, construction work)
Heavy physical work (e.g. forestry work, heavy agricultural work, heavy construction work)

HOW DO YOU FEEL?

In the last two weeks, have you felt: <no, a little, a good amount, very much>
Confident and calm?
Happy and optimistic?
Have you felt:
Nervous and restless?
Troubled by anxiety?
Irritable?
Down/depressed?
Lonely?

Read each item below and place an X next to the reply that comes closest to how you have been feeling **in the past week** (only one X per item). Do not take too long over your replies; your immediate reaction to each item will probably be more accurate than a long, thought-out response.

I still enjoy the things I used to enjoy
Definitely as much
Not quite so much
Only a little
Hardly at all

I get a sort of frightened feeling as if something awful is about to happen
Very definitely and quite badly
Yes, but not too badly
A little, but it doesn't worry me
Not at all

I can laugh and see the funny side of things
As much as I always could
Not quite so much now
Definitely not so much now
Not at all

Worrying thoughts go through my mind
A great deal of the time
A lot of the time
Not too often
Very little

I feel cheerful
Never
Not often
Sometimes
Most of the time

I can sit at ease and feel relaxed
Definitely
Usually
Not often
Not at all

I feel as if I'm slowed down
Nearly all the time
Very often
Sometimes
Not at all

I get a sort of frightened feeling like 'butterflies' in the stomach
Not at all
Occasionally
Quite often
Very often

I have lost interest in my appearance
Definitely
I don't take as much care as I should
I may not take quite as much care
I take just as much care as ever

I feel restless as if I have to be on the move
Very much indeed
Quite a lot
Not very much
Not at all

I look forward with enjoyment to things
As much as I ever did
Rather less than I used to
Definitely less than I used to
Hardly at all

I get sudden feelings of panic
Very often indeed
Quite often
Not very often
Not at all

I can enjoy a good book or radio or television programme
Often
Sometimes
Not often
Very seldom

EDUCATION

What is your highest level of education?

Primary school 7-10 years, continuation school, folk high school
High school, intermediate school, vocational school, 1-2 years high school
University qualifying examination, junior college, A levels
University or other post-secondary education, less than 4 years
University/college, 4 years or more

WORK

What kind of work do you currently do? (One or more Xs)
Paid work
Self-employed
Full-time housework
Student, military service
Unemployed, laid off
Retired/on Social Security

How many hours of paid work do you have a week? <Number of hours ____ >

Do you work shifts, at night, or on call? <yes, no>

IN GENERAL

Thinking about your life at the moment, would you say that you by and large are satisfied with life, or are you mostly dissatisfied?

(Put an X in only one box)
Very satisfied
Satisfied
Somewhat satisfied
Neither satisfied nor dissatisfied
Somewhat dissatisfied
Dissatisfied
Very dissatisfied

Which general practitioner would you prefer to be referred to if this health survey indicates that you should undergo a more thorough examination?
Write the doctor's name here_____

Thank you for completing this questionnaire!
And once again, Welcome to the examination!

YOUNG HUNT 1 (1995-1997)
The Nord-Trøndelag Health Study
Junior High School Students Aged 13-16

It's your turn to participate in the extensive health study being conducted in Nord-Trøndelag (HUNT)!

We hope that you have read the information sent home with you about Young HUNT and have decided to participate.

Read the informed consent form that is inside the questionnaire and check that your name is on it. Mark it as to whether you will participate or not, sign it and hand it in to the teacher. These will be put in an envelope and sealed.

Your name should NOT be on your questionnaire!

To fill out the questionnaire properly you must put an X in the boxes that you think apply to you. Answer the best you can! If there are questions that you do not want to answer, skip them. When you are finished, put the questionnaire in the envelope, seal it and give the envelope to the teacher. Do this even if you haven't finished the questionnaire.

All your answers will be treated in the strictest of confidence!

No one at school is allowed see your answers.

If you wish to speak to someone about the study, speak to the Young HUNT nurse at your school or ring HUNT Research Centre (see back of questionnaire).

Good Luck and Thank You!

Date: ___ / ___ - ___

1. Are you male or female? <male, female>

2. What grade are you in?
7th grade
8th grade
9th grade

3. What type of plans do you have regarding continued studies?
(Put an X in one or more boxes)
None
High School academic studies
High School vocational studies
College or university, less than 4 years
College or university for 4 years or more
Vocational school or training
Don't know

WHERE YOU LIVE

4. What type of housing do you live in?
(Put an X in only one box)
Single-family house/villa
Farm
Flat in block or terraced block of flats
Terraced house/2-4 family housing
Other accommodations

5. Who do you currently live with?
(Put an X in one or more boxes)
Mother
Father
1-2 siblings
3 or more siblings
Mother's new husband or partner
Father's new wife or partner
Spouse/partner (boyfriend or girlfriend)/friends
Alone/in a rented room
Foster parents
Other

6. Are there fitted carpets where you live:
In the living room? <yes, no>
In your bedroom? <yes, no>

7. Is there a cat where you live (in your home)? <yes, no>

8. Is there a dog where you live (in your home)? <yes, no>

9. Are there other animals with fur where you live (in your home)? <yes, no>

YOUR HEALTH

10. How is your health at the moment?
(Put an X in the box that best describes your health)
Poor
Not so good
Good
Very good

11. Are you disabled in any of these ways (function impairment)?
(Put an X in one box on each line) <No, A little, Somewhat, Severely>
Motor ability impairment (movement)
Vision impairment
Hearing impairment
Impairment due to physical illness
Impairment due to mental health problems

12. Have you had any of these ailments in the past 12 months?
(Put an X in one box on each line) <Never, Seldom, Sometimes, Often>
A Headache (without known medical cause)
B Neck or shoulder pain
C Joint or muscle pain
D Stomach pain (without known medical cause)
E Nausea
F Constipation
G Diarrhoea
H Heart palpitations
I Bronchitis or pneumonia
J Ear infection
K Sinus infection

13. If you answered "never" to <u>all</u> the above listed ailments, have you had any of these ailments <u>often</u> earlier (meaning before the last 12 months)**?** <yes, no>

If YES, **which ailment was it (see above list)?**
Write the name of the ailment or letter from above
_____

WHEEZING AND ASTHMA

14. Have you ever had wheezing or whistling in the chest? <yes, no>

If you answered NO, please skip to question 19

15. Have you had wheezing or whistling in the chest in the past 12 months?<yes, no>

If you answered NO, please skip to question 19

16. How many attacks of wheezing have you had in the past 12 months?
None
1 to 3
4 to 12
More than 12

17. In the past 12 months, how often, on average, has your sleep been disturbed due to wheezing?
Never woken with wheezing
Less than one night per week
One or more nights per week

18. In the past 12 months, has wheezing ever been severe enough to limit your speech to only one or two words at a time between breaths? <yes, no>

19. Have you ever had asthma? <yes, no>

If YES, **has a doctor said that you have had asthma?** <yes, no>

20. In the past 12 months, has your chest sounded wheezy during or after exercise? <yes, no>

21. In the last 12 months, have you had a dry cough at night apart from a cough associated with a cold or chest infection? <yes, no>

ECZEMA

22. Have you ever had an itchy rash which was coming and going for at least 6 months? <yes, no>
If you answered NO, please skip to question 27

23. Have you had this itchy rash at any time during the past 12 months? <yes, no>
If you answered NO, please skip to question 27

24. Have you had this itchy rash in the following places: the folds of your elbow (inside), back of your knees, on the front of your ankles, under your buttocks or around your neck, ears or eyes? <yes, no>

25. Has this rash cleared completely at any time during the past 12 months? <yes, no>

26. In the last 12 months, how often on the average have you been kept awake at night by this itchy rash?
Never in the past 12 months
Less than 1 night per week
1 or more nights per week

27. Have you ever had eczema? <yes, no>

RHINITIS

All these questions are about problems which occur when you DO NOT have a cold or the flu.

28. Have you <u>ever</u> had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or the flu? <yes, no>

If you answered NO, please skip to question 33

29. <u>In the past 12 months</u>, have you had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or the flu? <yes, no>

If you answered NO, please skip to question 33

30. <u>In the past 12 months</u>, has this nose problem been accompanied by itchy-watery eyes? <yes, no>

31. In which of <u>the past 12 months</u> did this nose problem occur?
(Put an X in the box for any which apply)
January
February
March
April
May
June
July
August
September
October
November
December

32. <u>In the past 12 months</u>, how much did this nose problem interfere with your daily activities?
<Not at all, A little, A moderate amount, A lot>

33. Have you ever had hay fever? <yes, no>

ALLERGIES

34. Do you have any allergies? <Yes, No, Don't know>

If you answered NO, please skip to question 37

35. What do you think you are allergic to? Put an X in the boxes to describe how you are affected by each item listed in the left column.
(Put an X in one or more boxes for each line.)
<No, Nose, Eyes, Eczema, Stomach reaction, Asthma/problems breathing, Other>
Dogs
Cats
Other animals
Grass/trees
House dust
Food
Smoke
Other

36. Has a doctor given you any allergy tests (blood tests, skin tests)**?** <yes, no>

MEDICINE

37. Do you take/use any of these medicines or dietary supplements?
Think about what you use these for. (Put an X in a box on every line.)
<never, sometimes, almost daily>
Pain relievers
Migraine medicine
Sleep medicine
Nerve medicine
Relaxants
Asthma medicine
Allergy medicine
Eczema cream
Laxatives
Iron tablets
Vitamins
Cod liver oil
Homeopathic medicine, herbal medicine
Other
List Other here: _____

CONCERNING OTHER ILLNESSES

38. Has a doctor diagnosed you with:
Epilepsy <yes, no>
Diabetes <yes, no>
Migraines <yes, no>

39. Have you had any other illness that lasted longer than 3 months? <yes, no>

If YES, which? _____

TOBACCO

40. Does anyone you live with smoke at home?
(Put an X in one or more boxes)
No, nobody
Yes, my mother
Yes, my father
Yes, a sibling
Yes, other people

41. Have you tried smoking? (at least one cigarette) <yes, no>
If you answered NO, go to question 45

42. Do you smoke? (Put an X in the appropriate box and write in the number of cigarettes. A package of loose tobacco equals approx. 50 cigarettes.)
Yes, I smoke about ____ cigarettes daily.
Yes, I smoke occasionally, but not daily.
No, not anymore, but previously I smoked once in a while.
No, not anymore, but previously I smoked about ____ cigarettes daily.
No, I don't smoke.

If you answered NO, I DON'T SMOKE, go to question 45

43. How old were you when you began smoking? _____ years old

44. How many years in total have you smoked daily? _____ years

45. Does the smell of smoke ever bother you?
At school? <Never, Sometimes, Often>
At home? <Never, Sometimes, Often>

---

46. Do you use or have you used snuff, chewing tobacco or similar products?
No, never
Yes, but I have quit
Yes, sometimes
Yes, everyday

If you answered NO, NEVER, go to question 50

47. How old were you when you began using snuff/chewing tobacco? _____ years old

48. How many years in total have you used snuff/chewing tobacco? _____ years

49. How many boxes/bags of snuff/chewing tobacco do you use in a week? ____ (number)

SPORTS AND EXERCISE

50. Not during the average school day: **How many <u>days</u> a week do you play sports or exercise to the point where you breathe heavily and/or sweat?**
Everyday
4-6 days a week
2-3 days a week
1 day a week
Not every week, but at least once every two weeks
Not every 14th day, but at least once a month
Less than once a month
Never

51. Not during the average school day: **How many <u>hours</u> a week do you play sports or exercise to the point where you breathe heavily and/or sweat?**
None
About ½ hour
About 1 hour
About 2-3 hours
About 4-6 hours
7 or more hours

52. Do you use asthma medication before you exercise, work out or compete in sports? <yes, no>

53. Are you actively involved in sports?
Yes
No, but I was before
No

If you answered NO, (never been actively involved in sports), go to question 59

54. If you no longer participate in sports, **how old were you when you stopped? ____** years old

55. Which sport(s) do/did you participate in?
(Put an X in one or more boxes)
A Skiing (cross country, biathlon)
B Skiing (downhill/slalom, ski jump)
C Football/soccer
D Horse riding
E Skating, ice hockey
F Handball, basketball, volleyball
G Martial arts, boxing
H Body building
I Cycling
J Weight lifting
K Track and field, orienteering
L Swimming
M Gymnastics
N Other, write in here: _____

56. Do you play any competitive sports? (X only one box)
Yes
No, but I did before
No

If you answered NO (never competed in sports), go to question 59

57. At what level do/did you compete in sports?
(Give highest level)
Local level (championships, series, etc.)
Regional or state level
National level

58. In which sports do/did you compete?
(In order of participation level, list 3 sports you are/were active in.)
I am/have been most active in _____ and have/had participated for ____ years.
I am/have been 2nd most active in _____ and have/had participated for ____ years.
I am/have been 3rd most active in _____ and have/had participated for ____ years.

YOUR GENERAL WELLBEING

59. Thinking about your life at the moment, would you say that you by and large are satisfied with life, or are you mostly dissatisfied? (Put an X in only one box)
Very satisfied
Satisfied
Somewhat satisfied
Neither satisfied nor dissatisfied
Somewhat dissatisfied
Dissatisfied
Very dissatisfied

60. Do you feel, for the most part, strong and fit or tired and worn out? (Put an X in only one box)
Very strong and fit
Strong and fit
Somewhat strong and fit
Somewhere in between
Somewhat tired and worn out
Tired and worn out
Very tired and worn out

61. Would you say you are usually cheerful or downhearted? (Put an X in only one box)
Very downhearted
Downhearted
Somewhat downhearted
Some of both
Somewhat cheerful
Cheerful
Very cheerful

62. How do you see yourself?
Put an X in a box for each sentence below indicating whether you agree or disagree in how it relates to you. (Put an X in one box on each line)
<Strongly agree, Agree, Disagree, Strongly Disagree>
I take a positive attitude toward myself.
I certainly feel useless at times.
I feel I do not have much to be proud of.
I feel that I'm a person of worth, at least on an equal plane with others**.**

63. In the last month have you:
< Almost every night, Often, Sometimes, Never>
Had difficulty falling asleep?
Woken up too early and not been able to fall asleep again?

64. The questions below are about how you usually behave, feel and deal with things. Place a cross in the box for Yes or No for each statement depending on whether it describes you or not. <yes, no>
Are you a relatively lively person?
Would you be upset by seeing a child or animal suffer?
Do you like meeting new people?
Are your feelings easily hurt?
Do you often feel that you lose interest?
Do you like to tease people even though it may hurt them?
Are you often worried?
Are good manners and cleanliness important to you?
Do you worry that terrible things might happen?
Do you usually take the first step to make new friends?
Are you mostly quiet when you are around other people?
Do you like to be on time for appointments?
Do you often feel tired and indifferent/unmotivated without reason?
Do many people try to avoid you?
Are you a life-of-the-party type person?
Are you bothered by an embarrassing experience long after it happens?
Do you like to have a lot of life and excitement around you?
Do people tell you a lot of lies?

65. Below is a list of some problems. Have you been bothered by any of these in the last 14 days?
(Put an X in one box on each line)
<Not at all, A little, Quite a bit, Very>
Been constantly afraid and anxious
Felt tense or uneasy
Felt hopelessness when you think of the future
Felt dejected or sad
Worried too much about various things

66. During the last month have you been bothered by nervousness (irritability, uneasiness, tenseness or restlessness)?
Almost always
Often
Sometimes
Never

YOUR LEISURE TIME

67. Think back over the last week, the last 7 days. If you did any of the things listed below, put an X in the box for about how many times you did this. (X an answer for each line)
<Not once, Once, 2 or 3 times, 4 times or more>
Visited someone you know
Were visited
Read a book you liked
Listened to music or played an instrument longer than 15 minutes
Were out for more than 2 hours (in a row) with friends
Were at a meeting or training with a club or team
Were active in a hobby
Watched television or a video
Did homework longer than 1 hour

68. How many teams or clubs are you a part of?
(For example: sports team, girl or boy scouts, band, etc.)
None
One
2 or more

FRIENDS

69. Do you have someone that you have considered your best friend during most of the time you have been at school? <yes, no>

70. Do you feel lonely?
(Put an X in one box)
Very often
Often
Sometimes
Seldom
Very seldom or never

71. Are your parents separated or divorced, or have they lived separately for more than one year?
(Put an X in one box and write in your age where necessary)
No
Yes, they lived separately or were separated when I was _____ years old, but they later moved back together again.
Yes, they were divorced or permanently separated when I was ____ years old.

72. If you have siblings, how good a relationship do you feel you have with your sister or brother? If you have several siblings, think about the one you have the best relationship to.
(Put an X in one box)
Much worse than normal
Worse than normal
Average
Better than normal
Much better than normal
I do not have siblings

73. About how many close friends do you have? Include those with whom you can confidentially talk and who help you when you are in need. Do not include the people you live with, but include other relatives.

(Put an X in one box)
None
One
2 or more
4 or more

74. Do you have a steady boyfriend/girlfriend? <yes, no>

75. Do you feel that you have enough friends? <yes, no>

SCHOOL

76. Do any of the following things happen to you at school/concerning school, or have any of them happened?
(Put an X in one box on each line)
<Never, Sometimes, Often, Very often>
Have difficulties concentrating during class
Think that gym or art is fun
Think other classes are fun
Argue with the teacher
Look forward to going to school
Skip school
Understand what is being taught
Have fun during recess/break time
Are satisfied with your test results
Get in a fist fight
Are teased/harassed by other students
Are reprimanded by the teacher
Cannot manage to be calm/sit still during class
Become bored or dissatisfied

MEALS AND EATING HABITS

77. How often do you usually eat these meals?
(Put an X in one box on each line)
<Everyday, 4-6 days a week, 1-3 days a week, Seldom or never>
Breakfast
Lunch
Warm dinner

78. Are you trying to lose weight?
No, I'm comfortable with my weight
No, but I need to lose weight
Yes

79. How often do you <u>not</u> eat your lunch even though you brought one with you?
(Put an X in one box)
Every school day
4-6 days a week
1-3 days a week
Seldom or never
I never bring a lunch with me

80. How often do you drink or eat the things listed below?
(Put an X in one box on each line)
<More than once a day, Once a day, Every week but not everyday, Seldom, Never>
Cola, soda or still soft drinks
Low fat milk/skim milk
Whole milk
Coffee
Potato chips and such
Candy, chocolate and other sweets
Chips/French fries, hamburgers or hot dogs
Whole grain bread/ Crispbread
Butter
Margarine
Fruit
Vegetables

81. Do you consider yourself:
(Put an X in one box)
Very fat
Chubby
About the same as others
Thin
Very thin

82. Below are listed things that concern your eating habits. Put an X in the boxes according to how they apply to you.
(Put an X in one box for each statement)
<Never, Seldom, Often, Always>

When I first begin eating, it is difficult to stop.
I spend too much time thinking about food.
I feel that food controls my life.
I cut my food into small pieces.
I take longer than others to eat my meals.
Older people think that I am too thin.
I feel that others pressure me to eat.

