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HEL 3950 - Master`s thesis in Public Health

Physical activity and perceived health among adolescents in Troms

Data based on Fit Futures

– a health survey among adolescents

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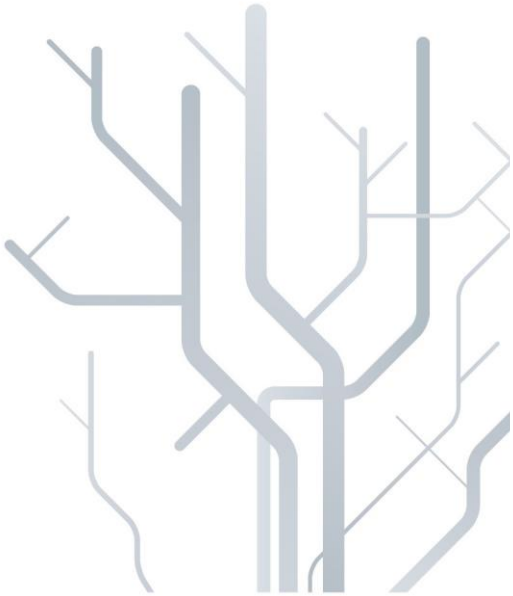

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Summary

Background: Perceived health is a predictor of morbidity and mortality in adults and has been an important measure of the general health status in population health studies for decades. Thus, perceived health during adolescence should be of high interest from a Public Health perspective. Regularly physical activity is well-documented to have beneficial effects on people`s physical, as well as mental health. Still, only 50% of Norwegian 15-year olds seem to comply with the government`s recommendations of physical activity. The aim of this thesis was to investigate the association between leisure time physical activity and perceived health among 15-18 year old adolescents in the municipalities of Tromsø and Balsfjord, Norway. ***Material and methods:*** Data is provided from Fit Futures, a comprehensive health survey among adolescents which is also a part of the Tromsø Study. The survey was carried out in 2010-2011, where all first grade high school students in the municipalities of Tromsø and Balsfjord were invited. Participation rate was 92%. The material consisted of 914 students aged 15-18 years (Mean 16.1, ±0.49), of whom 48.2% were girls. ***Results:*** Most adolescents in the study perceive their health as good (73.5%), with no significant gender differences. Boys and girls had significantly different habits of leisure time physical activity ($p<0.001$). Boys were more sedentary than girls, but at the same time more active in sports several times a week. A significant positive association between leisure time physical activity and perceived health was found for both boys and girls. Compared with being sedentary, boys had an odds ratio of 4.2 ($p<0.001$) in favor of perceiving health as good if being active and 5.4 ($p<0.001$) if being very active. For girls, the odds ratio in favor of perceiving health as good was 2.7 ($p<0.05$) for those who were active and 5.9 ($p<0.01$) for those who were very active, compared with being sedentary. ***Conclusion:*** For both boys and girls, perceived health seems to improve with increasing amount of leisure time physical activity. The most active adolescents perceived their health significantly better than their less active peers.