ALCOHOL

83. Have you ever tried drinking alcohol? (Meaning alcoholic beer, wine, hard liquor or moonshine)
<Yes, No, Don't know>

If you answered NO, go to question 87

84. Have you ever drunk so much alcohol that you felt intoxicated (drunk)?
(Put an X in one box)
No, never
Yes, once
Yes, 2-3 times
Yes, 4-10 times
Yes, more than 10 times

85. About how much beer, wine or hard liquor do you usually drink during <u>two weeks</u>? Don't count alcohol free beer. Write 0 if you do not drink alcohol.

Beer	____	number of 1/2 bottles
Wine	____	number of glasses (approx. 1 dl)
Hard liquor, liqueurs	____	number of glasses (approx. 1/2 dl)
Moonshine	____	number of glasses (approx. 1/2 dl)

86. On which days during the week do you most often drink alcohol?
(Put an X in one or more boxes)
I do not drink
Fridays
Saturdays
Other days

87. Have you ever seen either of your parents intoxicated?
(X one box)
Never
A few times
A few times a year
A few times a month
A few times a week

READING AND WRITING DIFFICULTIES

88. How often do you feel your reading or writing skills are below the level of the tasks you do at school and/or in your spare time?
<Never, Very seldom, Sometimes, Often, Always>
Reading
Writing

89. Have you had any particular reading or writing problems <u>in the last 12 months</u>?
<A lot of problems, Some problems, No problems>
Reading
Writing

90. Do you receive help for reading or writing difficulties at this time? <yes, no>

91. Have you had problems with reading or writing earlier, but not <u>within the last 12 months</u>?
<yes, no>
If YES, **did you receive help at that time?** <yes, no>

92. Do you have any speaking difficulties? <yes, no>
If YES, **which one(s):**
Stuttering
Pronunciation difficulties
Problems with your voice
Difficulties expressing yourself

HEALTH SERVICES

93. During <u>the last 12 months</u> have you been to:
(Put an X in one box for every line) <yes, no>
General practitioner (a doctor outside the hospital)
Doctor at the hospital (not having been admitted)
Psychologist
Physiotherapist
Chiropractor
Homeopath
Other treatment (naturopath, reflexologist, laying on of hands, healer, psychic, etc.)
94. Have you ever been admitted to the hospital (exclude when you were born)?
No, never
Yes, once
Yes, more than once

If YES, **have you been admitted to the hospital during the last 12 months?** <yes, no>

95. How often have you been to the school health centre/nurse's office during the last 12 months?
Not at all
1-3 times
More than 3 times

96. Have you ever contacted the school health centre? <yes, no>

97. Would you like to contact/visit the school health centre more than you have? <yes, no>

98. How often have you been absent from school due to illness during the last 12 months?
Less than 1 week
1-2 weeks
More than 2 weeks

PHYSICAL DEVELOPMENT

You are now at the age when your body has begun to change and become more like an adult's body. Below are some questions about physical changes that occur in young people around your age.

99. During the teenage years there are periods where one grows quickly (growing spurt). Have you noticed that your body has grown quickly (become taller)?
(Put an X in one box)
No, I have not begun to grow
Yes, I have barely begun a growing spurt
Yes, I've clearly begun a growing spurt
Yes, it seems that I'm finished with growing spurts

100. Concerning hair on your body (under your arms and your crotch/groin)? Would you say that the hair on your body has:
(Put an X in one box)
Not begun to grow yet
Barely begun to grow
Quite clearly begun to grow
It seems that my body hair has grown in

101. When you look at yourself, do you think that you are physically maturing/have physically matured earlier or later than others your own age?
(Put an X in one box)
Much earlier
Earlier
A little bit earlier
The same as others
A little bit later
Later
Much later

QUESTIONS FOR GIRLS ONLY

102. Have you begun to develop breasts?
(Put an X in one box)
No, haven't begun yet
Yes, have barely begun
Yes, have quite clearly begun
It seems my breasts are fully developed

103. Have you begun menstruating (gotten your period)?
<yes, no>
If you answered NO, go to question 106

104. How old were you when you first began menstruating?
I was ____ years and ____ months old.

105. Have you ever missed (not gotten) your period for several months after a regular period (without being pregnant)?
(Put an X in one box)
Yes, for 2-5 months
Yes, for 6-12 months
Yes, for more than a year
No, never

106. Have you ever been treated by a doctor for: <yes, no>
Inflammation/infection of the reproductive system (ovaries, fallopian tubes)
Vaginal discharge
Menstrual pain

107. Have you ever taken birth control pills or the mini pill? <yes, no>

If you answered NO, go to the last page

108. How old were you when you first began taking birth control pills?
____ years old

109. How long in total did you take birth control pills?
____ years

110. Do you take birth control pills now? <yes, no>

QUESTIONS FOR BOYS ONLY

112. Has your voice begun to change?
(Put an X in one box)
No, hasn't begun yet
Yes, has just barely begun
Yes, has clearly begun
It seems my voice has finished changing

113. Has facial hair begun to grow (moustache or beard)?
(Put an X in one box)
No, hasn't begun yet
Yes, has just barely begun
Yes, has clearly begun
Yes, I have quite a lot of facial hair

114. Have you been treated by a doctor for:
(Put an X in one box on every line)
Tight foreskin
Discharge from the penis (urethra)
Inflammation of the foreskin or scrotum (testicles)

COMMENTS

If you have time, you could write here about what you think is important, but was not asked about in this questionnaire. What are your thoughts about being young these days? What do feel can be improved upon concerning health and wellbeing for youth of today?

YOUNG HUNT 1 (1995-1997)
The Nord-Trøndelag Health Study
High School/Secondary School Students Aged 16-19

It's your turn to participate in the extensive health study being conducted in Nord-Trøndelag (HUNT)!

We hope that you have read the information sent home with you about Young HUNT and have decided to participate.

Read the informed consent form that is inside the questionnaire and check that your name is on it. Mark it as to whether you will participate or not, sign it and hand it in to the teacher. These will be put in an envelope and sealed.

Your name should NOT be on your questionnaire!

To fill out the questionnaire properly you must put an X in the boxes that you think apply to you. Answer the best you can! If there are questions that you do not want to answer, skip them. When you are finished, put the questionnaire in the envelope, seal it and give the envelope to the teacher. Do this even if you haven't finished the questionnaire.

All your answers will be treated in the strictest of confidence!

No one at school is allowed see your answers.

If you wish to speak to someone about the study, speak to the Young HUNT nurse at your school or ring HUNT Research Centre (see back of questionnaire).

Good Luck and Thank You!

Date: ___ / ___ - ___

1. Are you male or female? <male, female>

2. What grade are you in? <academic, vocational>
5th year Secondary School/10th grade
6th Form at Secondary School or College/11th grade
2nd year of 6th Form at Secondary School or College/12th grade
Folk high school

3. What type of plans do you have regarding continued studies?
(Put an X in one or more boxes)
None
College or university, less than 4 years
College or university for 4 years or more
Vocational school or training
Don't know

WHERE YOU LIVE

4. What type of housing do you live in?
(Put an X in only one box)
Single-family house/villa
Farm
Flat in block or terraced block of flats
Terraced house/2-4 family housing
Other accommodations

5. Who do you currently live with?
(Put an X in one or more boxes)
Mother
Father
1-2 siblings
3 or more siblings
Mother's new husband or partner
Father's new wife or partner
Spouse/partner (boyfriend or girlfriend)/friends
Alone/in a rented room
Foster parents
Other

6. Are there fitted carpets where you live:
In the living room? <yes, no>
In your bedroom? <yes, no>

7. Is there a cat where you live (in your home)? <yes, no>

8. Is there a dog where you live (in your home)? <yes, no>

9. Are there other animals with fur where you live (in your home)? <yes, no>

YOUR HEALTH

10. How is your health at the moment?
(Put an X in the box that best describes your health)
Poor
Not so good
Good
Very good

11. Are you disabled in any of these ways (function impairment)?
(Put an X in one box on each line) <No, A little, Somewhat, Severely>
Motor ability impairment (movement)
Vision impairment
Hearing impairment
Impairment due to physical illness
Impairment due to mental health problems

12. Have you had any of these ailments in the past 12 months?
(Put an X in one box on each line) <Never, Seldom, Sometimes, Often>
A Headache (without known medical cause)
B Neck or shoulder pain
C Joint or muscle pain
D Stomach pain (without known medical cause)
E Nausea
F Constipation
G Diarrhoea
H Heart palpitations
I Bronchitis or pneumonia
J Ear infection
K Sinus infection

13. If you answered "never" to <u>all</u> the above listed ailments, have you had any of these ailments <u>often</u> earlier (meaning before the last 12 months)**?** <yes, no>

If YES, **which ailment was it (see above list)?**
Write the name of the ailment or letter from above
_____

WHEEZING AND ASTHMA

14. Have you ever had wheezing or whistling in the chest? <yes, no>

If you answered NO, please skip to question 19

15. Have you had wheezing or whistling in the chest <u>in the past 12 months</u>? <yes, no>

If you answered NO, please skip to question 19

16. How many attacks of wheezing have you had <u>in the past 12 months</u>?
None
1 to 3
4 to 12
More than 12

17. <u>In the past 12 months, h</u>ow often, on average, has your sleep been disturbed due to wheezing?
Never woken with wheezing
Less than one night per week
One or more nights per week

18. <u>In the past 12 months</u>, has wheezing ever been severe enough to limit your speech to only one or two words at a time between breaths? <yes, no>

19. Have you ever had asthma? <yes, no>

If YES, **has a doctor said that you have had asthma?** <yes, no>

20. <u>In the past 12 months</u>, has your chest sounded wheezy during or after exercise? <yes, no>

21. <u>In the last 12 months</u>, have you had a dry cough at night apart from a cough associated with a cold or chest infection? <yes, no>

ECZEMA

22. Have you ever had an itchy rash which was coming and going for at least 6 months? <yes, no>
If you answered NO, please skip to question 27

23. Have you had this itchy rash at any time during the past 12 months? <yes, no>
If you answered NO, please skip to question 27

24. Have you had this itchy rash in the following places: the folds of your elbow (inside), back of your knees, on the front of your ankles, under your buttocks or around your neck, ears or eyes? <yes, no>

25. Has this rash cleared completely at any time during the past 12 months? <yes, no>

26. In the last 12 months, how often on the average have you been kept awake at night by this itchy rash?
Never in the past 12 months
Less than 1 night per week
1 or more nights per week

27. Have you ever had eczema? <yes, no>

RHINITIS

All these questions are about problems which occur when you DO NOT have a cold or the flu.

28. Have you ever had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or the flu? <yes, no>

If you answered NO, please skip to question 33

29. In the past 12 months, have you had a problem with sneezing, or a runny, or blocked nose when you DID NOT have a cold or the flu? <yes, no>

If you answered NO, please skip to question 33

30. In the past 12 months, has this nose problem been accompanied by itchy-watery eyes? <yes, no>

31. In which of the past 12 months did this nose problem occur?
(Put an X in the box for any which apply)
January
February
March
April
May
June
July
August
September
October
November
December

32. In the past 12 months, how much did this nose problem interfere with your daily activities?
<Not at all, A little, A moderate amount, A lot>

33. Have you ever had hay fever? <yes, no>

ALLERGIES

34. Do you have any allergies? <Yes, No, Don't know>

If you answered NO, please skip to question 37

35. What do you think you are allergic to? Put an X in the boxes to describe how you are affected by each item listed in the left column.
(Put an X in one or more boxes for each line.)
<No, Nose, Eyes, Eczema, Stomach reaction, Asthma/problems breathing, Other>
Dogs
Cats
Other animals
Grass/trees
House dust
Food
Smoke
Other

36. Has a doctor given you any allergy tests (blood tests, skin tests)**?** <yes, no>

MEDICINE

37. Do you take/use any of these medicines or dietary supplements?
Think about what you use these for. (Put an X in a box on every line.)
<never, sometimes, almost daily>
Pain relievers
Migraine medicine
Sleep medicine
Nerve medicine
Relaxants
Asthma medicine
Allergy medicine
Eczema cream
Laxatives
Iron tablets
Vitamins
Cod liver oil
Homeopathic medicine, herbal medicine
Other
List Other here: _____

CONCERNING OTHER ILLNESSES

38. Has a doctor diagnosed you with:
Epilepsy <yes, no>
Diabetes <yes, no>
Migraines <yes, no>

39. Have you had any other illness that lasted longer than 3 months? <yes, no>

If YES, which? _____

TOBACCO

40. Does anyone you live with smoke at home?
(Put an X in one or more boxes)
No, nobody
Yes, my mother
Yes, my father
Yes, a sibling
Yes, other people

41. Have you tried smoking? (at least one cigarette) <yes, no>
If you answered NO, go to question 45

42. Do you smoke? (Put an X in the appropriate box and write in the number of cigarettes. A package of loose tobacco equals approx. 50 cigarettes.)
Yes, I smoke about ____ cigarettes daily.
Yes, I smoke occasionally, but not daily.
No, not anymore, but previously I smoked once in a while.
No, not anymore, but previously I smoked about ____ cigarettes daily.
No, I don't smoke.

If you answered NO, I DON'T SMOKE, go to question 45

43. How old were you when you began smoking? _____ years old

44. How many years in total have you smoked daily? _____ years

45. Does the smell of smoke ever bother you?
At school? <Never, Sometimes, Often>
At home? <Never, Sometimes, Often>

---

46. Do you use or have you used snuff, chewing tobacco or similar products?
No, never
Yes, but I have quit
Yes, sometimes
Yes, everyday

If you answered NO, NEVER, go to question 50

47. How old were you when you began using snuff/chewing tobacco? _____ years old

48. How many years in total have you used snuff/chewing tobacco? _____ years

49. How many boxes/bags of snuff/chewing tobacco do you use in a week? ____ (number)

SPORTS AND EXERCISE

50. Not during the average school day: **How many <u>days</u> a week do you play sports or exercise to the point where you breathe heavily and/or sweat?**
Everyday
4-6 days a week
2-3 days a week
1 day a week
Not every week, but at least once every two weeks
Not every 14th day, but at least once a month
Less than once a month
Never

51. Not during the average school day: **How many <u>hours</u> a week do you play sports or exercise to the point where you breathe heavily and/or sweat?**
None
About ½ hour
About 1 hour
About 2-3 hours
About 4-6 hours
7 or more hours

52. Do you use asthma medication before you exercise, work out or compete in sports? <yes, no>

53. Are you actively involved in sports?
Yes
No, but I was before
No

If you answered NO, (never been actively involved in sports), go to question 59

54. If you no longer participate in sports, **how old were you when you stopped? ____** years old

55. Which sport(s) do/did you participate in?
(Put an X in one or more boxes)
A Skiing (cross country, biathlon)
B Skiing (downhill/slalom, ski jump)
C Football/soccer
D Horse riding
E Skating, ice hockey
F Handball, basketball, volleyball
G Martial arts, boxing
H Body building
I Cycling
J Weight lifting
K Track and field, orienteering
L Swimming
M Gymnastics
N Other, write in here: _____

56. Do you play any competitive sports? (X only one box)
Yes
No, but I did before
No

If you answered NO (never competed in sports), go to question 59

57. At what level do/did you compete in sports?
(Give highest level)
Local level (championships, series, etc.)
Regional or state level
National level

58. In which sports do/did you compete?
(In order of participation level, list 3 sports you are/were active in.)
I am/have been most active in _____ and have/had participated for ____ years.
I am/have been 2nd most active in _____ and have/had participated for ____ years.
I am/have been 3rd most active in _____ and have/had participated for ____ years.

YOUR GENERAL WELLBEING

59. Thinking about your life at the moment, would you say that you by and large are satisfied with life, or are you mostly dissatisfied? (Put an X in only one box)
Very satisfied
Satisfied
Somewhat satisfied
Neither satisfied nor dissatisfied
Somewhat dissatisfied
Dissatisfied
Very dissatisfied

60. Do you feel, for the most part, strong and fit or tired and worn out? (Put an X in only one box)
Very strong and fit
Strong and fit
Somewhat strong and fit
Somewhere in between
Somewhat tired and worn out
Tired and worn out
Very tired and worn out

61. Would you say you are usually cheerful or downhearted? (Put an X in only one box)
Very downhearted
Downhearted
Somewhat downhearted
Some of both
Somewhat cheerful
Cheerful
Very cheerful

62. How do you see yourself?
Put an X in a box for each sentence below indicating whether you agree or disagree in how it relates to you. (Put an X in one box on each line)
<Strongly agree, Agree, Disagree, Strongly Disagree>
I take a positive attitude toward myself.
I certainly feel useless at times.
I feel I do not have much to be proud of.
I feel that I'm a person of worth, at least on an equal plane with others.

63. In the last month have you:
< Almost every night, Often, Sometimes, Never>
Had difficulty falling asleep?
Woken up too early and not been able to get to fall asleep again?

64. The questions below are about how you usually behave, feel and deal with things. Place a cross in the box for Yes or No for each statement depending on whether it describes you or not. <yes, no>
Are you a relatively lively person?
Would you be upset by seeing a child or animal suffer?
Do you like meeting new people?
Are your feelings easily hurt?
Do you often feel that you lose interest?
Do you like to tease people even though it may hurt them?
Are you often worried?
Are good manners and cleanliness important to you?
Do you worry that terrible things might happen?
Do you usually take the first step to make new friends?
Are you mostly quiet when you are around other people?
Do you like to be on time for appointments?
Do you often feel tired and indifferent/unmotivated without reason?
Do many people try to avoid you?
Are you a life-of-the-party type person?
Are you bothered by an embarrassing experience long after it happens?
Do you like to have a lot of life and excitement around you?
Do people tell you a lot of lies?

65. Below is a list of some problems. Have you been bothered by any of these in the last 14 days?
(Put an X in one box on each line)
<Not at all, A little, Quite a bit, Very>
Been constantly afraid and anxious
Felt tense or uneasy
Felt hopelessness when you think of the future
Felt dejected or sad
Worried too much about various things

66. During the last month have you been bothered by nervousness (irritability, uneasiness, tenseness or restlessness)?
Almost always
Often
Sometimes
Never

YOUR LEISURE TIME

67. Think back over the last week, <u>the last 7 days</u>. If you did any of the things listed below, put an X in the box for about how many times you did this. (X an answer for each line)
<Not once, Once, 2 or 3 times, 4 times or more>
Visited someone you know
Were visited
Read a book you liked
Listened to music or played an instrument longer than 15 minutes
Were out for more than 2 hours (in a row) with friends
Were at a meeting or training with a club or team
Were active in a hobby
Watched television or a video
Did homework longer than 1 hour

68. How many teams or clubs are you a part of?
(For example: sports team, girl or boy scouts, band, etc.)
None
One
2 or more

FRIENDS

69. Do you have someone that you have considered your best friend during most of the time you have been at school? <yes, no>

70. Do you feel lonely?
(Put an X in one box)
Very often
Often
Sometimes
Seldom
Very seldom or never

71. Are your parents separated or divorced, or have they lived separately for more than one year?
(Put an X in one box and write in your age where necessary)
No
Yes, they lived separately or were separated when I was _____ years old, but they later moved back together again.
Yes, they were divorced or permanently separated when I was ____ years old.

72. If you have siblings, how good a relationship do you feel you have with your sister or brother? If you have several siblings, think about the one you have the best relationship to.
(Put an X in one box)
Much worse than normal
Worse than normal
Average
Better than normal
Much better than normal
I do not have siblings

73. About how many close friends do you have? Include those with whom you can confidentially talk and who help you when you are in need. Do not include the people you live with, but include other relatives.

(Put an X in one box)
None
One
2 or more
4 or more

74. Do you have a steady boyfriend/girlfriend? <yes, no>

75. Do you feel that you have enough friends? <yes, no>

SCHOOL

76. Do any of the following things happen to you at school/concerning school, or have any of them happened?
(Put an X in one box on each line)
<Never, Sometimes, Often, Very often>
Have difficulties concentrating during class
Think that gym or art is fun
Think other classes are fun
Argue with the teacher
Look forward to going to school
Skip school
Understand what is being taught
Have fun during recess/break time
Are satisfied with your test results
Get in a fist fight
Are teased/harassed by other students
Are reprimanded by the teacher
Cannot manage to be calm/sit still during class
Become bored or dissatisfied

MEALS AND EATING HABITS

77. How often do you usually eat these meals?
(Put an X in one box on each line)
<Everyday, 4-6 days a week, 1-3 days a week, Seldom or never>
Breakfast
Lunch
Warm dinner

78. Are you trying to lose weight?
No, I'm comfortable with my weight
No, but I need to lose weight
Yes

79. How often do you <u>not</u> eat your lunch even though you brought one with you?
(Put an X in one box)
Every school day
4-6 days a week
1-3 days a week
Seldom or never
I never bring a lunch with me

80. How often do you drink or eat the things listed below?
(Put an X in one box on each line)
<More than once a day, Once a day, Every week but not everyday, Seldom, Never>
Cola, soda or still soft drinks
Low fat milk/skim milk
Whole milk
Coffee
Potato chips and such
Candy, chocolate and other sweets
Chips/French fries, hamburgers or hot dogs
Whole grain bread/ Crispbread
Butter
Margarine
Fruit
Vegetables

81. Do you consider yourself:
(Put an X in one box)
Very fat
Chubby
About the same as others
Thin
Very thin

82. Below are listed things that concern your eating habits. Put an X in the boxes according to how they apply to you.
(Put an X in one box for each statement)
<Never, Seldom, Often, Always>

When I first begin eating, it is difficult to stop.
I spend too much time thinking about food.
I feel that food controls my life.
I cut my food into small pieces.
I take longer than others to eat my meals.
Older people think that I am too thin.
I feel that others pressure me to eat.

ALCOHOL

83. Have you ever tried drinking alcohol? (Meaning alcoholic beer, wine, hard liquor or moonshine)
<Yes, No, Don't know>

If you answered NO, go to question 87

84. Have you ever drunk so much alcohol that you felt intoxicated (drunk)?
(Put an X in one box)
No, never
Yes, once
Yes, 2-3 times
Yes, 4-10 times
Yes, more than 10 times

85. About how much beer, wine or hard liquor do you usually drink during <u>two weeks</u>? Don't count alcohol free beer. Write 0 if you do not drink alcohol.

Beer	____	number of 1/2 bottles
Wine	____	number of glasses (approx. 1 dl)
Hard liquor, liqueurs	____	number of glasses (approx. 1/2 dl)
Moonshine	____	number of glasses (approx. 1/2 dl)

86. On which days during the week do you most often drink alcohol?
(Put an X in one or more boxes)
I do not drink
Fridays
Saturdays
Other days

87. Have you ever seen either of your parents intoxicated?
(X one box)
Never
A few times
A few times a year
A few times a month
A few times a week

READING AND WRITING DIFFICULTIES

88. How often do you feel your reading or writing skills are below the level of the tasks you do at school and/or in your spare time?
<Never, Very seldom, Sometimes, Often, Always>
Reading
Writing

89. Have you had any particular reading or writing problems in the last 12 months?
<A lot of problems, Some problems, No problems>
Reading
Writing

90. Do you receive help for reading or writing difficulties at this time? <yes, no>

91. Have you had problems with reading or writing earlier, but not within the last 12 months?
<yes, no>
If YES, **did you receive help at that time?** <yes, no>

92. Do you have any speaking difficulties? <yes, no>
If YES, **which one(s):**
Stuttering
Pronunciation difficulties
Problems with your voice
Difficulties expressing yourself

HEALTH SERVICES

93. During the last 12 months have you been to:
(Put an X in one box for every line) <yes, no>
General practitioner (a doctor outside the hospital)
Doctor at the hospital (not having been admitted)
Psychologist
Physiotherapist
Chiropractor
Homeopath
Other treatment (naturopath, reflexologist, laying on of hands, healer, psychic, etc.)

94. Have you ever been admitted to the hospital (exclude when you were born)?
No, never
Yes, once
Yes, more than once

If YES, **have you been admitted to the hospital during the last 12 months?** <yes, no>

95. How often have you been to the school health centre/nurse's office during the last 12 months?
Not at all
1-3 times
More than 3 times

96. Have you ever contacted the school health centre? <yes, no>

97. Would you like to contact/visit the school health centre more than you have? <yes, no>

98. How often have you been absent from school due to illness <u>during the last 12 months</u>?
Less than 1 week
1-2 weeks
More than 2 weeks

PHYSICAL DEVELOPMENT

You are now at the age when your body has begun to change and become more like an adult's body. Below are some questions about physical changes that occur in young people around your age.

99. During the teenage years there are periods where one grows quickly (growing spurt). Have you noticed that your body has grown quickly (become taller)?
(Put an X in one box)
No, I have not begun to grow
Yes, I have barely begun a growing spurt
Yes, I've clearly begun a growing spurt
Yes, it seems that I'm finished with growing spurts

100. Concerning hair on your body (under your arms and your crotch/groin), would you say that the hair on your body has:
(Put an X in one box)
Not begun to grow yet
Barely begun to grow
Quite clearly begun to grow
It seems that my body hair has grown in

101. When you look at yourself, do you think that you are physically maturing/have physically matured earlier or later than others your own age?
(Put an X in one box)
Much earlier
Earlier
A little bit earlier
The same as others
A little bit later
Later
Much later

QUESTIONS FOR GIRLS ONLY

102. Have you begun to develop breasts?
(Put an X in one box)
No, haven't begun yet
Yes, have barely begun
Yes, have quite clearly begun
It seems my breasts are fully developed

103. Have you begun menstruating (gotten your period)?
<yes, no>
If you answered NO, go to question 106

104. How old were you when you first began menstruating?
I was ____ years and ____ months old.

105. Have you ever missed (not gotten) your period for several months after a regular period (without being pregnant)?
(Put an X in one box)
Yes, for 2-5 months
Yes, for 6-12 months
Yes, for more than a year
No, never

106. Have you ever been treated by a doctor for: <yes, no>
Inflammation/infection of the reproductive system (ovaries, fallopian tubes)
Vaginal discharge
Menstrual pain

107. Have you ever taken birth control pills or the mini pill? <yes, no>

If you answered NO, go to the last page

108. How old were you when you first began taking birth control pills?
____ years old

109. How long in total did you take birth control pills?
____ years

110. Do you take birth control pills now? <yes, no>

QUESTIONS FOR BOYS ONLY

112. Has your voice begun to change?
(Put an X in one box)
No, hasn't begun yet
Yes, has just barely begun
Yes, has clearly begun
It seems my voice has finished changing

113. Has facial hair begun to grow (moustache or beard)?
(Put an X in one box)
No, hasn't begun yet
Yes, has just barely begun
Yes, has clearly begun
Yes, I have quite a lot of facial hair

114. Have you been treated by a doctor for:
(Put an X in one box on every line)
Tight foreskin
Discharge from the penis (urethra)
Inflammation of the foreskin or scrotum (testicles)

FOR STUDENTS IN HIGH SCHOOL

These questions are in this questionnaire for high school students to answer.

115. During the last year, have you often felt that you pressured yourself or continuously pushed yourself? <Yes, No, Don't know>

116. Do you feel that you are constantly short of time, even in your everyday tasks?
Always, or almost always
Sometimes
Never

117. Have you ever had thoughts about taking your own life? <yes, no>

118. Have you ever tried hash, marijuana or related drugs? <yes, no>

119. Have you ever used steroids or other performance enhancing drugs? <yes, no>

120. If YES, **how old were you the first time? ____** years old

121. Have you ever had sexual intercourse? <yes, no>

122. For GIRLS: Have you ever become pregnant when you didn't want to be? <yes, no>

123. For BOYS: Have you ever gotten a girl pregnant without intending to? <Yes, No, Don't know>

For BOTH boys and girls
If YES:

124. How old were you when this happened? ____ years old

125. Was the result an abortion? <Yes, No, Don't know>

COMMENTS

If you have time, you could write here about what you think is important, but was not asked about in this questionnaire. What are your thoughts about being young these days? What do feel can be improved upon concerning health and wellbeing for youth of today?

Appendix 3

Questionnaires used in HUNT3 and Young-HUNT3 (paper 3)

HUNT 3 Questionnaire 1

Health and daily life

1. How is your health at the moment?

Poor ☐ Not so good ☐ Good ☐ Very good ☐

	Yes	No
2. Do you suffer from long-term (at least 1 year) illness or injury of a physical or psychological nature that impairs your functioning in your daily life?	☐	☐

If Yes,
Would you describe your impairment as slight, moderate or severe?

	Slight	Moderate	Severe
Motor ability impairment	☐	☐	☐
Vision impairment	☐	☐	☐
Hearing impairment	☐	☐	☐
Impairment due to physical illness	☐	☐	☐
Impairment due to mental health problems	☐	☐	☐

3. Do you have physical pain now that has lasted more than 6 months?

Yes ☐ No ☐

4. How strong has your physical pain been during the last 4 weeks?

No pain	Very mild	Mild	Moderate	Strong	Very strong
☐	☐	☐	☐	☐	☐

5. To what extent has your physical health or emotional problems limited you in your usual socializing with family or friends during the last 4 weeks?

Not at all	Very little	Somewhat	Much	Was not able to socialize
☐	☐	☐	☐	☐

Health services

6. During the last 12 months, have you visited any of the following:	Yes	No
General practitioner	☐	☐
Another specialist outside the hospital	☐	☐
Consultation w/ a doctor without being admitted		
to the psychiatric out-patient dept.	☐	☐
to another hospital out-patient dept.	☐	☐
Chiropractor	☐	☐
Homeopath, acupuncturist, reflexologist, laying on of hands or other alternative treatment practitioner	☐	☐
7. Have you been admitted to hospital in the last 12 months?	☐	☐

Illness and Injury

	Yes	No
8. Have you had any kind of attack of wheezing or breathlessness during the last 12 months?	☐	☐
9. Have you at any time during the last 5 years taken medicine for asthma, chronic bronchitis, emphysema or COPD?	☐	☐
10. Do you take or have you taken medication for high blood pressure?	☐	☐

11. Have you had or do you have any of the following:
(Put an X on each line)

	Yes	No	If Yes, how old were you the first time
			Ex: (34 years old)
Myocardial infarction (heart attack)	☐	☐	☐ years old
Angina pectoris (chest pain)	☐	☐	☐ years old
Heart failure	☐	☐	☐ years old
Other heart disease	☐	☐	☐ years old
Stroke/brain haemorrhage	☐	☐	☐ years old
Kidney disease	☐	☐	☐ years old
Asthma	☐	☐	☐ years old
Chronic bronchitis, emphysema or COPD	☐	☐	☐ years old
Diabetes	☐	☐	☐ years old
Psoriasis	☐	☐	☐ years old
Eczema on hands	☐	☐	☐ years old
Cancer	☐	☐	☐ years old
Epilepsy	☐	☐	☐ years old
Arthritis (rheumatoid arthritis)	☐	☐	☐ years old
Bechterew's disease	☐	☐	☐ years old
Sarcoidosis	☐	☐	☐ years old
Osteoporosis	☐	☐	☐ years old
Fibromyalgia	☐	☐	☐ years old
Degenerative joint disease (osteoarthritis)	☐	☐	☐ years old
Mental health problems you sought help for	☐	☐	☐ years old

12. Has it ever been verified that you had high blood sugar (hyperglycaemia)?

Yes ☐ No ☐

If Yes, **in what situation was this discovered the first time?**

At a health examination ☐ While sick ☐

While pregnant ☐ Other ☐

Injuries

13. Have you ever had:

	Yes	No	If Yes, how old were you the **first** time *Ex: (34 years old)*
Hip fracture	☐	☐	☐ years old
Fractured wrist/forearm	☐	☐	☐ years old
Fracture/compressed dorsal vertebrae?	☐	☐	☐ years old
Whiplash	☐	☐	☐ years old

Illness in immediate family

14. Do your parents, siblings or children have, or have they had, the following illnesses? *(one X per line)*

	Yes	No	Don't know
Stroke or brain haemorrhage before the age of 60	☐	☐	☐
Myocardial infarction (heart attack) before the age of 60	☐	☐	☐
Asthma	☐	☐	☐
Allergies/hay-fever/nasal allergies	☐	☐	☐
Chronic bronchitis, emphysema or COPD	☐	☐	☐
Cancer	☐	☐	☐
Mental health problems	☐	☐	☐
Osteoporosis	☐	☐	☐
Kidney disease (not kidney stone, urinary tract infection, urinary incontinence)	☐	☐	☐
Diabetes	☐	☐	☐

15. Have your parents' siblings, your cousins or either of your grandparents been diagnosed with diabetes (type 1 or type 2)?

Yes ☐ No ☐

How do you feel?

16. In the last two weeks, have you felt: *(one X per line)*

	No	A little	A good amount	Very much
Confident and calm	☐	☐	☐	☐
Happy and optimistic	☐	☐	☐	☐
Nervous and restless	☐	☐	☐	☐
Troubled by anxiety	☐	☐	☐	☐
Irritable	☐	☐	☐	☐
Down/depressed	☐	☐	☐	☐
Lonely	☐	☐	☐	☐

17. Has anyone at any time in your life tried to oppress, degrade or humiliate you over an extended period of time?

Yes ☐ No ☐

Lifestyle

Smoking

	Yes	No
18. Did any of the adults where you grew up smoke indoors?	☐	☐
19. Did your mother smoke when you were growing up?	☐	☐

20. Do you smoke? *(Put an X in only one box)*

- **No**, I have never smoked ☐
  - *If you never smoked, skip to question **22***
- **No**, I quit smoking ☐
- Yes, cigarettes occasionally (parties/vacation, not daily) ☐
- Yes, cigars/cigarillos/pipe occasionally ☐
- Yes, cigarettes daily ☐
- Yes, cigars/cigarillos/pipe daily ☐

21A. Answer this if you smoke daily now or previously smoked daily:

1. How many cigarettes do/did you usually smoke daily?	☐ Cigarettes pr day
2. How old were you when you started smoking daily?	☐ years old
3. If you previously smoked daily, how old were you when you quit smoking?	☐ years old

21B. Answer this if you smoke/previously smoked occasionally, but not daily:

1. How many cigarettes do/did you usually smoke in a month?	☐ Cigarettes pr mo.
2. How old were you when you started smoking occasionally?	☐ years old
3. If you previously smoked occasionally, how old were you when you quit?	☐ years old

22. Do you use, or have you used snuff?

No, never	☐	Yes, occasionally	☐
Yes, but I quit	☐	Yes, daily	☐

*If you answered No, never, skip to question **23***

If Yes,

How old were you when you began using snuff?

☐ years old

How many portions snuff do/did you use a month?

☐ Portions snuff a month

If you use(d)/smoke(d) both cigarettes and snuff, which did you begin with first?

Snuff	☐	About the same time (within 3 months)	☐
Cigarettes	☐	Don't remember	☐

Did you begin using snuff to try to quit or cut down on smoking?

No ☐

Yes, to quit smoking ☐ Yes, to cut down on smoking ☐

Diet

23. How often do you normally eat these foods?
(one X on each line)

	0-3 times a month	1-3 times a week	4-6 times a week	Once a day	Twice or more a day
Fruits, berries	☐	☐	☐	☐	☐
Vegetables	☐	☐	☐	☐	☐
Chocolate/candy	☐	☐	☐	☐	☐
Boiled potatoes	☐	☐	☐	☐	☐
Pasta/rice	☐	☐	☐	☐	☐
Sausages/hamburgers	☐	☐	☐	☐	☐
High-fat fish on bread or for dinner (salmon, trout, herring, mackerel, haddock)	☐	☐	☐	☐	☐

24. Do you take the following dietary supplements?
(One X for each supplement)

	Yes, daily	Occasionally	No
Cod-liver oil	☐	☐	☐
Omega-3 capsules	☐	☐	☐
Vitamins and/or minerals	☐	☐	☐

25. How <u>many glasses</u> do you usually drink of the following? ½ litre = 3 glasses (one X on each line)

	Seldom/ never	1-6 gl. a week	1 gl. a day	2-3 gl. a day	4 gl or more a day
Water, Farris, etc.	☐	☐	☐	☐	☐
Whole milk (sweet/sour)	☐	☐	☐	☐	☐
Other milk (sweet/sour)	☐	☐	☐	☐	☐
Soda/juice w/sugar	☐	☐	☐	☐	☐
Soda/juice w/out sugar	☐	☐	☐	☐	☐
Juice or nectar	☐	☐	☐	☐	☐

26. How many cups of coffee do you drink a day?
(write 0 if you do not drink coffee/tea daily)

	Boiled coffee	Other coffee	Tea
Number of cups			

27. How many cups of coffee do you drink in the evening (after 6pm)?

Number of cups ☐

Alcohol

28. About how often in the last 12 months did you drink alcohol? *(do not include low-alcohol beer)*

4-7 times a <u>week</u>	☐	About once a <u>month</u>	☐
2-3 times a <u>week</u>	☐	A few times a <u>year</u>	☐
About once a <u>week</u>	☐	Not at all the last <u>year</u>	☐
2-3 times a <u>month</u>	☐	<u>Never</u> drink alcohol	☐

29. Did you drink alcohol during the last 4 weeks?

Yes ☐ No ☐

If Yes,
Did you drink so much that you felt very intoxicated (drunk)?