Sammendrag

Bakgrunn: Selvopplevd helse er funnet å være en prediktor for sykelighet og dødelighet blant voksne og har vært en viktig indikator for generell helsetilstand i befolkningsstudier i flere tiår. Selvopplevd helse i ungdomsårene bør derfor være av stor interesse fra et folkehelseperspektiv. Regelmessig fysisk aktivitet er godt dokumentert å ha gunstige effekter på folks fysiske og mentale helse. Likevel tilfredsstiller kun halvparten av norske 15-åringer de nasjonale anbefalingene for fysisk aktivitet. I denne oppgaven ville jeg se på sammenhengen mellom vaner av fysisk aktivitet i fritiden og selvopplevd helse hos ungdommer i Tromsø og Balsfjord. ***Materiale og metode:*** Data er hentet fra Fit Futures-undersøkelsen, en omfattende helseundersøkelse blant ungdom som også er en del av Tromsøundersøkelsen. Undersøkelsen ble gjennomført i 2010-11, hvor alle elever i første trinn på videregående skoler i Tromsø og Balsfjord ble invitert til å delta. Deltagelsen var 92%. Materialet besto av 914 elever i alderen 15-18 år (M16.1, ±0.49), hvorav 48.2% var jenter. ***Resultater:*** De fleste ungdommene i undersøkelsen opplever sin egen helse som god (73.5%),og det var ingen signifikant forskjell mellom jenter og gutter. Gutter og jenter hadde signifikant forskjellige vaner for fysisk aktivitet i fritiden ($p<0.001$). Guttene var mer inaktive enn jentene, men også mer aktive i idrett flere ganger i uken. Det ble funnet en signifikant positiv sammenheng mellom vaner av fysisk aktivitet i fritiden og selvopplevd helse for både gutter og jenter. Sammenlignet med å være inaktiv hadde guttene en oddsratio i favør av god selvopplevd helse på henholdsvis 4.2 ($p<0.001$) og 5.4 ($p<0.001$) dersom de var aktive eller meget aktive. Blant jentene var oddsratio i favør av god selvopplevd helse 2.7 ($p<0.05$) for de som var aktive og 5.9 ($p<0.01$) for de som var meget aktive, sammenlignet med å være inaktiv. ***Konklusjon:*** Både for gutter og jenter i undersøkelsen synes selvopplevd helse å bedres ved en økning i fysisk aktivitet i fritiden. De mest aktive ungdommene opplevde sin egen helse signifikant bedre enn deres mindre aktive jevnaldrende.

Abbrevations

LTPA	Leisure time physical activity
BMI	Body Mass Index
CI	Confidence Interval
OR	Odds Ratio
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
UNN	University Hospital of Northern Norway (Universitetssykehuset Nord-Norge)
WHO	World Health Organization
DWM	Doubly Water Method
HBSC	Health Behavior in School-Aged Children

Contents

1 Introduction

Perceived health is shown as a predictor of morbidity and mortality in adults [1-3], and is even connected to mortality in young populations [4]. Although young people in general are healthy, many adolescents reports subjective health complaints [5, 6]. Lifestyle, including physical activity is considered as one of the major determinants of health in a population [7] and regularly physical activity is well documented to increase physical [8, 9], as well as mental health [10, 11]. Still, only half of Norwegian 15-year-olds meet the national recommendations of at least 60 minutes of moderate physical activity per day [12, 13], and one can expect that low levels of physical activity affect adolescent`s health into adulthood [14]. Thus, investigating factors influencing adolescent`s perceived health may be important not only in promoting their health at this period of life, but also in preventing morbidity and mortality in adult age.

1.1 Background

The Norwegian government emphasizes that behaviors affecting good health throughout life are formed already during childhood and adolescence [15]. The World Health Organization (WHO) also highlights adolescence as a crucial period for establishing health-related behavior [16]. This implies that public health efforts should be directed towards initiating health promoting actions as early as possible. Physical activity has already been given a priority by the Norwegian government [17], and the emphasis on public health initiatives in Norway is now legislative through a dedicated Public Health Act (Folkehelseloven) introduced in January 2012. The main objective of this is to promote the population health, well-being and social and environmental conditions, as well as contribute to the prevention of mental and physical illness, injury or disease [18]. A substantial part of this responsibility is placed on the municipalities, where resources often are scarce. Given the Norwegian government`s focus on

physical activity as an important public health initiative and the negative health consequences of poor perceived health, the topic of this thesis should be of high interest in promoting adolescent health. In addition, it should be interesting from a health economic perspective, as poor self-reported health has also been linked to increased health service attendance among adults [19].

1.1.1 Determinants of health

The health of a population is influenced by a great variety of factors, and exploring all of these would be above the scope of this thesis. This section provides a brief description of the major determinants of health.

Roughly speaking there seems to be three main groups of determinants concerning the population health; (1) genetics, (2) environmental factors and (3) lifestyle factors [7]. Within these determinants there are a wide range of factors affecting our health. While genetics is predetermined (e.g. gender), environmental factors are more complicated as they include both physical and sociological factors in people`s surroundings. Examples of physical factors are air pollution and traffic noise, while social factors may refer to cultural norms and social position. Lifestyle refers to the choices people make regarding their health, which basically comprises tobacco use, exercise or (lack of) physical activity, alcohol consumption and diet [7].

The environmental determinants, especially social factors, have received great attention in a global health perspective the last decades, both between and within countries [20]. Even though lifestyle is the determinant that people themselves have most influence on, people`s choice of lifestyle may not simply be a result of their ability to make good or poor decisions, but rather a consequence of social inequalities [20]. Conversely, it is suggested participation in sports and exercise seems to be highly valued among peers during adolescence, contributing to higher

social status [21]. Thus, social factors may also be important in the relationship between physical activity and perceived health.

1.1.2 Adolescent health

Different terms are used to define the period of life between childhood and adulthood. Terms like adolescence, teenager, youth and young people are all found in the literature, each with its different time span describing the period [22]. Even though many of the studies referred to in this thesis use different terms, I will use to the term adolescence, in which World Health Organization (WHO) defines as "young people between 10 and 19 years old"[23]. This period is also divided into early- and late adolescence, with an age span of 10-14 and 15-19, respectively [22].

Adolescents are mostly thought of as a healthy group. Those living in high income-countries in Europe, Norway included, have the lowest total mortality rates in the world and deaths in these countries are primarily caused by injuries and non-communicable diseases [24]. This implies that many of these deaths are preventable. Norwegian adolescents in general seem to be satisfied with their health. The Norwegian report from the WHO cross-national Health Behavior in School-Aged Children (HBSC) Study 1985-2005 examined trends in health and lifestyle among children and adolescents and revealed that about 80 percent of first grade high school students reported their health to be either good or very good [6]. Studies using data from the Young HUNT survey in Norway reports similar findings [25, 26].

Even though adolescents in general seem to report their health as good, there are also some concerns regarding their health. The abovementioned report from the HBSC Study found that 17 percent of male- and 25 percent of female students in first grade high school reported at least one subjective health complaint per day (involving headache, abdominal- and back pain, feeling depressed, irritable, nervous, dizziness and having difficulty falling asleep) [6]. Similar

patterns were reported in a paper presenting results from the same study, using data from 1993-94; relatively high levels of subjective health complaints appeared already at the age of eleven [5].

Psychological distress is also considered to be a major health issue in Norway today [27]. The Norwegian Institute of Health has reported the prevalence of emotional distress to be higher among adolescents than among children and adults [28]. A survey among 15-16-year olds in the county of Hedmark found symptoms of depression and anxiety to be present in approximately 15 and 35 percent of boys and girls, respectively [29]. However, it is worth bearing in mind that adolescence in its nature is a period characterized by substantial physical and psychosocial changes [21], and that some of the mentioned symptoms might simply be natural reactions to becoming an adult. For instance, adolescents with early and late pubertal maturing have shown to score higher in depression symptoms compared to peers with "on time" maturing [30].

1.1.3 Perceived health

Perceived health, by some also phrased as "self-rated health", has been an important and frequently used measure of health status in population health studies for decades. Several studies have shown consistently results, demonstrating that perceived health is a strong and valid independent predictor of mortality and morbidity in the adult population [1-4, 31]. However, as opposed to mortality and morbidity rates, perceived health is a subjective indicator of people`s general health [32]. It is generally measured by a single item, commonly formulated like "In general, how would you consider your own health?" or "Overall, how would you evaluate your health?". Ratings are usually ranging on a scale from "poor" or "bad"/"very bad" to "excellent" or "good"/"very good" in 2 to 5 response alternatives [2].

Perceived health do not only serve as a predictor of mortality, it may also capture several important dimensions for people`s overall health status. In a qualitative study by Simon and