No ☐ Yes, 1–2 times ☐ Yes, 3 times or more ☐

30. How many glasses of beer, wine or spirits do you usually drink <u>in the course of two weeks</u>: *(do not include low-alcohol beer, write 0 if you do not drink alcohol)*

	Beer	Wine	Spirits
Number of glasses			

31. How often do you drink <u>5 glasses or more</u> of beer, wine or spirits in one sitting?

Never ☐ Monthly ☐ Weekly ☐ Daily ☐

Exercise

By exercise we mean going for walks, skiing, swimming and working out/sports.

32. How often do you exercise? *(on the average)*

Never ☐
Less than once a week ☐
Once a week ☐
2-3 times a week ☐
Nearly every day ☐

33. If you exercise as often as once or several times a week: How hard do you exercise? (average)

I take it easy, I don't get out of breath or break a sweat ☐
I push myself until I'm out of breath and break into a sweat ☐
I practically exhaust myself ☐

34. For how long do you exercise each time?(average)

Less than 15 minutes ☐ 30 min.-1 hour ☐
15-29 minutes ☐ More than 1 hour ☐

35. Do you have at <u>least 30 minutes</u> of physical activity daily at work or in your leisure time?

Yes ☐ No ☐

36. About how many hours do you sit during a normal day? *(include work hours and leisure time)*

☐ hours

Employment

37. If you have had paid or unpaid employment, how would you describe your job? *(One X only)*

- Work that mostly involves sitting *(ex: desk work, assembly worker)* ☐
- Work that requires much walking (*ex: clerk, light industry worker, teacher*) ☐
- Work that requires much walking and lifting (*ex: mail carrier, nurse, construction worker*) ☐
- Heavy physical labour (ex: *forester, farmer, heavy construction worker*) ☐

Height/Weight

38. About how tall were you <u>at age 18</u>?

☐☐☐ cm Don't remember ☐

39. About how much did you weigh <u>at age 18</u>?

☐☐☐ kg Don't remember ☐

40. Are you satisfied with your weight now?

Yes ☐ No, don't weigh enough ☐ No, weigh too much ☐

41. Have you tried to diet <u>in the last 10 years</u>?

No ☐ Yes, a few times ☐ Yes, many times ☐

42. Do you weigh at least 2 kg less than you did 1 year ago?

Yes ☐ No ☐

If Yes, **what is the reason for this?**

Dieting ☐ Illness/stress ☐ Don't know ☐

Serious events in the last 12 months

43. Has a member of your immediate family died?
(Child, spouse/partner, sibling or parent)

Yes ☐ No ☐

44. Have you been in imminent mortal danger because of a serious accident, catastrophe, violent situation or war?

Yes ☐ No ☐

45. Has your relationship with your spouse or long-term partner ended?

Yes ☐ No ☐

46. If you answered Yes to one or more of the above questions (43, 44 or 45), how much have you reacted to this in the last <u>7 days</u>?

- Not at all ☐
- A little ☐
- Moderate amount ☐
- Very much ☐

Childhood – When you were <u>0-18 years old</u>

47. Who did you grow up with?

- Mother ☐
- Father ☐
- Stepmother/ stepfather ☐
- Other relatives ☐
- Adoptive parents ☐
- Foster parents ☐

48. Did your parents leave each other, or get a divorce, when you were a child?

No ☐

Yes, before I was 7 years old ☐ Yes, when I was 7-18 years old ☐

49. Did either of your parents die when you were a child?

No ☐

Yes, before I was 7 years old ☐ Yes, when I was 7-18 years old ☐

50. Did you grow up with pets?

No ☐

Yes, cat ☐ Yes, dog ☐ Yes, horse ☐ Yes, other animal ☐

51. How much milk or yoghurt did you usually drink?

Seldom/ never	1-6 glasses pr. week	1 glass pr. day	2-3 glasses pr. day	More than 3 glasses pr. day
☐	☐	☐	☐	☐

52. Did you grow up on a farm with farm animals? Yes ☐ No ☐

53. When you think about your childhood, would you describe it as:

Very good ☐ Average ☐ Very difficult ☐

Good ☐ Difficult ☐

In General

54. Thinking about your life at the moment, would you say that you by and large are satisfied with life, or are you mostly dissatisfied? *(One X only)*

- Very satisfied ☐
- Satisfied ☐
- Somewhat satisfied ☐
- A bit of both ☐
- Somewhat dissatisfied ☐
- Dissatisfied ☐
- Very dissatisfied ☐

Young HUNT

ADOLESCENT SECTION OF THE HEALTH STUDY IN NORD-TRØNDELAG, HUNT

It's your turn to participate in the Nord-Trøndelag Health Study (**HUNT**)!

We hope you have read the information brochure about YOUNG HUNT that you took home with you and have decided to participate!

Read the informed consent form that is inside the questionnaire and check that it is your name that is on it. Mark it as to whether you will participate or not, sign it and hand it in to the teacher.

Your name should NOT be on your questionnaire!

Put an X in the boxes ∀ that you think apply to you. Answer the best you can! If there are questions that you do not want to answer, skip them.

When you are finished, put the questionnaire in the envelope you have been given, seal it and give the envelope to the teacher. Do this even if you haven't finished the questionnaire.

All your answers will be treated in the strictest of confidence!

No one at school is allowed to see your answers.

If you wish to speak to someone about the study, speak to the Young HUNT nurse when she visits your school or ring HUNT Research Centre (see back of questionnaire).

Good Luck and Thank You!

Date of questionnaire completion ____/_____20____

1. For those who are in Junior High School: **What type of plans do you have regarding your studies in High School?**

High School academic studies ∀ High School vocational studies ∀ Don't know ∀

2. **What type of plans do you have regarding continued studies?**
(Put one or more Xs)

* College or university for 4 years or more …… ∀
* College or university less than 4 years ……. ∀
* Other vocational training ……∀
* No plans ……..…..∀
* Don't know……∀

WHERE YOU LIVE

3. **What type of housing do you live in?** (Only one X)

* Single-family house ……..…∀
* Row house/2-4 family housing ……∀
* Flat in block/flat ……..∀
* Farm w/ animal husbandry……..∀
* Farm w/out animal husbandry ……∀
* Other housing ……..∀

4. **Who do you currently live with?** (Put one or more Xs)

* Mother ……∀
* Father ……..∀
* 1-2 siblings ……….∀
* 3 or more siblings…… ∀
* Mother's new husband or partner ∀
* Father's new wife or partner……∀
* Foster parents……..∀
* Adoptive parents ……∀
* Grandparents/other……∀
* Spouse/partner……∀
* Friends……..∀
* Alone/in a rented room…….. ∀

5. **If your mother and father do not live together, who do you live with?**

Mostly my mother ∀ Mostly my father ∀ Equal time at both parents ∀

6. **Are there pets living in your home?**

No …… ∀
Yes, cat …… ∀
Yes, dog …….. ∀
Yes, other animals with fur ……. ∀
Yes, bird …… ∀
Yes, other …… ∀

YOUR HEALTH

7. How is your health at the moment? (One X)

* Poor ……..∀ *Good……..∀
* Not so good ……..∀ * Very good……∀

8. Are you disabled in any of these ways? (Put an X for each line)

	No	A little	Somewhat	Severely
* Motor impairment (movement)	∀	∀	∀	∀
* Vision impairment	∀	∀	∀	∀
* Hearing impairment	∀	∀	∀	∀
* Impairment due to physical illness	∀	∀	∀	∀
* Impairment due to mental health problems	∀	∀	∀	∀

9. Have you had any of these ailments <u>in the past 12 months</u>: (Put an X for each line)

	Not at all	A little	Much
* Palpitation	∀	∀	∀
* Constipation	∀	∀	∀
* Diarrhoea	∀	∀	∀
* Alternating constipation and diarrhoea	∀	∀	∀
* Bloating	∀	∀	∀
* Nausea	∀	∀	∀

ALLERGIES

10. Do you have allergies? Yes ∀ No ∀ Don't know ∀

If Yes, **what do you think you are allergic to?** (One or more Xs)

* Grass/trees	∀	* Dogs	∀	* Food	∀
* House dust	∀	* Cats	∀	* Other	∀
		* Horses	∀	* Don't know	∀

11. Has a doctor given you any allergy tests (blood tests, skin tests)**?**

Yes ∀ No ∀ Don't know ∀

If Yes, **what did you have an allergic reaction to?** (One or more Xs)

* Nothing	∀	* Dog	∀	* Food	∀
* Grass/trees	∀	* Cat	∀	* Other	∀
* House dust	∀	* Horse	∀	* Don't know	∀

RESPIRATORY TRACT

12. Have you ever had wheezing or whistling in the chest?

Yes ∀ No ∀

IF YOU ANSWERED "NO", SKIP TO QUESTION 15

13. Have you had wheezing or whistling in the chest <u>in the past 12 months</u>?

Yes ∀ No ∀

IF YOU ANSWERED "NO", SKIP TO QUESTION 15

14. How many attacks of wheezing have you had <u>in the past 12 months</u>?

None ∀ 1 to 3 ∀ 4 to 12 ∀ More than 12 ∀

****

15. Do you have or have you had asthma? Yes ∀ No ∀

If YES, **has a doctor said that you have/have had asthma?** Yes ∀ No ∀

16. In the past <u>12 months</u> has your chest sounded wheezy during or after exercise?

Yes ∀ No ∀

17. <u>In the last 12 months</u> have you had a dry cough at night apart from a cough associated a cold or chest infection?

Yes ∀ No ∀

NASAL PROBLEMS

18. <u>In the past 12 months</u>, have you had a problem with sneezing or a runny or blocked nose when you did not have a cold or the flu?

Yes ∀ No ∀

IF YOU ANSWERED "NO", SKIP TO QUESTION 21

19. Has this nose problem been accompanied by itchy-watery eyes?

Yes ∀ No ∀

20. How much did this nose problem interfere with your daily activities? (One X)

Not at all ∀ A little ∀ A moderate amount ∀ A lot ∀

21. Have you ever had hay fever or nasal allergies? Yes ∀ No ∀

RASHES

22. Have you had an itchy rash during <u>the last 12 months</u>? Yes ∀ No ∀

IF YOU ANSWERED "NO", SKIP TO QUESTION 25

23. Have you had this itchy rash in the following places: the folds of your elbow (inside), back of your knees, on the front of your ankles, under your buttocks or around your neck, ears or eyes? Yes ∀ No ∀

24. How often on the average has this itchy rash kept you awake at night? (One X)

Not at all ∀ Less often than 1 night a week ∀ 1 night or more a week ∀

---

25. Have you ever had eczema? Yes ∀ No ∀

If Yes, has a doctor said that you have/ have had "atopic eczema"? Yes ∀ No ∀

ACNE

26. Have you had problems with acne? Yes ∀ No ∀

IF YOU ANSWERED "NO", SKIP TO QUESTION **31**

27. Where was the acne? (Put one or more Xs)

Forehead……..∀ Cheeks……..∀ Shoulders……..∀ Other places……...∀

Nose……..∀ Chest……..∀ Back……∀

28. How much has the acne bothered you? Very much ∀ Much ∀ A little ∀ Not at all ∀

Only one X

29. Have you used non-prescription creams, skin astringents or other similar products to get rid of the acne? (bought at the drug store or other shop, not prescribed by a doctor)

Yes ∀ No ∀

If Yes, has it helped? One X No ∀ Some ∀ Yes ∀

30. Have you been to a doctor because of acne? Yes ∀ No ∀

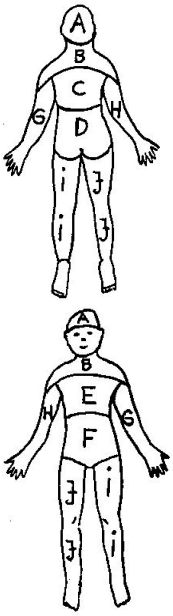
If Yes, did the doctor recommend any of the following treatments? (Put an X for each line)

- Topical treatment (ex: creams or liquid solutions) ……. Yes ∀ No ∀
- Antibiotic tablets (tetracycline) …….. Yes ∀ No ∀
- Roaccutan tablets …… Yes ∀ No ∀

If Yes, did this treatment help? (One X) No ∀ Some ∀ Yes ∀

PAIN

31. How often have you had any of the below listed pain <u>during the last 3 months</u>? (Without having injured yourself or having a known illness that is the reason for the pain)
Look at the figure and put an X for each line



	Never or seldom	About once a month	About once a week	More than once a week	Almost every day
A. Headache/migraine					
B. Neck/ shoulder pain					
C. Pain in the upper back					
D. Pain in the lower back/buttocks					
E. Pain in chest					
F. Stomach pain					
G. Pain in left arm					
H. Pain in right arm					
I. Pain in left leg					
J. Pain in right leg					
Other pain					

IF YOU ANSWERED "NEVER OR SELDOM" FOR EVERYTHING, SKIP TO QUESTION 34

If you have had pain during the last 3 months,

32. Does anything on the below list apply to you? (Put an X for each line):

	Yes	No
* Pain makes it difficult to fall asleep……..	∀	∀
* Pain disturbs my sleep at night. ……	∀	∀
* Pain makes it difficult to sit in class. …… ……	∀	∀
* Pain makes it difficult for me to walk more than one kilometre. …… ……..	∀	∀
* Because of pain I have problems in gym class. ……..	∀	∀

33. All things considered, has pain made it difficult to do daily activities? (Put an X for each line)

	No	Yes, sometimes	Yes, often
* At school ……	∀	∀	∀
* In leisure time ……	∀	∀	∀

If you answered Yes, **what type of pain makes daily activities difficult?** *(One or more Xs)*

Headache/migraine ∀ Stomach pain ∀ Muscular/skeletal pain ∀ Other pain ∀

OTHER ILLNESSES

34. Has a doctor diagnosed you with: (Put an X for each line)

	Yes	No
* Epilepsy	∀	∀
* Diabetes	∀	∀
* Migraine	∀	∀
* Juvenile arthritis	∀	∀
* Other illnesses that have lasted longer than 3 months	∀	∀

MEDICINE USE

35. How often <u>in the last 3 months</u> have you taken non-prescription medicine for any of the below listed complaints? (medicine not prescribed by a doctor, for example bought at a store or pharmacy) (Put an X for each line)

	Never	1 day a week or less	2 days a week	3 days a week	4 days a week or more
* Headache/migraine	∀	∀	∀	∀	∀
* Muscle/joint pain	∀	∀	∀	∀	∀
* Back pain	∀	∀	∀	∀	∀
* Stomach pain	∀	∀	∀	∀	∀
* Other	∀	∀	∀	∀	∀

36. Do you take any medicine that was prescribed for you by a doctor? Yes ∀ No ∀

37. Do you take/use any of these medicines or dietary supplements?
(Put an X for each line)

	Never	Sometimes	Almost daily
* Iron tablets	∀	∀	∀
* Laxative tablets	∀	∀	∀
* Vitamins	∀	∀	∀
* Cod-liver oil	∀	∀	∀
* Homeopathic medicine, herbal medicine	∀	∀	∀
* Other	∀	∀	∀

TOBACCO

38. Does anyone you live with smoke at home? (One or more Xs)

* No, nobody ∀
* Yes, my mother ∀
* Yes, my father ∀
* Yes, a sibling ∀
* Yes, other people ∀

39. Have you tried smoking? (at least one cigarette) Yes ∀ No ∀

IF YOU ANSWERED "NO", SKIP TO QUESTION 43

40. **Do you smoke?** (Put an X in the appropriate box and write in the number of cigarettes. A package of loose tobacco equals approx. 50 cigarettes)

∀ Yes, I smoke about _____ cigarettes daily.

∀ Yes, I smoke occasionally, but not daily.

∀ No, not anymore, but previously I smoked occasionally.

∀ No, not anymore, but previously I smoked about _____cigarettes daily.

∀No, I don't smoke.