colleagues [33] examining what aspects people considered in their assessment of health, they found that the responders referred to a total of 17 health aspects. They were able to group these aspects into five main dimensions: (1) physical, (2) functional, (3) coping, (4) well-being and (5) behavioral, in which the physical dimension was most frequently referred to [33]. An extensive review by Idler and Benyamini [2] examined 27 studies on self-rating of health as a predictor of mortality, and concluded that self-rated health clearly added something more than the prediction of mortality itself. In their interpretations of the findings they suggested that self-rating of health may capture the full range of people`s illness, as well as including the individual's judgment of the severity of illness. They also suggested that it influences health-related behavior and reflects resources that may attenuate decline in health [2 p.27-30]. Another study found that poor self-rating of health was significantly associated with increased risk of physical ailments like carotid atherosclerosis, reduced lung function and decreased fitness [1]. Ware [34] highlights two main reasons in favor of using self-rating of health. First, other more specific measures (e.g. physical and social function) do not entirely capture personal evaluations of health experiences. Second, as opposed to measures of limitations or behavioral dysfunctions self-ratings are positively oriented, thus able to take into account the well-being dimension. This would be relevant when measuring the health of adolescents, who in general are a healthy part of the population. Despite the fact that adolescence is a period characterized with substantial changes physical and psychological changes [21], perceived health is still found to be a stable measure during this period [26].

In sum, this may illustrate that perceived health is a stable and robust indicator of the overall health among adolescents, as it captures both qualitative (e.g. well-being) and quantitative (mortality) aspects of health. Interestingly, the same aspects are also embedded in WHO`s definition of health, formulated as *"a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"* [35 p.XVIII].

I will end this part by clarifying a feasible confusion. Perceived health may by someone be mistaken with the term "mental health". However, this is a misunderstanding, of the simple reason that they represent two different things. Perceived health is, as already explained, a subjective indicator of people`s overall health status. The term "mental health" on the other hand, is by WHO defined as *"a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community"* [35 p.2]. Thus, mental health is a state of health in itself, particularly connected to the aspect of well-being and coping. So, mental health may admittedly be a central part of perceived health, but should not be confused with the term.

1.1.4 Factors affecting adolescents health

In public health research, rates of mortality and morbidity are commonly used indicators for measuring the population health [6, 36]. However, since adolescents in high income countries like Norway have low rates of mortality and morbidity [24], perceived health is a more appropriate indicator. As such, we have to know something about which factors affects their own assessment of health.

Adolescents in general have a broad understanding of health. Their overall sense of functioning seems to be important, which is associated with indicators such as physical, psychological, social and health behavior [32 p. 67]. In a Canadian population health survey, investigating factors predicting 12-19 year-old adolescents` perception of health, Vingilis [37] found that even though physical health status was the most important predictor, several other components involving personal-, socio-environmental and behavioral factors also had an important influence in their overall perception of health. Furthermore, negative perceived health among mid-aged adolescents has been associated with body dissatisfaction [38] and psychosomatic complaints [39]. A qualitative study by Woodgate and Leach, who investigated

how Canadian youths framed their health within the context of their life situations, found that lifestyle factors were highlighted as the most important in their perception of health [40]. Others have found similar patterns regarding adolescents understanding of health. Breidablik and colleagues investigated the relationship between self-rated health and several structural, medical, psychological and social variables and concluded that adolescent's perception of health includes a broad set of background variables, such as body concern, health-compromising behavior and physical activity[25].

Female adolescents tend to rate their health lower than their male peers [6, 32, 37, 38, 41]. Regarding how age affects adolescent perception of health, there seems to be some inconsistency. While most studies conclude that perceived health decrease with age during adolescence [32, 38, 41], others have found an association between increased age and higher rating of health [37].

1.1.5 Health benefits from physical activity

Physical activity is defined as *"any bodily movement produced by skeletal muscles that result in energy expenditure"* [42 p. 963]. As such, physical activity may include a range of activities, like walking, cycling, all types of physical exercise, sport activities (e.g. soccer or tennis), gardening and snow shoveling. Two closely related terms are exercise and fitness, which deserves a short explanation in order to clarify their distinction from physical activity. Exercise is a subcategory of physical activity, but is more planned, structured and repetitive and is aimed at improving or maintaining elements of physical fitness [42]. Physical fitness composes attributes people have or achieve that relates to the ability to perform physical activity, and these attributes include muscle strength, body composition, cardiorespiratory fitness and flexibility [43]. According to the aim of this thesis the focus here will rest mainly on physical activity.

It appears to be a dose-response relationship regarding the health benefits from physical activity, with no specific lower threshold [43]. In short, this means that some activity is better than no activity at all and when the amount of physical activity increases, until reaching an extreme level, the health benefits increases accordingly. The general beneficial effects from regularly physical activity on people`s health is well documented. Physical activity is associated with reduced risk of premature mortality, cardiovascular disease, type 2 diabetes, hypertension, obesity and certain types of cancer [9, 43, 44]. Moreover, high impact weight bearing activities and dynamic activities of short duration (e.g. jumping) may also enhance bone strength among adolescents [9]. This has also shown to be a preventive factor for bone fractures among adults [45]. Using data from two large British birth cohorts Sacker found that physical activity in adolescence reduced the odds of psychological distress in adulthood [46]. In addition, physical activity has been associated with reduced risk of depression [9, 47, 48] and increased self-perception and self-efficacy among adolescents [11]. On the other hand, physical inactivity is globally recognized as the fifth leading risk factor for mortality [49], and is suggested to be contributing to health complaints during childhood and into adulthood [50]. Sedentary behavior has also been linked to increased likelihood of depressive symptoms in early adolescence [48].

1.1.6 Physical activity among adolescents

The Norwegian Directorate of Health recommends children and adolescents to be physical active at least 60 minutes per day, and the activity is recommended to be of both moderate and vigorous intensity [17]. Studies examining habits of physical activity among Norwegian children and adolescents report that only 50 percent of 15-year olds meet these recommendations [12, 13]. Evidence from studies in other countries shows somewhat similar patterns [32, 51].

Trends in reported frequencies of participation in physical activity among Norwegian 15-year olds indicate that the physical activity level has remained stable between 1999 and 2005 [13]. However, an increase in sedentary behavior (time spent in front of a computer) is observed among Norwegian 15-year olds between 2001 and 2005 [6]. This trend should cause concern for their future health, as it is suggested that adolescence is a period in life in which health related behavior are being established [6, 16, 37]. Furthermore, adolescents who engage in physical activity are more likely to be physically active as adults compared to their inactive peers[32, 52, 53].

Although level of physical activity in general seems to decrease with age, some contradictory findings are observed regarding trends in age-specific physical activity during childhood and adolescence. For instance, Kjelvik found the level of physical activity to be higher for those in the age group 11-15 years than among children aged 6-10 years[50]. On the other hand, the Norwegian report from the cross-national HBSC Study found that the proportion of Norwegian students who engaged in sports or exercise declined with age [6]. The same trend was also observed among children and adolescents in Oslo, where level of physical activity was significantly lower among 15-year olds than among 9-year olds [13]. Kahn also reported a decline in level of physical activity among U.S. adolescents from the age of 13[54]. In general, adolescent boys in Norway tend to be more physical active than their female peers [6, 12, 55].

1.1.7 Assessment of physical activity

Physical activity is a complex and multidimensional variable, and quantifying this behavior is not an easy task. A variety of methods exist, all differing in respect to their accuracy and feasibility [56]. Regardless of the method chosen when quantifying physical activity, it`s important to distinguish between the term energy expenditure and physical activity as these terms possess different meanings in this context. According to its definition, physical activity is a *behavior* resulting in a certain amount of energy expenditure and is typically quantified in

terms of its frequency and duration [56]. Energy expenditure is a *physiological consequence* of physical activity, reflecting the associated energy cost of the performed physical activity [56, 57]. In short, quantifying physical activity can be done both directly and indirectly either by assessing the energy expenditure from a given physical activity or by measuring people`s physical activity [56]. This section will give a brief description of the most common assessment of physical activity, focusing most on the subjective methods. For more detailed information of the different methods, I refer to some review articles dealing with the subject [56-59].

Methods to assess physical activity can broadly be divided into two categories: objective- and subjective techniques. Objective techniques involve the doubly-labeled water method (DLW), heart rate monitors and motion sensors [57]. The DLW method is suggested to be the only method to accurately estimate daily life energy expenditure over longer time periods. However, due to its high costs it is not an appropriate method in large epidemiologic studies [60]. Heart rate monitors have shown to be a valid method in estimating level of physical activity in both children and adolescents, but have high sensitivity for other factors than the physical activity itself [57]. Motion sensors are small electronic devices, able to provide an estimate of energy expenditure by detecting participant`s body movements and consists of pedometers and accelerometers [57]. Pedometers can only register steps and walking distance (if the step length is known), while accelerometers are more sophisticated measuring acceleration and may capture both frequency, duration and intensity of physical activity [60].