IF YOU ANSWERED "NO, I DON'T SMOKE", SKIP TO QUESTION 44

41. **If you smoke or have smoked daily**:

* How old were you when you began smoking daily? _____ years old

* If you quit smoking daily, how old were you when you quit? _____ years old

42. **If you smoke or have smoked occasionally**:

* How old were you when you began smoking occasionally? _____ years old

* How many days have you smoked in the last month? _____ number of days
(Write 0 if you have not smoked in the past month)

* About how many cigarettes have you smoked in the last month? _____ number of cigarettes
(Write 0 if you have not smoked in the past month)

* If you quit smoking occasionally, how old were you when you quit? _____ years old

43. **How many of your friends smoke?** None ∀ A few ∀ Almost all ∀
(One X)

****

44. **Do you use or have you used snuff, chewing tobacco or similar products?** (One X)

No, never ∀ Yes, but have quit ∀ Yes, sometimes ∀ Yes, everyday ∀

IF YOU ANSWERED "NO, NEVER", SKIP TO QUESTION 50

45. If you use or have used snuff/chewing tobacco:

* How old were you when you began using snuff/chewing tobacco? _____ years old

* If you stopped using snuff/chewing tobacco, how old were you when you stopped? _____years old

* How many boxes/bags of snuff/chewing tobacco do you use/have you used a week?
_____ number of boxes/bags
(Write 0 if you use less than one box a month

46. If you smoke cigarettes and use snuff, which did you start first?
(One X)

∀ Snuff ∀ About the same time (within 3 months)
∀ Cigarettes ∀ Don't remember

47. Did you start using snuff to try to quit smoking or to smoke less?
(One X)

∀ No ∀ Yes, to quit smoking ∀ Yes, to smoke less

48. How many of your friends use snuff/chewing tobacco? (One X**)**

None ∀ A few ∀ Almost all ∀

****

49. Have you ever tried hash, marijuana or other drugs? (One X) Yes ∀ No ∀

If Yes, **How old were you the first time?** _____ years old

50. Do you have friends or acquaintances who use drugs? Yes ∀ No ∀

SPORTS AND EXERCISE

51. Not during the average school day: **How many <u>days</u> a week do you play sports or exercise to the point where you breathe heavily and/or sweat?** (*Only one X*)

* Everyday ∀
* 4-6 days a week ∀
* 2-3 days a week ∀
* 1 day a week ∀
* Less often than once a week ∀
* Less often than once a month ∀
* Never ∀

52. Not during the average school day: **How many <u>hours</u> a week do you play sports or exercise to the point where you breathe heavily and/or sweat?** (*Only one X*)

None	∀	* About 2-3 hours	∀
About ½ hour	∀	* About 4-6 hours	∀
About 1-1½ hours	∀	* 7 or more hours	∀

53. **Think about <u>the past 7 days</u>: How many hours did you spend sitting in an average day?** (This could be the time spent sitting at the computer, doing homework, at friends, reading and TV watching (include times both sitting and laying down for the last two). Count the times at school and in your leisure time.) _____Number of hours

54. **Do you work out/train at a health club?** Yes ∀ No ∀

55. **How often have you done/participated in any of the following activities/sports <u>the past 12 months</u>?** (Put an X for each line)

	Never	Less than 1 x a week	Once a week	Several x a week
* Endurance sports (ex: running, cross-country skiing, cycling, swimming)	∀	∀	∀	∀
* Team sports (ex: football, volleyball, handball, ice hockey, squash)	∀	∀	∀	∀
* Aesthetic sports (ex: dance, gymnastics, aerobics)	∀	∀	∀	∀
* Strength sports (ex: weightlifting, wrestling, bodybuilding)	∀	∀	∀	∀
* Martial arts/combat sports (ex: judo, karate, taekwondo, boxing)	∀	∀	∀	∀
* Technical sports (ex: riding, track sports, alpine skiing, ski jumping, snowboard, skate boarding)	∀	∀	∀	∀
* Adrenaline sports (ex: white water rafting, mountain climbing, paragliding)	∀	∀	∀	∀
* Jogging or racewalking/hiking	∀	∀	∀	∀
* Other	∀	∀	∀	∀

56. **If you haven't been involved in any of these activities/sports in the past 12 months, but did so previously, how old were you when you stopped?** ____ years old

57. **Do you participate in sports competitions?** (One X)

Yes ∀ No, but I used to compete ∀ No ∀

ALCOHOL

58. **Have you ever tried drinking alcohol?** (Meaning alcoholic beer, wine, hard liquor or moonshine)

Yes ∀ No ∀ Don't know ∀

If Yes, **do you sometimes drink alcohol now?** Yes ∀ No ∀

IF YOU ANSWERED NO, SKIP TO QUESTION 66

59. How old were you when you began drinking (more than a sip)**?** _____ years old

60. Have you ever drunk so much alcohol that you felt intoxicated (drunk)?
(One X)

* No, never ……. ∀
* Yes, once ……. ∀
* Yes, 2-3 times …… ∀
* Yes, 4-10 times …….. ∀
* Yes, 11-25 times …….. ……. ∀
* Yes, more than 25 times ..... ∀

61. About how much beer, wine or hard liquor do you usually drink during <u>two weeks</u>? Don't count alcohol free beer. Write 0 if you do not drink alcohol.

Beer..... number of 1/2 bottles

Hard liquor, liqueurs..... number of glasses (approx. 1/2 dl)

Wine..... number of glasses (approx. 1 dl)

Moonshine ..... number of glasses (approx. 1/2 dl)
Alcopop ……. number of bottles

62. How often do you currently drink alcohol? (One X)

* Every week or more often …… ∀
* Every other week …….. ∀
* More seldom than every other week, but more often than once a month …… ∀
* Once a month or more seldom than once a month ……..……..... ∀
* Never …….. ∀

63. On which days during the week do you most often drink alcohol? (One or more Xs)

I do not drink ∀ Fridays/Saturdays ∀ Other days of the week ∀

64. Have you ever seen either of your parents intoxicated? (One X)

* Never ……..∀
* A few times ……∀
* A few times during the year ……∀
* A few times a month ……∀
* A few times a week ……..∀

MEALS AND EATING HABITS

65. How often do you usually eat these meals? *(Put an X for each line)*

	Every-day	4-6 days a week	1-3 days a week	Seldom or never
* Breakfast	∀	∀	∀	∀
* Lunch	∀	∀	∀	∀
* Dinner (warm)	∀	∀	∀	∀
* Supper/evening snack	∀	∀	∀	∀

66. Are you trying to lose weight? (*One X)*

No, I'm comfortable with my weight ∀ No, but I need to lose weight ∀ Yes ∀

67. What do you usually eat at school? (*One X)*

Packed lunch ∀ Buy food at the cafeteria ∀ Do not eat lunch at school ∀

68. Below are listed things that concern your eating habits. (Put an X for each line*)*

	Never	Seldom	Often	Always
* When I first begin eating, it is difficult to stop.	∀	∀	∀	∀
* I vomit after I have eaten.	∀	∀	∀	∀
* I spend too much time thinking about food.	∀	∀	∀	∀
* I feel that food controls my life.	∀	∀	∀	∀
* When I eat, I cut my food up in small pieces.	∀	∀	∀	∀
* It takes me longer than others to finish a meal.	∀	∀	∀	∀
* Other people think I'm too thin.	∀	∀	∀	∀
* I feel that others pressure me to eat.	∀	∀	∀	∀

69. How often do you usually drink the following? (Put an X for each line)

	Seldom/ never	1-6 glasses a week	1 glass a day	2-3 glasses a day	4 glass or more a day
* Cola/soda/still soft drinks w/ sugar……	∀	∀	∀	∀	∀
* Cola/soda/still soft drinks w/out sugar…	∀	∀	∀	∀	∀
* Whole milk/kefir/yoghurt……..	∀	∀	∀	∀	∀
* Low fat milk or yoghurt/cultured milk……..	∀	∀	∀	∀	∀
* Skim milk (sour/sweet) ..……	∀	∀	∀	∀	∀
* Fruit juice ……	∀	∀	∀	∀	∀
* Water …… ……	∀	∀	∀	∀	∀

70. How often do you usually eat the following foods? (Put an X for each line)

	Several times a day	Once a day	Every week but not everyday	Less often than every week	Never
* Whole grain bread/crispbread ……	∀	∀	∀	∀	∀
* Oily fish (salmon, trout, mackerel)……	∀	∀	∀	∀	∀
* Fruit……..	∀	∀	∀	∀	∀
* Vegetables ……	∀	∀	∀	∀	∀
* White cheese ……	∀	∀	∀	∀	∀
* Potato chips and such ……	∀	∀	∀	∀	∀
* Candy, chocolate, other sweets…….….	∀	∀	∀	∀	∀

71. What type of fat do you usually use on bread? (One X)

Butter/hard margarine ∀ Soft/low fat margarine ∀ Liquid margarine/Oil ∀ Don't use any ∀

72. Do you consider yourself: (One X)

* Very fat …… ∀
* Chubby …… ∀
* About the same as others…… ∀
* Thin…… ∀
* Very thin…….. ∀

HOW THINGS ARE GOING FOR YOU

73. Thinking about your life at the moment, would you say that you by and large are satisfied with life, or are you mostly dissatisfied? (One X)

* Very satisfied …….. ∀
* Satisfied…….. …….. ∀
* Somewhat satisfied …….. ∀
* Neither satisfied nor dissatisfied ∀
* Somewhat dissatisfied …… ∀
* Dissatisfied …….. ∀
* Very dissatisfied …….. ∀

74. Do you feel, for the most part, strong and fit or tired and worn out? (One X)

* Very strong and fit ……. ∀
* Strong and fit …….. ∀
* Somewhat strong and fit …….. ∀
* Somewhere in between …… ∀
* Somewhat tired and worn out.. ∀
* Tired and worn out……. ∀
* Very tired and worn out …. ∀

75. Would you say you are usually cheerful or downhearted (sad)? (One X)

* Very downhearted (sad) …….. ∀
* Downhearted (sad) …… ∀
* Somewhat downhearted (sad) …… ∀
* Some of both …….. ∀
* Somewhat cheerful …….. ∀
* Cheerful …….. ∀
* Very cheerful …… ∀

76. Below is a list of some problems. Have you been bothered by any of these in <u>the last 14 days</u>? (Put an X for each line)

	Not bothered	A little bothered	Quite bothered	Very bothered
* Been constantly afraid and anxious ……	∀	∀	∀	∀
* Felt tense or uneasy …..……	∀	∀	∀	∀
* Felt hopelessness when you think of the future ……..…	∀	∀	∀	∀
* Felt dejected or sad ……	∀	∀	∀	∀
* Worried too much about various things ……	∀	∀	∀	∀

77. How do you see yourself? Put an X in a box for each sentence below indicating whether you agree or disagree in how it relates to you. (Put an X for each line)

	Strongly Agree	Agree	Disagree	Strongly disagree
* I take a positive attitude toward myself…….……	∀	∀	∀	∀
* I certainly feel useless at times……..…	∀	∀	∀	∀
* I feel I do not have much to be proud of.……..	∀	∀	∀	∀
* I feel that I am a person of worth, at least on an equal plane with others…..……	∀	∀	∀	∀

78. How often do you experience the reactions that are described below?

(Put an X for each line)	Never	Seldom	Some-times	Often	Always
* I feel anxious and don't know what to do in an embarrassing situation ……	∀	∀	∀	∀	∀
* I feel anxious when I am with others and have to do something while they watch me do it *(ex: be in a play, play music, sports)* ……..	∀	∀	∀	∀	∀
* I feel anxious when I have to speak or read aloud in front of a group of people ……	∀	∀	∀	∀	∀
* Before I go someplace where I'm going to be with people (*ex: a party, school, football game*) I sweat, my heart beats fast and/or I get a headache or stomach ache ……	∀	∀	∀	∀	∀
* Before I go to a party or someplace with other people I think about what could go wrong *(ex: that I make mistakes, seem dumb and/or…what if they see how frightened I am!)* …….	∀	∀	∀	∀	∀
* I feel anxious and don't know what to do when I'm in a new situation ……	∀	∀	∀	∀	∀

79. How have you thought and felt about yourself and about your family in <u>the past month</u>?
(Put an X for each line)

	Totally agree	Agree	Average	Disagree	Totally disagree
* I easily make others feel comfortable around me ……..	∀	∀	∀	∀	∀
* In my family we share views of what is important in life....	∀	∀	∀	∀	∀
* I easily find new friends …….	∀	∀	∀	∀	∀
* I feel comfortable with my family ……..	∀	∀	∀	∀	∀
* I am good at talking to new people ……..……..	∀	∀	∀	∀	∀
* My family view the future as positive, even when very sad things happen……..	∀	∀	∀	∀	∀
* I always find something fun to talk about……..	∀	∀	∀	∀	∀
* In my family we support each other… ……..	∀	∀	∀	∀	∀

81. Have you during <u>the past month</u>:

(Put an X for each line)	Almost every night	Often	Some-times	Never
* Had difficulty falling asleep in the evening	∀	∀	∀	∀
* Woke too early and couldn't fall asleep again	∀	∀	∀	∀

82. Have any of the following things happened to you? *(Put an X for each line)*

	No	Yes, last year	Yes, in my life
* That someone in your family has been seriously ill……..	∀	∀	∀
* Death of a loved one…….. ……..	∀	∀	∀
* A catastrophe (fire, avalanche, tidal wave, hurricane, etc.)……	∀	∀	∀
* A serious accident (ex: a very serious car accident) ……	∀	∀	∀
* Been violently hurt (beaten or injured) …….	∀	∀	∀
* Seen others violently hurt ……	∀	∀	∀
* Been put in sexually uncomfortable/abusive situations by someone about your age ……	∀	∀	∀
* Been put in sexually uncomfortable/abusive situations by an adult……	∀	∀	∀
* Been threatened or physically harassed by other students at school for a long time……	∀	∀	∀
* Received painful or frightening treatment at the hospital while being treated for an illness or injury……	∀	∀	∀
* Experienced something else that was very frightening, dangerous or violent……..	∀	∀	∀

IF YOU ANSWERED NO TO ALL THE ABOVE, SKIP TO QUESTION 86

If you have experienced any of the above in question 82:

83. Do you still think very much about what happened? Yes ∀ No ∀

If Yes, **do you have frightening thoughts, see images or hear sounds from the actual experience even when you don't want to?** Yes ∀ No ∀

84. When something reminds you about what happened do you become distant, afraid or sad? Yes ∀ No ∀

85. Do you try to avoid talking about it, thinking about it or feel any feelings about what happened? Yes ∀ No ∀

86. If it was an injury or accident, do you have physical (bodily) late complications/problems from this? Yes ∀ No ∀

LEISURE TIME

87. How many teams or clubs are you part of? (for example: sports team, boy/girl scouts, band, etc.)

None ∀ One ∀ Two or more ∀

88. How often have you done any of these activities in <u>the past week</u>?
(Put an X for each line)

	None	Once	2-3 times	4 times or more
* Visited someone you know……	∀	∀	∀	∀
* Was visited at home……	∀	∀	∀	∀
* Read a book, magazine, comic book……	∀	∀	∀	∀
* Listened to music …… ……	∀	∀	∀	∀
* Played an instrument …… ……	∀	∀	∀	∀
* Was out with friends for more than two hours in a row……	∀	∀	∀	∀
* Was at a meeting or training with a club/team……. ……	∀	∀	∀	∀
* Did a hobby……. ……	∀	∀	∀	∀
* Did homework for more than one hour……..……	∀	∀	∀	∀
* Watched TV/DVD ……..	∀	∀	∀	∀
* Played a computer/TV game……..……..	∀	∀	∀	∀
* Played, chatted or surfed the internet ……..…….	∀	∀	∀	∀
* Was at the library……..…….	∀	∀	∀	∀
* Went to the movies…….…….	∀	∀	∀	∀
* Was at a cafe or a meeting place for people your age…….....	∀	∀	∀	∀
* Was in a play, theatre……..…….	∀	∀	∀	∀
* Did photography/film..……..…….	∀	∀	∀	∀
* Went to a concert..……..……	∀	∀	∀	∀
* Went to watch a sport event, game..……..……	∀	∀	∀	∀
* Sang in a chore …… …….....	∀	∀	∀	∀

89. **If you normally do some of the below listed activities, how long do you usually do so each time?** (Put an X for each line)

	Less than ½ hour	½ -1 hour	More than 1 hour
* Watch TV/DVD …….……..	∀	∀	∀
* Play computer/TV games…….……...∀		∀	∀
* Play, chat or surf the internet ……..…….∀		∀	∀
* Listen to music.……...…	∀	∀	∀

90. Do you have a mobile phone? Yes ∀ No ∀

If Yes:

* How long do you usually talk on your mobile phone a day? _____Number of minutes

* How many text/picture messages do you usually get a day? _____ Number of messages

* How many text/picture messages do you send a day? _____Number of messages

FAMILY AND FRIENDS

91. About how many close friends do you have? (Include those you can speak confidentially with and who help you when you need help. Do not include people you live with, but other relatives should be included.) (One X)

None ∀ One ∀ Two or more ∀

92. Do you have a steady boyfriend/girlfriend? Yes ∀ No, not now, but before ∀ No ∀

93. Are your parents separated or divorced, or have they lived separately for more than one year? *(X the appropriate box and write in your age where necessary)*

∀ No

∀ Yes, they lived separately or were separated when I was _____ years old, but they later moved back together again.

∀ Yes, they were divorced or separated when I was ____ years old.

94. How well off do you think your family is compared to most others? (One X)

About the same as most others ∀ Better financial situation ∀ Worse financial situation ∀

95. Has there been or is there much arguing in your family? (One X)

No ∀ Yes, the past 12 months ∀ Yes, previously ∀

96. **How good is the relationship you have with your immediate family?** (Put an X for each line of the family members you have. If you have more than one sibling, think about the sibling you have the best relationship to.)

	Very good	Good	Not so good	Bad	*
Mother ……	∀	∀	∀	∀	
* Father ……	∀	∀	∀	∀	
* Sibling ……	∀	∀	∀	∀	
* Stepmother or stepfather……	∀	∀	∀	∀	

97. **Do you often feel lonely?** (One X)

* Very often …… ∀
* Often ……..∀
* Sometimes ……∀
* Seldom ……..∀
* Very seldom or never…….. ∀

SCHOOL

98. Do any of the following things happen to you at school, or have any of them happened? (Put an X for each line)

	Never	Some-times	Often	Very often
* Have difficulties concentrating during class	∀	∀	∀	∀
* Think that gym or art is fun	∀	∀	∀	∀
* Think other classes are fun	∀	∀	∀	∀
* Argue with the teacher	∀	∀	∀	∀
* Look forward to going to school	∀	∀	∀	∀
* Skip school	∀	∀	∀	∀
* Understand what is being taught	∀	∀	∀	∀
* Have fun during recess/break time	∀	∀	∀	∀
* Are satisfied with your test results	∀	∀	∀	∀
* Have fistfights	∀	∀	∀	∀
* Are reprimanded by the teacher	∀	∀	∀	∀
* Cannot manage to be calm/sit still during class	∀	∀	∀	∀
* Become bored or dissatisfied	∀	∀	∀	∀
* Receive help for reading or writing problems	∀	∀	∀	∀
* Are called a negative name by students for a long time	∀	∀	∀	∀
*Are snubbed/excluded by the students for a long time	∀	∀	∀	∀

HEALTH SERVICES

99. During <u>the last 12 months</u> have you been to: (Put an X for each line)

	Yes	No
* General practitioner (family doctor, doctor outside the hospital).....	∀	∀
* Doctor at the hospital ……	∀	∀
* Child health care clinic run by nurses……..	∀	∀
* School health services ……	∀	∀
* Psychologist ……	∀	∀
* Physiotherapist ……	∀	∀
* Chiropractor ……	∀	∀
* Other practitioner (naturopath, reflexologist, laying on of hands, healer, psychic, etc.).....	∀	∀

100. Have you been admitted to the hospital <u>during the past 12 months</u>?

Yes ∀ No ∀

101. How often have you been absent from school due to illness <u>during the last 12 months</u>?

Less than 1 week ∀ 1-2 weeks ∀ More than 2 weeks ∀

PHYSICAL DEVELOPMENT

Below are some questions about physical changes that occur through adolescence.