Among the subjective techniques we find direct observations, self-reports and diaries [57]. Direct observations are carried out by visually observe the physical activity in real time or by means of video recording, and is often a preferred method in assessment of physical activity among young children within small areas [58]. This is also suggested to be the most appropriate criterion measure of physical activity [57]. However, it cannot measure the intensity of the activity [61], it may affect the children`s behavior and involves high costs [57;58]. Self-report

questionnaires are the most common used measure when assessing physical activity in large population studies and can be either interviewer- or self-administered. The method has its main advantage in that it is relatively inexpensive and therefore applicable to large groups of people (e.g. population surveys), and it also represent a low burden for both respondents and investigators [57, 58]. The most important limitations of this measure is associated with response bias, such as failure in recalling the activity, the desirability to report particular activities and a tendency to overestimate the amount of physical activity [57, 59]. The use of diaries for estimating physical activity is time consuming, thus representing a significant burden to the responders. It is suggested to be the most accurate subjective method in adults, but because of the participant burden it is not assumed to be appropriate in estimating young people`s physical activity [57].

1.1.8 Physical activity and perceived health

This section presents the current knowledge regarding the relationship between physical activity and perceived health.

Several studies using self-rated health as the dependent variable have been able to demonstrate physical activity as one of many important predictors of self-rated health in adults [19, 62-64]. Other studies among adults have aimed specifically to investigate the relationship between physical activity and perceived health, and most have found that higher level of physical activity is significantly associated with better ratings of health status [46, 65-67].

Few studies have examined the relationship between leisure time physical activity and perceived health among adolescents. An Icelandic study from 1990 investigated the direct and indirect effect of *sport participation* (measured as how often and how many hours a week) on perceived health, but not the effect of general physical activity. The study used data from a nationwide random sample, consisting of 1200 Icelandic male and female students aged 15-

and 16-years [68]. They used a model where sport participation was defined as an exogenous factor directly affecting perceived health, but also indirectly affecting health via health-related behaviors (smoking and alcohol consumption) and psychological distress (depression, anxiety and psychophysiological symptoms). Their results showed that sport participation was both directly and indirectly linked to perceived health; the latter mediated through smoking and psychological distress [68]. Later a Spanish study using a sample of 1038 high-school students between the age 15 and 18 from the Valencian Community examined the same relation (i.e. the direct and indirect effects of sports participation on perceived health) as an adaptation of Thorlindsson and his colleagues` model, except that they also extended the study by introducing a new model including perceived physical fitness as a mediator [69]. In short, they found quite similar results as the Icelandic study; sport participation had a direct effect on perceived health, as well as an indirect effect on perceived health by decreasing smoking and alcohol consumption, feelings of depression and psychophysiological symptoms. In addition their extended model showed an indirect effect on perceived health trough increased perceived physical fitness [69].

Another study used data from the Canadian National Health Survey, with a sample consisting of 1493 boys and girls between the age of 12 and 19 years. This study aimed at examining which factors predict adolescent perceived health [37]. In addition to physical activity they examined the variables sex, age, grade, family structure, income, disability, chronic health problems, social supports, social involvement, school/work involvement, smoking, alcohol bingeing, Body Mass Index (BMI) and psychological health status. Their findings revealed that physical activity was one of the factors significantly associated with perceived health, and interestingly those in the highest tertile of physical activity were found to have lower rating of health [37]. A study among Finnish twins examining the association between leisure time physical activity over a 3 year period (age 16 at baseline) and health related behaviors, social

relationships and health status, found a significant relationship between being persistently physical active in leisure time and reporting good perceived health. They also found that being persistently inactive was significantly associated with bad perceived health [70]. Breidablik and colleagues aimed at examine the relationship between Norwegian adolescents` self-rated health and several structural, medical, psychological, social and health behavioral factors. They found that sports and exercise was among the significantly associated variables with adolescents` self-rated health[25].