102. During the teenage years there are periods where one grows quickly (growing spurt). Have you noticed that your body has grown quickly (become taller)? (One X)

* No, I have not begun to grow …… ∀
* Yes, I have barely begun a growing spurt …… ∀
* Yes, I've clearly begun a growing spurt …… ∀
* Yes, it seems that I'm finished with growing spurts …… ∀

103. Concerning hair on your body (under your arms and your crotch/groin)? Would you say that the hair on your body has: (One X)

* Not begun to grow yet …… ∀
* Barely begun to grow …… ∀
* Quite clearly begun to grow …… ∀
* It seems that my body hair has grown in …… ∀

104. When you look at yourself, do you think that you are physically maturing/have physically matured earlier or later than others your own age? (One X)

* Much earlier …… ∀
* Earlier ……. …… ∀
* A little bit earlier…….. ∀
* The same as others …… ∀
* A little bit later …… ∀
* Later ……..…….... ∀
* Much later ……..…….. ∀

QUESTIONS FOR BOYS

105. Has your voice begun to change? (One X)

* No, hasn't begun yet …… ∀
* Yes, has just barely begun …… ∀
* Yes, has clearly begun …….. ∀
* It seems my voice has finished changing …….. ∀

106. Has facial hair begun to grow (moustache or beard)? (One X)

* No, hasn't begun yet …… ∀
* Yes, has just barely begun …… ∀
* Yes, has clearly begun …… ∀
* Yes, I have quite a lot of facial hair …… ∀

QUESTIONS FOR GIRLS

107. Have you begun to develop breasts? (One X)

* No, haven't begun yet ……. ∀ * Yes, have quite clearly begun …….. ∀
* Yes, have barely begun ……. ∀ * It seems my breasts are fully developed ….…. ∀

108. Have you begun menstruating (gotten your period)? Yes ∀ No ∀

IF YOU ANSWERED "NO", GO TO PAGE 22

109. How old were you when you first began menstruating?

I was _____years old and _____months.

110. How many times have you menstruated in the last 12 months? _____ times

111. How long is it usually between your menstruation periods? (From the first day of a period to the first day of the next period)

Less than 3 weeks ∀ 3-4 weeks ∀ More than 4 weeks ∀

112. Have you ever missed (not gotten) your period for several months after a regular period? (without being pregnant)? (One X)

*Yes, 2-5 mos. ……..∀ * Yes, more than 1 year ……. ∀
*Yes, 6-12 mos. ……∀ * No, never …….. ∀

113. Have you ever taken birth control pills or the mini-pill?

Yes, I take them now ∀ Yes, I took them before ∀ No ∀

If Yes:

How old were you when you first began taking birth control pills/mini-pills? _____ years old

How long in total have you taken birth control pills/mini-pills? _____ years old

FOR STUDENTS IN HIGH SCHOOL

These questions are only to be answered by High School students.

114. During the last year, have you often felt that you pressured yourself or continuously pushed yourself?

Yes ∀ No ∀ Don't know ∀

115. Do you feel that you are constantly short of time, even in your everyday tasks?

* Always, or almost always …… ∀
* Sometimes …… ∀
* Never…… ∀

116. Have you ever had thoughts about taking your own life? Yes ☐ No ☐

117. Have you ever used anabolic steroids or other performance enhancing drugs?

Yes ☐ No ☐

118. Have you ever had sexual intercourse? Yes ∀ No ∀

If Yes, **How old were you the first time?** _____ years old

119. For GIRLS: Have you ever become pregnant when you did not want to be?

Yes ∀ No ∀

120. For BOYS: Have you ever gotten a girl pregnant without intending to?

Yes ∀ No ∀ Don't know ∀

For BOTH boys and girls:
If Yes,

How old were you when this happened? ____ years old

Was the result an abortion? Yes ∀ No ∀ Don't know ∀

COMMENTS

If you have time, you could write here about what you think is important, but was not asked about in this questionnaire. What are your thoughts about being young these days? What do feel can be improved upon concerning health and wellbeing for youth of today?

Thank you for your contribution ☺

Sincerely,

Turid Lingaas Holmen, førsteamanuensis/barnelege
Ung-HUNT leder

HUNT forskningssenter, Neptunveien 1, 7650 Verdal
Telefon: 74075180

Appendix 4

Information and declaration of consent from paper 1

FORESPØRSEL OM Å DELTA I EN VITENSKAPELIG UNDERSØKELSE OM FYSISK AKTIVITET (VUFA)

Du er en av 300 ungdommer, 13-19 år fra Levanger og Verdal som herved inviteres til en undersøkelse om fysisk aktivitet (VUFA). Undersøkelsen gjøres i samarbeid mellom Høgskolen i Nord-Trøndelag (HiNT) og HUNT forskningssenter (Helseundersøkelsen i Nord-Trøndelag, NTNU).

Hvorfor ber vi deg om å delta?

Denne undersøkelsen er et ledd i et omfattende arbeid for å bedre helsetilbudet til ungdom. Vi vet at fysisk aktivitet er viktig for god helse, uansett hvor gammel du er, men vi vet lite om hvordan aktivitetsnivået er i dag og hvordan det har utviklet seg over tid. I de fleste forskningsprosjekter blir fysisk aktivitet målt ved at deltagerne selv sier hvor aktive de er, for eksempel hvor mange ganger i uka de trener. Men vi vet ikke om det de svarer på spørreskjema, faktisk stemmer med virkeligheten. Det ønsker vi å kontrollere, og da er vi avhengig av at du som ungdom deltar i en enkel test. Målet for denne undersøkelsen er:

- å finne hvor stort samsvar det er mellom fysisk aktivitet målt ved hjelp av spørreskjema og den faktiske aktiviteten som gjennomføres. Det er viktig å finne denne sammenhengen med tanke på undersøkelser der en bruker spørreskjema til å måle den fysiske aktiviteten hos ungdom. Helseundersøkelsen i Nord-Trøndelag (HUNT) er et eksempel der slike spørreskjema brukes.
- å finne ut hvilke spørsmål som fungerer best

Hvordan skal undersøkelsen gjennomføres?

Undersøkelsen foregår på skolen, i skoletiden. Du vil bli bedt om å fylle ut spørreskjema om fysisk aktivitet og du får tilbud om:

- å måle maksimalt O_2-opptak på tredemølle, dvs. en kondisjonstest.
- å måle hvor mye du beveger deg i løpet av en uke ved bruk av nyutviklet teknologi, dvs. en måler kalt ActiReg. Måleren er en liten boks på størrelse med to fyrstikkesker som du har rundt livet i et elastisk belte.

- å føre en dagbok (logg), der du registrerer aktiviteten din i løpet av en uke.

Du bør beregne at utfylling av spørreskjema og måling av O_2-opptak, tar ca. 45 minutter. Informasjon om bruk av aktivitetsmåleren (ActiReg) blir gitt samtidig.

Alle svarene og registreringer er underlagt taushetsplikt

Svar og andre data som blir registrert i undersøkelsen vil være forbeholdt denne undersøkelsen. Under behandling av data vil alle filer være avidentifisert, og det vil ikke bli offentliggjort opplysninger som kan føres tilbake til deg. Alle data og all informasjon blir behandlet i samsvar med reglene for taushetsplikt i Helsepersonelloven og Forvaltningsloven.
Undersøkelsen er tilrådd av Regional komite for medisinsk forskningsetikk (REK), Helseregion Midt-Norge og meldt til personvernombudet ved Norsk samfunnsvitenskaplig datatjeneste (NSD).

Undersøkelsen er frivillig, men vi håper du ønsker å delta

Hvis du ønsker å være med i undersøkelsen fyller du ut svarslippen på neste side. For ungdom under 16 år trenger vi foresattes tillatelse for å delta i undersøkelsen.

Dersom du har spørsmål knyttet til denne undersøkelsen kan du ta kontakt med:

Vegar Rangul,
Tlf: 74022776 (HiNT direkte), 92687858 (mob.),
e-post: vegar.rangul@hint.no

Prosjektleder, Dr.gradsstipendiat
Vegar Rangul

Klipp her

NTNU
HUNT forskningssenter

HiNT
HØGSKOLEN I NORD-TRØNDELAG

Attachment 2

Samtykkeerklæring

Vi inviterer deg blant 300 andre ungdommer i alderen 13-19 til å delta i vitenskaplig undersøkelse om fysisk aktivitet, VUFA.

Jeg har lest informasjonsskrivet vedrørende undersøkelsen og har hatt anledning til å stille spørsmål. Jeg samtykker i å delta i prosjektet.

Ditt navn:..... Kommune.....

Skole:..... Klasse:.....

☐ JA, jeg vil være med i VUFA

Det er frivillig å delta, og du har full rett til å trekke deg fra undersøkelsen når som helst, og du trenger ikke å oppgi noen grunn for å trekke deg.

....
Sted Dato Underskrift

.....
Foresattes underskrift
(for elever under 16 år)

Klipp her

Vi ber om at denne svarslippen fylles ut og legges i vedlagt konvolutt og leveres klassestyrer

Appendix 5

Information and declaration of consent HUNT

HUNT 3
Declaration of Consent form + 2nd to last page of the brochure

Consent

Participation in HUNT 3 and other public health studies is voluntary. The information from the health study cannot be used for research without the consent of the participants. You will be asked to sign a declaration of consent when you participate. Information and samples that you give will be stored for an indefinite time period. In the future it may be used in studies that as of yet have not been planned provided the studies are in accordance with laws and regulations.

In the future, you will be informed about new research projects that use HUNT data. This information can be found at www.hunt.ntnu.no, and in addition, once a year written information will be sent out to the public. There will also be media coverage about some of the research projects.

You can, at any time after the health study, withdraw your consent and ask that the data about you is deleted or that your blood and urine samples be destroyed. If you wish to withdraw your consent, contact HUNT Research Centre, Neptunveien 1, 7650 Verdal, Telephone 74 07 51 80, Fax 74 07 51 81 or their e-mail: hunt@medisin.ntnu.no. We will respect your wishes to not use your information in specific research projects if you request this.

New Consent

If in the future we need your information for new types of research questions not described in this brochure, it may be necessary to ask for a new declaration of consent. If this is the case, we will send you a letter. You may also be asked for a new consent in the eventuality of a collaboration with a private company in genetic research. The research of this type of collaboration must also adhere to public laws and regulations. Under no circumstances will blood or other biological material be sold.

Personal Information Protection and Security

All information that you give to HUNT 3 will be handled with respect to personal information protection and your private life and in accordance with the laws and regulations. As soon as information, blood samples and/or urine samples are collected, they are stored without being labelled using the identity of the donor. Researchers who later use the information do not have access to names, birthdates or personal identification numbers. All employees associated with the health study have an obligation of confidentiality.

The Data Inspectorate supervises to ensure that the laws and regulations concerning the storage and use of health care information are followed. HUNT 3 is licensed by the The Data Inspectorate.

Ethical Approval

All research projects must be approved by an ethical committee. The committee is an independent agency that evaluates the ethical aspect of research projects. HUNT 3 has been approved by The Regional Committee for Medical Research Ethics, Mid-Norway. All future research projects that use data from HUNT must gain approval from the committee.

HUNT Databank

HUNT databank contains information collected during HUNT 1, 2 and 3 by means of questionnaires, examinations and analyses of blood and urine samples. If you participated in HUNT 1 and 2, your information will be compared to information in HUNT 3. Genetic material is stored at the HUNT biobank. The goal of the biobank is that in the future it will be possible to take out samples, perform various analyses and compare it to the results of other data from the HUNT databank. In this way there will be continuously more data to be put into the databank.

When researchers receive data from the HUNT databank there are no names, birthdates or other identifiable characteristics with the data, so they do not know who gave the information.

Comparing Information from other Registers

For certain research projects it may be necessary to compare data from HUNT with other public records, for example The Norwegian Prescription Database, The Birth Register, The Cancer Register and The Cause of Death Register. HUNT data may also be compared to other registers/databases at Statistics Norway (SSB), for example concerning the environment, population, education, income, public contribution, employment and other situations that may have an effect on health.

In addition, it may also be relevant to obtain diagnosis information, for example hip fracture, heart attack, stroke or lung illnesses from primary health care, the hopitals in Nord-Trøndelag or St. Olavs hospital. Some projects may compare information of parents, children, siblings and grandparents if they have participated in HUNT.

All these comparisons require consent and/or approval from the applicable agencies, for example The Regional Committee for Medical Research Ethics, The Data Inspectorate, The Public Health Department or Social Security. All information will be handled with respect to personal information protection and your private life and in accordance with the laws and regulations. No researchers will know who gave the information.

Compensation

There is very little risk that participation will lead to injury. If this should occur, compensation can be applied for through The Norwegian System of Compensation to Patients (NPE). NPE facilitates compensation applications for patients who have been injured in the public health care service system.

Young HUNT

All adolescents in the age group 13 to 19 years old in Nord-Trøndelag are invited to participate in Young HUNT. The project will take place at their schools, with the filling out of the questionnaire and clinical examinations occurring during school hours. Adolescents and their parents will receive information about Young HUNT through the school.

Declaration of consent for use of health information in research
The Nord-Trøndelag Health Study 2006-2008 (HUNT3)

In the brochure I received I have read about the health study's content and intent, and I have been given the opportunity to ask questions.

I consent to participating in the study.

Place, date time

_____ _____
Name Date of Birth

ung-hunt
Helseundersøkelsen i Nord-Trøndelag

FOLKEHELSA
Samfunnsmedisinsk forskningssenter, Verdal

Til ungdom og foresatte

I alle kommunene i Nord-Trøndelag pågår det i perioden 1995-1997 en stor helseundersøkelse, HUNT, hvor alle innbyggerne over 13 år blir invitert til å delta. Ungdommer mellom 13 og 19 år blir invitert til å delta i *ungdomsdelen* av HUNT, ***ung-hunt***.

Hvorfor bør ungdommene være med i helseundersøkelsen?

Ungdomsgruppen faller ofte mellom barn og voksne, og mange kommuner i Norge har ikke godt nok helsetilbud til ungdommene. Mange har ikke skolehelsetjeneste i videregående skole. Når det skapes et miljø omkring forebyggende helsearbeid i fylket er det viktig at også ungdommene tas med i dette. Målet for helseundersøkelsen er:

* å finne ut hvordan helsa til ungdommene er
* å finne ut hva som er årsakene til sykdom, og hva som gir god helse
* å bedre helsetjenesten og det forebyggende helsearbeid for ungdom

For å kunne forebygge sykdom og gi et bedre helsetilbud til alle er det også viktig å finne ut hvordan ungdommene selv mener de har det.

Hvordan skal helseundersøkelsen gjennomføres?

Helseundersøkelsen foregår på skolen i skoletiden og inneholder følgende:

* Ungdommene blir tilbudt en *klinisk undersøkelse*.
Det blir målt blodtrykk, høyde og vekt, og gjort en lungefunksjonsundersøkelse (pusteprøve). Det blir ikke tatt blodprøver av ungdommene og ingen av undersøkelsene er smertefulle. Alle får skriftlig svar på undersøkelsene og beskjed om hva man bør gjøre dersom prøvene ikke er tilfredsstillende. Dersom man ønsker det vil også lege få prøvesvarene. Elevene tas ut av klassen som ved en skolehelseundersøkelse. Undersøkelsen utføres av en prosjektsykepleier og en assistent.

* Ungdommene blir bedt om å fylle ut et *spørreskjema*.
Dette gjøres i en skoletime. Spørreskjema vil inneholde spørsmål om sykdom og helse, kosthold, idrett, rus og hvordan de selv synes de har det. Spørreskjema inneholder ikke navn, men personnummer i *strekkode* som bare kan leses av en datamaskin. Det legges i en konvolutt som klistres igjen av eleven selv før det samles inn.

I tilslutning til undersøkelsen vil det bli tilbudt kurs til lærere og til skolehelsetjenesten om emner som omhandles i spørreskjema. I samarbeid med Høgskolen i Nord-Trøndelag (avd. for helsefag og avd. for lærerutdanning) planlegges det et opplegg for helseinformasjon og helsefremmende arbeid i skolen.

Alle opplysninger blir behandlet med taushetsplikt!

I tillegg til at de unge selv får svarene på den kliniske undersøkelsen, vil dataene bli brukt til medisinsk forskning, eventuelt ved å sammenholde opplysningene med opplysninger fra andre helseregistre. Dette vil i tilfelle skje i samråd med Datatilsynet og Regional komite for medisinsk forskningsetikk, helseregion IV. Forskerne vil få datafiler som er anonymiserte, og det vil ikke bli offentliggjort opplysninger som kan føres tilbake til en bestemt elev. Ingen på skolen har anledning til å se svarene på spørreskjemaene.

Det er mulighet for at noen unge vil få tilbud om videre undersøkelser på et senere tidspunkt. Dette vil være unge med sykdom og plager, men også noen friske. Det er mulig til en hver tid å trekke seg fra undersøkelsen og også be om at data blir slettet.

Regional komite for medisinsk forskningsetikk, helseregion IV, tilrår undersøkelsen og Datatilsynet har også godkjent undersøkelsen.

Undersøkelsen er selvfølgelig frivillig, men vi håper at alle ønsker å delta.
De som ikke ønsker å delta i undersøkelsen vil få vanlig skolearbeid mens denne pågår.

På skolen blir alle unge på nytt informert om undersøkelsen og bedt om å undertegne et skriftlig samtykke samtidig som spørreskjemaet utfylles. For ungdom i alderen 13-16 år ønsker vi også foresattes tillatelse til at de unge skal delta i undersøkelsen.

Ved spørsmål, ta gjerne kontakt med Folkehelsa, Verdal!

Vennlig hilsen

Turid Lingaas Holmen

Turid Lingaas Holmen
barnelege, prosjektleder
Folkehelsa, Verdal **tlf. 74 07 71 44**

Kjell Terje Gundersen

Kjell Terje Gundersen
høgskoledosent, prosjektansvarlig
ved Høgskolen i Nord-Trøndelag (HiNT)

Bak undersøkelsen står: Statens Institutt for Folkehelse (Folkehelsa), Universitetet i Trondheim, Norges forskningsråd, Statens helseundersøkelser (SHUS), Fylkeslegen, Fylkesskolesjefen, Statens Utdanningskontor, Norske Kvinners Sanitetsforening (Nord-Trøndelag krets) og Høgskolen i Nord-Trøndelag(HiNT). Undersøkelsen ledes av Samfunnsmedisinsk forskningssenter (Folkehelsa), Verdal.

ung-hunt
Helseundersøkelsen i Nord-Trøndelag

FOLKEHELSA
Samfunnsmedisinsk forskningssenter, Verdal

VI BER OM AT SVARSLIPPEN NEDENFOR FYLLES UT AV FORESATTE OG LEVERES TIL SKOLEN

Barnets navn.....Kommune.....

Skole.....Klasse.....

☐ Ja, jeg gir tillatelse til at mitt barn kan delta i ***ung-hunt,*** ungdomsdelen av Helseundersøkelsen i Nord-Trøndelag.

☐ Nei, jeg gir ikke tillatelse til at mitt barn kan delta i ***ung-hunt***.

☐ Hvis prøvesvarene ikke er tilfredstillende ønsker jeg at de skal sendes til lege.

Navnet på legen:.....

Hvis den unge ikke har noen fast lege sendes svaret til kommunelege 1

☐ Jeg ønsker ikke at prøvesvarene skal sendes til lege

....
Dato Foresattes underskrift

ung-hunt
Helseundersøkelsen i Nord-Trøndelag

FOLKEHELSA
Samfunnsmedisinsk forskningssenter, Verdal

Til ungdom og foresatte

I alle kommunene i Nord-Trøndelag pågår det i perioden 1995-1997 en stor helseundersøkelse, HUNT, hvor alle innbyggerne over 13 år blir invitert til å delta. Ungdommer mellom 13 og 19 år blir invitert til å delta i *ungdomsdelen* av HUNT, ***ung-hunt***.

Hvorfor bør ungdommene være med i helseundersøkelsen?

Ungdomsgruppen faller ofte mellom barn og voksne, og mange kommuner i Norge har ikke godt nok helsetilbud til ungdommene. Mange har ikke skolehelsetjeneste i videregående skole. Når det skapes et miljø omkring forebyggende helsearbeid i fylket er det viktig at også ungdommene tas med i dette. Målet for helseundersøkelsen er:

* å finne ut hvordan helsa til ungdommene er
* å finne ut hva som er årsakene til sykdom, og hva som gir god helse
* å bedre helsetjenesten og det forebyggende helsearbeid for ungdom

For å kunne forebygge sykdom og gi et bedre helsetilbud til alle er det også viktig å finne ut hvordan ungdommene selv mener de har det.

Hvordan skal helseundersøkelsen gjennomføres?

Helseundersøkelsen foregår på skolen i skoletiden og inneholder følgende:

* Ungdommene blir tilbudt en *klinisk undersøkelse*.

Det blir målt blodtrykk, høyde og vekt, og gjort en lungefunksjonsundersøkelse (pusteprøve). Det blir ikke tatt blodprøver av ungdommene og ingen av undersøkelsene er smertefulle. Alle får skriftlig svar på undersøkelsene og beskjed om hva man bør gjøre dersom prøvene ikke er tilfredsstillende. Dersom man ønsker det vil også lege få prøvesvarene. Elevene tas ut av klassen som ved en skolehelseundersøkelse. Undersøkelsen utføres av en prosjektsykepleier og en assistent.

* Ungdommene blir bedt om å fylle ut et *spørreskjema*.

Dette gjøres i en skoletime. Spørreskjema vil inneholde spørsmål om sykdom og helse, kosthold, idrett, rus og hvordan de selv synes de har det. Spørreskjema inneholder ikke navn, men personnummer i *strekkode* som bare kan leses av en datamaskin. Det legges i en konvolutt som klistres igjen av eleven selv før det samles inn.

I tilslutning til undersøkelsen vil det bli tilbudt kurs til lærere og til skolehelsetjenesten om emner som omhandles i spørreskjema. I samarbeid med Høgskolen i Nord-Trøndelag (avd. for helsefag og avd. for lærerutdanning) planlegges det et opplegg for helseinformasjon og helsefremmende arbeid i skolen.

Alle opplysninger blir behandlet med taushetsplikt!

I tillegg til at de unge selv får svarene på den kliniske undersøkelsen, vil dataene bli brukt til medisinsk forskning, eventuelt ved å sammenholde opplysningene med opplysninger fra andre helseregistre. Dette vil i tilfelle skje i samråd med Datatilsynet og Regional komite for medisinsk forskningsetikk, helseregion IV. Forskerne vil få datafiler som er anonymiserte, og det vil ikke bli offentliggjort opplysninger som kan føres tilbake til en bestemt elev. Ingen på skolen har anledning til å se svarene på spørreskjemaene.

Det er mulighet for at noen unge vil få tilbud om videre undersøkelser på et senere tidspunkt. Dette vil være unge med sykdom og plager, men også noen friske. Det er mulig til en hver tid å trekke seg fra undersøkelsen og også be om at data blir slettet.

Regional komite for medisinsk forskningsetikk, helseregion IV, tilrår undersøkelsen og Datatilsynet har også godkjent undersøkelsen.

Undersøkelsen er selvfølgelig frivillig, men vi håper at alle ønsker å delta.
De som ikke ønsker å delta i undersøkelsen vil få vanlig skolearbeid mens denne pågår.

På skolen blir alle unge på nytt informert om undersøkelsen og bedt om å undertegne et skriftlig samtykke samtidig som spørreskjemaet utfylles. For ungdom i alderen 13-16 år ønsker vi også foresattes tillatelse til at de unge skal delta i undersøkelsen.

Ved spørsmål, ta gjerne kontakt med Folkehelsa, Verdal!

Vennlig hilsen

Turid Lingaas Holmen

Kjell Terje Gundersen

Turid Lingaas Holmen
barnelege, prosjektleder
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FOLKEHELSA
Statens Institutt for Folkehelse
Samfunnsmedisinsk
forskningssenter, Verdal

ung-hunt
Helseundersøkelsen i Nord-Trøndelag

Hei!

Sammen med alle ungdommene i alderen 13- 19 år i hele Nord-Trøndelag (ca. 13 000) blir du nå invitert til å være med i ungdomsdelen av helseundersøkelsen i Nord-Trøndelag, HUNT.

Hensikten med undersøkelsen er å få vite mer om hvordan helsa er hos dere som er unge og hvordan dere selv synes dere har det. Dette er viktig for å kunne forebygge sykdom og gi et bedre helsetilbud til alle unge.

Du blir nå bedt om å fylle ut dette spørreskjemaet i denne skoletimen. Siden vil du bli undersøkt som ved en vanlig skolehelsetjeneste. En sykepleier og en assistent undersøker blodtrykk, spirometri (pusteprøve), høyde og vekt. Ingen av undersøkelsene er smertefulle. Du får svar på hvordan prøvene dine er. Hvis du ønsker at en lege også skal få svar på prøvene så kryss av på svarlappen nedenfor.

Alle svarene dine blir behandlet med taushetsplikt!

I tillegg til de svarene du selv får på undersøkelsen, vil dataene bli brukt til medisinsk forskning, eventuelt ved å sammenholde opplysningene med opplysninger fra andre helseregistre. Dette vil i tilfelle skje i samråd med Datatilsynet og Regional komite for medisinsk forskningsetikk, helseregion IV. Forskerne vil få datafiler som er anonymiserte (uten navn og personnummer). Det vil ikke bli offentliggjort opplysninger om akkurat hva du har svart. Ingen på skolen får se svarene på spørreskjemaet ditt.

Du kan få tilbud om videre undersøkelser på et senere tidspunkt. Dette vil være hvis du har en sykdom eller plager, men også noen friske får et slikt tilbud. Du kan trekke deg fra undersøkelsen når som helst og også be om at dine data blir slettet.

Regional komite for medisinsk forskningsetikk, helseregion IV, tilrår undersøkelsen og Datatilsynet har også godkjent undersøkelsen.

Undersøkelsen er selvsagt frivillig, men vi håper at også du vil være med!
Hvis du ikke vil være med får du skolearbeid av læreren din som du kan gjøre isteden.

Hvis du vil være med i undersøkelsen skriver du navnet ditt på svarslippen. Kontroller at det er ditt navn som står der fra før. Navnet ditt skal ikke stå på spørreskjemaet. Lappene blir samlet inn, og skal ikke legges sammen med spørreskjemaet.

SVAR----------

☐ **JA**, jeg vil være med i ***ung-hunt*** ☐ **NEI**, jeg vil ikke være med

☐ Prøvesvar kan sendes lege.....
legens navn

....
Dato Underskrift

Ung-hunt 2000
Helseundersøkelsen i Nord-Trøndelag

FOLKEHELSA
Statens Institutt for Folkehelse
Samfunnsmedisinsk
forskningssenter,
Verdal

Til ungdom og foresatte!

I 1995-97 ble alle ungdommer i fylket i alderen 13-19 år invitert til å delta i **UNG-HUNT**, ungdomsdelen av Helseundersøkelsen i Nord-Trøndelag, der 9130 ungdommer (91%) av de som var i ungdoms-eller videregående skole deltok. Vi ønsker nå å invitere alle som gikk i ungdomsskolen og som nå går i videregående til en ny oppfølgingsundersøkelse.

Hvorfor skal det gjøres en ny helseundersøkelse?

Ungdommer faller ofte mellom barn og voksne, ikke minst når det gjelder helse og helsetjenester. Takket være de dataene vi fikk gjennom 95-97, vil vi få en god del kunnskap om dette og mange forskere er for tiden opptatt med å studere de ulike problemstillinger/tema som inngikk i undersøkelsen.

Ungdom har sin egen livsstil og er i hurtig vekst og utvikling på helt andre måter enn voksne. Sannsynligvis medfører dette også raske endringer i helsetilstand og hvordan en tar vare på egen helse. For å kunne si noe mer om utvikling og årsaker til helse og sykdom, må det gjøres undersøkelser der ungdommer følges over tid. Målet for den nye UNG-HUNT 2000 undersøkelsen er derfor:

* å finne ut hvordan sykdom og plager utvikler seg i ungdomsårene
* å finne ut hva som er årsakene til sykdom, og hva som gir god helse
* å bedre helsetjenesten og det forebyggende helsearbeid for ungdom

For å kunne forebygge sykdom og gi et bedre helsetilbud til alle, er det også viktig å finne ut hvordan ungdommene selv mener de har det.

Hvordan skal helseundersøkelsen gjennomføres?

Helseundersøkelsen foregår på skolen i skoletiden og er den samme som i **UNG-HUNT 95-97**:

- Ungdommene blir tilbudt en *klinisk undersøkelse.*

Det blir målt høyde og vekt, og gjort en lungefunksjonsundersøkelse (pusteprøve). Det blir ikke tatt blodprøver og ingen av undersøkelsene er smertefulle. Alle får svar på undersøkelsen og beskjed om hva man bør gjøre dersom prøvene ikke er tilfredsstillende. Elevene tas ut av klassen som ved en skolehelseundersøkelse. Undersøkelsen utføres av en prosjektsykepleier.

- Ungdommene blir bedt om å fylle ut et *spørreskjema.*

Dette gjøres i en skoletime. Spørreskjemaet inneholder spørsmål om sykdom og helse, kosthold, idrett, rus og hvordan de selv synes de har det. Spørreskjema inneholder ikke navn, men personnummer i *strekkode* som bare kan leses av en datamaskin. Det legges i en konvolutt som klistres igjen av eleven selv før det samles inn.

Alle opplysninger er underlagt taushetsplikt!

I tillegg til at elevene selv får svar på de kliniske undersøkelsene, vil dataene bli sammenholdt med data fra 95-97 og brukt til medisinsk forskning. Dataene kan også bli sammenholdt med opplysninger fra andre helseregistre. Dette vil i tilfelle skje i samråd med Datatilsynet og Regional komite for medisinsk forskningsetikk, helseregion IV. Forskerne vil få datafiler som er anonymiserte, og det vil ikke bli offentliggjort opplysninger som kan føres tilbake til en bestemt elev. Ingen på skolen har anledning til å se svarene på spørreskjemaene.

De unge kan få tilbud om å være med på flere undersøkelser på et seinere tidspunkt, men det vil selvsagt være frivillig. Det er mulig å trekke seg fra undersøkelsen til en hver tid og be om at data blir slettet.

Regional komite for medisinsk forskningsetikk, helseregion IV, tilrår undersøkelsen og Datatilsynet har godkjent undersøkelsen. Skolemyndighetene i fylket har anbefalt skolene å delta.

Undersøkelsen er selvfølgelig frivillig, men vi håper at alle ønsker å delta.

Ettersom undersøkelsen gjennomføres i samarbeid med skolen og inngår i skoletida, vil de som ikke ønsker å delta i **UNG-HUNT 2000**, utføre vanlig skolearbeid i den timen spørreundersøkelsen pågår.

På skolen blir alle unge på nytt informert om undersøkelsen og bedt om å undertegne et skriftlig samtykke samtidig som spørreskjemaet utfylles.

Ved spørsmål, ta gjerne kontakt med Folkehelsa i Verdal!

Vennlig hilsen

Turid Lingaas Holmen

Turid Lingaas Holmen
barnelege, prosjektleder
Folkehelsa, Verdal **tlf. 74 07 51 80**

Kjell Terje Gundersen

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høgskoledosent, prosjektansvarlig
ved Høgskolen i Nord-Trøndelag (HiNT)

Bak undersøkelsen står: Statens Institutt for Folkehelse (Folkehelsa), Nord-Trøndelag Fylkeskommune, Universitetet i Trondheim, Fylkeslegen, Fylkesutdanningssjefen, og Høgskolen i Nord-Trøndelag(HiNT). Undersøkelsen ledes av Samfunnsmedisinsk forskningssenter (Folkehelsa), Verdal.

Ung-hunt 2000
Helseundersøkelsen i Nord-Trøndelag

FOLKEHELSA
Statens Institutt for Folkehelse
Samfunnsmedisinsk forskningssenter, Verdal

SAMTYKKE-ERKLÆRING

Vi inviterer deg og alle andre ungdommer i alderen 16-19 år til en ny helseundersøkelse. UNG-HUNT 2000 er en oppfølgingsundersøkelse av UNG-HUNT 95-97, som mange av dere deltok i mens dere gikk i ungdomsskolen.

Hensikten med undersøkelsen er å få vite mer om hvordan sykdom og helse utvikler seg over tid hos dere som er unge, og hvorfor sykdom og helseplager oppstår. Alt dette er viktig for å kunne drive forebyggende arbeid.

Først ber vi deg om å fylle ut spørreskjemaet i løpet av denne skoletimen. Siden vil du bli innkalt til en undersøkelse her på skolen hvor en sykepleier måler lungefunksjon (pusteprøve), høyde og vekt. Ingen av undersøkelsene er smertefulle. Du får svar på prøvene dine.

Alle svarene dine er underlagt taushetsplikt!

I tillegg til at du får svar på undersøkelsen, vil dataene bli sammenholdt med data fra 95-97 og brukt til medisinsk forskning. Dataene kan også bli sammenholdt med opplysninger fra andre helseregistre. Dette vil i tilfelle skje i samråd med Datatilsynet og Regional komite for medisinsk forskningsetikk, helseregion Midt-Norge. Forskerne vil få datafiler som er anonymiserte, og det vil ikke bli offentliggjort opplysninger som kan føres tilbake til deg. Ingen på skolen har anledning til å se svarene på spørreskjemaene.

Du kan få tilbud om å være med på flere undersøkelser på et seinere tidspunkt, men det vil selvsagt være frivillig. Du kan velge å trekke deg fra undersøkelsen når som helst, og be om at dine data blir slettet.

UNG-HUNT 2000 er godkjent av Datatilsynet og tilrådd av Regional komite for medisinsk forskningsetikk, helseregion Midt-Norge .

Undersøkelsen er selvsagt frivillig, men vi håper at du vil være med!

Hvis du ønsker å være med, skriver du navnet ditt nedenfor. Kontroller at det er ditt navn som står der fra før. Navnet ditt skal ikke stå på spørreskjemaet.
Samtykke-erklæringen blir samlet inn og skal ikke legges sammen med spørreskjemaet.

☐ **Ja**, jeg vil være med i ***ung-hunt 2000*** ☐ **Nei**, jeg vil ikke være med

_____ _____

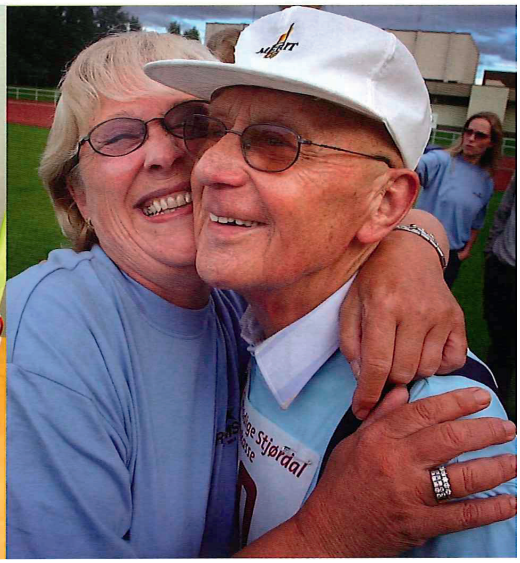
Dato Underskrift

1. Viktig
2. Enkelt
3. Gratis

En time for bedre folkehelse

hunt 3

Helseundersøkelsen i Nord-Trøndelag



Hva er HUNT 3?

HUNT 3 er en folkehelseundersøkelse.
Når du deltar får du en enkel undersøkelse av din egen helse, og du gir et viktig bidrag til forskning.

HUNT 3 gjennomføres først og fremst for å øke vår kunnskap om store folkehelseproblemer som:

- Hjerte- og karsykdommer
- Lungesykdommer, andre luftveisplager og allergi
- Diabetes
- Muskel- og skjelettplager
- Hodepine
- Stoffskiftesykdommer
- Kreftsykdommer
- Psykiske plager
- Rusmiddelbruk
- Tannhelse
- Vektutvikling i befolkningen

Opplysninger, blod- og urinprøver som samles inn vil også bli benyttet til forskning om kvinnesykdommer, sykdommer i fordøyelsesorganer, urinveier, nervesystemet, sanseorganer og hud. Noen prosjekter vil undersøke hvordan livsstil, samfunn, levekår og miljø påvirker helse og trivsel. Det vil også bli forsket på arbeidsuførhet som følge av disse sykdommene eller tilstandene. Sammenhenger mellom arv, miljø og sykdom vil også være aktuelle tema. Til slike prosjekter vil det bli hentet ut DNA (arvestoff) fra blodprøvene.