Nesheim and Haugland used data from the Norwegian part of the HBSC Study 1997-1998 to examine the association between perceived health and leisure-time physical activity in 4909 students aged 11- 13- and 15 years [41]. For perceived health they used the question "How do you consider your own health at present?", with the response alternatives "Very good", "Good" and "Not so good". Leisure-time physical activity was measured by the question "How many times a week do you engage in sports or exercise so that you feel exhausted and/or are sweating?", with the response alternatives "Every day", "4-6 times a week", "2-3 times a week", "once a week", "once a month", "less than once a month" or "never". They found a significant association between physical activity and perceived health when adjusting for age and gender, where those who reported to be most physical active more often reported their own health as "good" or "very good" [41]. Recently a Spanish study, using data from the Spanish part of the HBSC study 2006, examined the association between frequencies of moderate-to-vigorous physical activity and self-reported health status (self-rated health, health complaints, satisfaction with life and health-related quality of life) in Spanish adolescents aged 11-18 years old [71]. They found that the health benefits got stronger for all four health aspects as frequencies of physical activity increased, and these benefits were observed in all scales of physical activity, already from the lowest level. They were also able to demonstrate a significantly linear trend for self-rated health ($p<0.05$).

1.2 Rationale for the topic

In this introduction we have seen that perceived health is a strong predictor of mortality in the adult population[1-4, 31]. In addition, it is a good subjective indicator of adolescent`s overall health status, as it captures several dimensions of adolescents perception of health [2, 33]. Even though adolescents in general are healthy, studies show that perceived health seem to decrease with age during adolescence [37, 38, 41] and many adolescents also reports subjective health complaints [5, 6]. Despite the compelling evidence showing great health benefits from regularly physical activity, only half of Norwegian 15-year olds meet the national recommendations of physical activity, which is worryingly as health-related behavior often establishes during this stage of life [6, 16, 37].

The Norwegian government is concerned of the growing number of sedentary children and adolescents. At the same time it may be a challenge for the municipalities to comply with the requirements by the authorities, following the introduction of the Public Health Act. This suggests that focus should be directed towards health promoting actions. Few studies have investigated the relationship between leisure time physical activity and perceived health among adolescents. Knowing the many health benefits from physical activity and the negative health implication of poor perceived health in adulthood, it would be of great interest from a public health perspective to examine the association between leisure time physical activity and perceived health among adolescents.

1.3 Aims

The main objective of this thesis was to examine the association between leisure time physical activity and perceived health among 15-18 year old adolescents in the municipalities of Tromsø and Balsfjord.

Specific aims were to examine:

1) perceived health among male and female students
2) habits of leisure time physical activity among male and female students
3) the association between habits of leisure time physical activity and perceived health among adolescents in Tromsø and Balsfjord

2 Material and methods

2.1 The Fit Futures survey

The thesis is based on data from Fit Futures (FF), a cross-sectional health survey among first grade high school (1. trinn i videregående skole) students in the municipalities of Tromsø and Balsfjord (personal communication). The primary purpose of FF was to create a baseline for a youth cohort in Troms, supplementing the Tromsø Study which only includes adults. Investigating secular trends regarding youth health, as well as facilitating future population surveys are also important objectives for the survey. By mapping risk factors and prevalence of several health- and lifestyle variables, the FF survey aims at increasing the knowledge and understanding about factors affecting the health of Norwegian adolescent during the transition from youth to adulthood. The survey comprised six parts, consisting of (1) a questionnaire, (2) an interview, (3) a general physical health examination, (4) body-scan (DEXA), (5) dental examination and (6) a respiratory function examination. At the present time, no profile of the FF-survey has been published. For more information regarding the survey, see FF-protocol (Appendix 1).

2.2 Sample and sampling procedure

All students in first grade high schools in the municipalities of Tromsø and Balsfjord were invited to participate in FF. A total of 1038 students attended the survey. Participation rate was 92%. As this thesis focuses especially on adolescents, the sample was restricted to those aged 15 to 18 years (n = 986), which is defined as late adolescence [22]. Subjects with missing answers on any of the key questions were excluded from the analyses (n = 72). After exclusion the final sample eligible for analyses consisted of 914 students. Of these, 48.2% were girls. Mean age for girls and boys in the final sample were 16.2 and 16.1 years, respectively.