Forskning

Det er allerede planlagt over 130 studier som skal benytte data fra HUNT 3. En liste over disse finnes på internett: www.hunt.ntnu.no. Hvis du ønsker å få listen tilsendt, kan du henvende deg til HUNT forskningssenter.

Samarbeidsprosjekt

HUNT 3 er et samarbeidsprosjekt mellom

- NTNU (Norges teknisk-naturvitenskapelige universitet)
- Helse Midt-Norge RHF
- Nord-Trøndelag fylkeskommune
- Kommunene i Nord-Trøndelag
- Nasjonalt folkehelseinstitutt
- Helse- og omsorgsdepartementet

HUNT 3 blir også støttet av

- NTE (Nord-Trøndelag Elektrisitetsverk)
- Sparebank 1 Midt-Norge
- Statoil

Noen delprosjekter støttes av næringsliv og ideelle organisasjoner. Bidragsyterne har ingen innflytelse på forskningen.

Vil du delta?

Du er invitert til å gi et viktig bidrag til forskning om hvordan sykdom kan forebygges og behandles.

Alle innbyggere i Nord-Trøndelag som er 13 år eller eldre, blir invitert til å være med i HUNT 3. Det er frivillig å delta. Du gir ditt bidrag ved å fylle ut det vedlagte spørreskjemaet og møte fram til en helseundersøkelse et sentralt sted i din kommune. Noen deltakere vil i ettertid bli invitert til videre undersøkelser. Hvis det gjelder deg, vil du få en ny invitasjon i posten. Du er ikke forpliktet til å delta selv om du er med i den første undersøkelsen.

Du er viktig!

Hver deltaker er like viktig, enten du er gammel eller ung, frisk eller syk. For å få gode forskningsdata er det viktig at alle er med. Hvis du har deltatt i HUNT tidligere, håper vi at du vil møte opp igjen.

Din helse

Etter undersøkelsen får du et brev med resultatene fra noen av dine prøver. Det gjelder blodtrykk, kolesterol, blodsukker og stoffskifte. Du vil bli anbefalt å kontakte din fastlege hvis noen av prøvene er unormale. Hvis du ikke ønsker å vite resultatene, kan du si fra om dette når du signerer samtykket. Hvis et prøveresultat er slik at det er nødvendig med rask legebehandling, vil du uansett bli kontaktet.

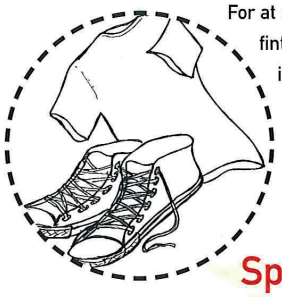
Verdens største

HUNT er verdens største folkehelseundersøkelse. To ganger tidligere har nord-trønderne møtt fram, første gang i 1984. Opplysninger fra HUNT 1 og HUNT 2 er benyttet i mer enn 300 vitenskapelige arbeider, og har gitt oss ny kunnskap om blant annet hjerte- og karsykdommer, lungesykdommer, diabetes, kreft og mental helse. Resultatene er publisert både nasjonalt og internasjonalt. Disse dataene er fortsatt verdifulle, og vil bli brukt i flere arbeider i framtiden. Forskning fører til ny kunnskap om forebygging og behandling av sykdom. Uten en innsats fra hver enkelt, hadde dette ikke vært mulig.

Slik foregår helseundersøkelsen

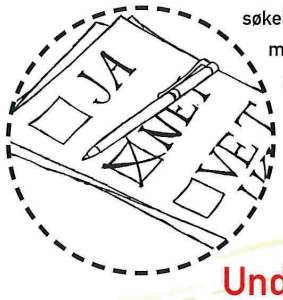
På forsiden av spørreskjemaet som du har fått, står det hvor du skal møte fram. Det er også foreslått et tidspunkt, men hvis dette ikke passer kan du selv velge når du vil møte. Den første delen av undersøkelsen tar omtrent en halv time.

Påkledning



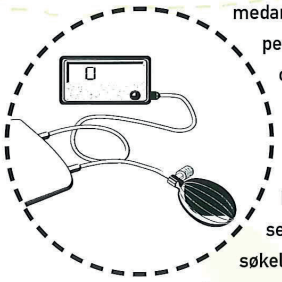
For at det skal gå raskt å måle blodtrykk, er det fint om du har på deg et kortermet plagg innerst. Når du skal veies må du ta av deg skoene, men ellers behøver du ikke å kle av deg.

Spørreskjema



Sammen med denne brosjyren har du fått et spørreskjema som du skal fylle ut og ta med til helseundersøkelsen. Der vil du få ett eller flere nye skjemaer. Disse er ulike for menn og kvinner og ulike aldersgrupper. Du kan fylle ut på stedet eller ta dem med hjem og returnere med post. Porto er betalt.

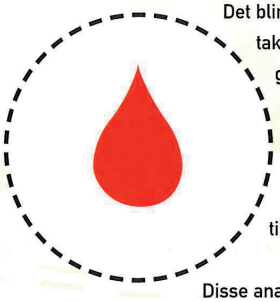
Undersøkelser



Du blir tatt i mot og registrert av HUNT 3-medarbeiderne, som alle er kvalifisert helsepersonell. Det blir målt høyde, vekt og omkrets av liv og hofter. Så gjennomføres et kort intervju og blodtrykket blir målt.

De fleste vil bli spurt om de kan tenke seg å delta i ytterligere én eller to undersøkelser. Hvilke undersøkelser det blir avhenger av kommunen du bor i, kjønn, alder og tilfeldig uttrekning.

Blodprøver



Det blir tatt blodprøve av alle deltakerne. Blodet fordeles på fem glass, men til sammen utgjør det ikke mer enn 40 milliliter, som er mindre enn en tidel av det en blodgiver gir. For de aller fleste vil det være tilstrekkelig med ett stikk.

Disse analysene blir gjort:

- Vanlige blodprøveanalyser som kolesterol, blodsukker og stoffskifteprøver.
- Det blir hentet ut DNA (arvestoff) som brukes i forskningsprosjekter som kartlegger sammenhengen mellom arv og miljø i sykdomsutvikling.
- Studier av hvite blodlegemer som deltar i kroppens forsvarsmekanisme mot sykdommer.
- Miljøanalyser, blant annet sporstoffer og spormetaller som bly og kvikksølv. Forekomsten i blodprøvene kan sammenliknes med mengden metaller som finnes i drikkevann og ellers i miljøet, for å finne ut mer om hvilke effekter det har på mennesker.
- Andre analyser vil også være aktuelle avhenging av forskningsprosjektene som blir satt i gang.

Kan vi be deg om litt til?

Etter at den første delen er gjennomført, kan du bli invitert til å delta i en eller to av følgende undersøkelser:

Pusteprøve

Pusteprøven er en enkel undersøkelse av lungefunksjonen. Du skal puste ut så kraftig som du klarer gjennom et munnstykke. Undersøkelsen er viktig for å studere mulige årsaker til lungesykdommer som astma og KOLS og for-bedre behandling av disse. Det er viktig for resultatene at flest mulig av de inviterte, både med og uten lungesykdom, deltar. Tid: ca 5 minutter.

Beinmassemåling

Norge ligger på verdenstoppen i antall brudd, noe som trolig har sammenheng med lav beintetthet. Forskere ønsker å undersøke forskjeller i beintetthet avhengig av blant annet kjønn, alder, kosthold, fysisk aktivitet, sykdom og behandling av sykdom. Beintettheten vil enten bli målt i en underarm eller ved en mer omfattende måling i kors-rygg, hofte og underarm. Stråledosen er svært lav, og målingen innebærer ingen risiko. Tid: ca 5 -10 minutter.

Ultralyd av hjerte

Personer som ikke har kjent hjertesykdom, kan delta i denne undersøkelsen. Hensikten er å kartlegge hvordan friske hjerter arbeider, noe som blant annet vil hjelpe leger og forskere til å skille mellom normale forskjeller og det som kan være tegn på sykdom. Du ligger på en benk mens undersøkelsen pågår. Du må være avkledd på overkroppen, men kan beholde bh. Gjennomføres for dem som bor i Steinkjer og Namsos. Tid: ca 20 minutter.

Ultralyd av lever og fettfordeling på kroppen

Det er stor variasjon mellom mennesker når det gjelder forekomsten av fett i leveren. Fordelingen av kroppsfett er også veldig ulik. Hensikten med undersøkelsen er å se på sammenhengen mellom fettavleiring i leveren og fett-fordeling ellers på kroppen, blant annet for å undersøke om dette kan si noe om risikoen for hjerte- og karsykdom. Du ligger på en benk mens undersøkelsen pågår. Gjennomføres for dem som bor i Steinkjer, Namdalseid og Flatanger. Tid: ca 5 minutter.

Kondisjonstest

Fysisk aktivitet er viktig for god helse. Vi ønsker å finne ut mer om sammenhengen mellom kondisjon og helse, og hva som er årsaken til dårlig kondisjon. Derfor inviteres det til en test av blodårefunksjonen ved hjelp av ultralyd og en kondisjonstest på tredemølle. I kondisjonstesten skal du gå eller løpe til du føler at du anstrenger deg så hardt du kan. Testen avbrytes når du ikke klarer å yte mer, eller når du ønsker å stoppe.

Hvis du vil delta i denne undersøkelsen, må du være i stand til å gå eller løpe, ha på deg lette klær når du kommer til undersøkelse, og ha med deg joggesko eller andre sko som er gode å gå eller løpe i. Alder er ingen hindring for å delta, men hvis du har hjertesykdom skal du ikke være med. Gjennomføres for dem som bor i Stjørdal, Levanger, Verdal og Namsos. Tid: ca 20 minutter.

Urinprøve

Noen deltakere blir bedt om å avgi urinprøve når de møter til undersøkelse, eller hjemme etter undersøkelsen. Nødvendig utstyr blir delt ut.

Samtykke

Det er frivillig å delta i HUNT 3 og i andre folkehelseundersøkelser. Hver deltaker må gi sitt skriftlige samtykke for at opplysningene skal kunne brukes til forskning. Du blir bedt om å signere et samtykke når du møter fram. Opplysninger og prøver som du gir, blir oppbevart på ubestemt tid. I framtida kan de bli brukt i prosjekter som ennå ikke er planlagt, forutsatt at det er i samsvar med lover og forskrifter.

I framtida skal du få informasjon om nye forskningsprosjekter som bruker data fra HUNT. Slik informasjon finner du på internett www.hunt.ntnu.no. En gang i året vil det bli gitt ut skriftlig informasjon til befolkningen. Det vil også være omtaler av en del forskningsprosjekter i mediene.

Du kan når som helst etter undersøkelsen trekke tilbake ditt samtykke og be om at data om deg slettes eller at blod- og urinprøven blir ødelagt. Hvis du ønsker å trekke tilbake samtykket, kan du henvende deg til HUNT forskningssenter, Neptunveien 1, 7650 Verdal, telefon 74 07 51 80, faks 74 07 51 81 eller e-post: hunt@medisin.ntnu.no. Hvis det er et bestemt forskningsprosjekt du ikke ønsker at opplysninger om deg skal brukes til, vil det bli tatt hensyn til dette.

Nytt samtykke

Hvis det i framtida blir aktuelt å bruke opplysninger til å forske på nye spørsmål som ikke er beskrevet i denne brosjyren, kan det bli nødvendig å be om et nytt samtykke. Vi vil da sende deg et brev.

Du kan også bli spurt om et nytt samtykke hvis det blir aktuelt å samarbeide med private aktører om genetisk forskning. Slikt samarbeid vil være underlagt offentlig regulering og kontroll. Det vil ikke i noen tilfeller være aktuelt å selge blodprøver eller annet biologisk materiale.

Personvern og sikkerhet

Du kan være trygg på at informasjonen som du gir til HUNT 3 vil bli behandlet med respekt for personvern og privatliv, og i samsvar med lover og forskrifter. Så snart opplysninger, blodprøver og eventuelt urinprøver er samlet inn, blir de lagret uten å være merket med deltakerens identitet. Forskere som senere skal bruke opplysningene, har ikke tilgang til navn, fødselsdato eller personnummer. Alle medarbeidere i helseundersøkelsen har taushetsplikt.

Datatilsynet fører tilsyn med at lover og forskrifter om oppbevaring og bruk av helseopplysninger blir fulgt. HUNT 3 har konsesjon fra Datatilsynet.

Etisk godkjenning

Alle forskningsprosjektene skal godkjennes av en etisk komité. Komitéen er et frittstående organ som sikrer at de etiske sidene ved forskningsprosjekter blir vurdert. HUNT 3 er godkjent av Regional komité for medisinsk forskningsetikk, Midt-Norge. Alle framtidige forskningsprosjekter som benytter data fra HUNT, skal også godkjennes.

HUNT databank

HUNT databank består av opplysninger som er samlet inn gjennom HUNT 1, 2 og 3 gjennom spørreskjema, undersøkelser og analyser fra blod- og urinprøver. Hvis du deltok i HUNT 1 eller HUNT 2, vil dine data bli sammenstilt med opplysningene fra HUNT 3.

Genetisk materiale samles i HUNT biobank. Formålet med biobanken er at det i framtida skal være mulig å ta ut prøver, gjøre ulike analyser og sammenstille resultatene med øvrige data fra HUNT databank. På den måten vil det stadig komme nye data som legges til databanken.

Når forskerne får data fra HUNT databank er navn, fødselsnummer og andre kjennetegn fjernet, slik at de ikke kan vite hvem som har gitt opplysningene.

Sammenstilling med andre registre

For spesielle forskningsprosjekter kan det være aktuelt å sammenstille data fra HUNT med andre offentlige registre, for eksempel Reseptregisteret, Medisinsk fødselsregistrer, Kreftregisteret og Dødsårsaksregisteret. HUNT-data kan også bli sammenstilt med andre registre ved Statistisk sentralbyrå (SSB), for eksempel om miljø, befolkning, utdanning, inntekt, offentlige ytelser, yrkesdeltakelse og andre forhold som kan ha betydning for helsa.

I tillegg kan det være aktuelt å hente diagnoseopplysninger som for eksempel lårhalsbrudd, hjerteinfarkt, hjerneslag eller lungesykdommer hos primærhelsetjenesten, sykehusene i Nord-Trøndelag og St. Olavs hospital. For enkelte prosjekter kan det også være aktuelt å sammenstille opplysninger fra foreldre med opplysninger fra barn, søsken, foreldre og besteforeldre hvis disse også har deltatt i HUNT.

Alle slike sammenstillinger krever samtykke og/eller forhåndsgodkjenning av de offentlige instanser loven krever, for eksempel Regional komité for medisinsk forskningsetikk, Datatilsynet, Sosial- og helsedirektoratet eller Rikstrygdeverket. All informasjon vil bli behandlet med respekt for personvern og privatliv, og i samsvar med lover og forskrifter. Ingen av forskerne kan vite hvem som har gitt opplysningene.

Skadeerstatning

Det er svært liten risiko for at deltakere skal komme til skade som følge av undersøkelsen. Hvis det likevel skulle skje, kan man søke om skadeerstatning gjennom Norsk Pasientskadeerstatning (NPE). NPE behandler erstatningskrav for pasienter som er blitt påført skade innen det offentlige helsevesenet.

Ung-HUNT

Alle ungdommer i alderen 13-19 år i Nord-Trøndelag inviteres til å delta i Ung-HUNT. Prosjektet blir gjennomført på skolene, med utfylling av spørreskjema og kliniske undersøkelser i skoletiden. Ungdommer og foreldre vil få egen informasjon om Ung-HUNT via skolen.

Vil du delta?

Hvis du vil delta i HUNT 3, må du gi ditt skriftlige samtykke. Her er en kopi av dokumentet som du blir bedt om å signere når du møter fram til helse-undersøkelsen.

Samtykke til bruk av helseopplysninger i forskning

Helseundersøkelsen i Nord-Trøndelag 2006-08 (HUNT 3)

I brosjyren jeg har fått tilsendt har jeg lest om helse-undersøkelsens innhold og formål, og jeg har hatt mulighet til å stille spørsmål.

Jeg samtykker i å delta i undersøkelsen.

Dato _____

Signatur Marianne Olsen

Deltok du i HUNT 2?

I etterkant av HUNT 2 (1995-97) ble det gjennomført flere undersøkelser der en mindre del av befolkningen deltok. Disse prosjektene hadde opprinnelig tidsbegrensede konsesjoner fra Datatilsynet, og avtalen var at opplysningene skulle slettes etter en bestemt dato.

I ettertid har det vist seg at opplysningene har stor verdi for framtidig forskning, og HUNT forskningssenter har derfor fått Datatilsynets tillatelse til å inkludere dem i HUNT databank. En liste over prosjektene som dette gjelder, finnes på internett www.hunt.ntnu.no. Du kan få listen tilsendt ved å henvende deg til HUNT forskningssenter.

Hvis du deltok i et av disse prosjektene og ikke ønsker at opplysninger om deg skal oppbevares videre, kan du ta kontakt med HUNT forskningssenter, Neptunveien 1, 7650 Verdal, og be om at opplysningene slettes. Det er ikke nødvendig å oppgi noen grunn til dette.

Deltok du i Ung-HUNT?

Hvis du deltok i Ung-HUNT i 1995-1997 eller 2000-01 vil disse opplysningene fra deg bli oppbevart og brukt på samme måte som opplysninger fra de voksne i tidligere HUNT-undersøkelser. Hvis du ikke ønsker at opplysningene skal oppbevares videre, kan du ta kontakt med HUNT forskningssenter, Neptunveien 1, 7650 Verdal, og be om at de slettes. Det er ikke nødvendig å oppgi noen grunn til dette.

Layout og produksjon: Fangst design, Steinkjer - Foto: Harald Sæterøy og Johan Arnt Nesgård

NTNU
Det skapende universitet

HUNT forskningssenter

HUNT forskningssenter ligger i Verdal og er en del av Det medisinske fakultet, NTNU. HUNT forskningssenter gjennomfører befolkningsundersøkelser i Nord-Trøndelag, forvalter forskningsdata og driver medisinsk forskning.

Hvis du har spørsmål om HUNT 3, kan du kontakte:
HUNT forskningssenter
Neptunveien 1, 7650 Verdal
Telefon: 74 07 51 80
Faks: 74 07 51 81
e-post: hunt@medisin.ntnu.no
www.hunt.ntnu.no