Recruitment of subjects to FF was conducted in close collaboration between the research group and the schools. As part of the recruitment procedure researchers visited the invited schools prior to the survey, informing the students about the survey by giving a shared oral briefing in the school classrooms. Additional written information was handed out in a folder, in which the students were told to bring home to inform their parents or legal guardians. The information was also available at the school`s web site. The students were informed that participation was voluntarily and anonymous, and that they were able to withdraw their consent to participate in the survey at any time without giving further reason.

The survey was carried out class-wise at the University Hospital in Northern Norway (UNN) from September 2010 until April 2011. Both the questionnaire and the physical examination were carried out at UNN. The students were given legitimate absence to participate, and were transported by bus from school to the research department at UNN. All subjects received a gift voucher valued NOK 200 when they met up at the research department.

2.3 Measurements

Data used in the thesis is based on self-reported data from the questionnaire and data from the physical examination (body height and weight). The questionnaire consisted of topics concerning lifestyle habits, wellbeing, personal characteristics, diseases and health complaints, as well as family conditions. Many of the questions used in FF were also used in the Tromsø VI study [72]. A link to the entire FF questionnaire is found in Appendix 3.

Except from Body Mass Index (BMI), all included variables are derived from the self-reported questionnaire. At the physical examination body weight was measured in kilograms and height was measured in centimeters. The measurements were conducted by trained nurses at the research department at UNN. BMI was calculated as weight per squared height (kg/m^2), using measurements from the physical examination. For the analyses, the variable was

categorized into three BMI-groups; ”Underweight”, “Normal weight” and “Overweight/Obese”. Age- and gender-specific BMI cut-offs for thinness and overweight (Table 1 and 2) was derived from the extended international (IOTF) Body Mass Index cut-offs for thinness, overweight and obesity in children [73]. BMI-values between the cut-offs for thinness and overweight was regarded as normal weight. Overweight and obesity was combined as one category due to few subjects in the obese-category. This resulted in following cut-offs used in the analysis:

Table 1: BMI cut-offs for girls

Age (years)	**BMI (kg/m^2) cut-offs**		
	Underweight	*Normal weight*	*Overweight/obese*
15	≤ 17.68	> 17.68 and < 24.13	≥ 24.13
16	≤ 18.08	>18.08 and <24.53	≥ 24.53
17	≤ 18.38	>18.38 and <24.85	≥ 24.85
18	≤ 18.50	>18.50 and <25.00	≥ 25.00

Table 2: BMI cut-offs for boys

Age (years)	**BMI (kg/m^2) cut-offs**		
	Underweight	*Normal weight*	*Overweight/obese*
15	≤17.26	>17.26 and < 23.60	≥ 23.60
16	≤ 17.79	>17.79 and < 24.18	≥ 24.18
17	≤ 18.28	>18.28 and < 24.73	≥ 24.73
18	≤ 18.50	>18.50 and <25.00	≥ 25.00

2.3.1 Dependent variable

The dependent variable perceived health was based on a single item question, as presented in Table 3.

Table 3: Question regarding perceived health in Fit Futures, illustrating the dichotomy of perceived health

Question	**Response alternatives**	**Recoding (code value)**
In general, how would you consider your own health?	□ Very bad	Bad (0)
	□ Bad	
	□ Neither good nor bad	
	□ Good	Good (1)
	□ Excellent	

Perceived health was dichotomized for use in the logistic regression analysis, with response alternatives representing "Bad" and "Good" health as shown in Table 3. I chose to measure "good health" (coded 1) instead of "bad health" (coded 0) because I wanted the focus to be on the positive health outcome.

2.3.2 Predictor variable

Physical activity was assessed by one question based on average level of leisure-time physical activity the last year (Table 4).

Table 4: Question regarding leisure time physical activity in Fit Futures

Question	Response alternatives
Which description suits you best when it comes to your physical activity in leisure time over the past year?	□ Reading, watching TV or other sedentary activity
	□ Walking, cycling or other forms of exercise at least 4 hours a week (including walking or cycling to school, Sunday walking, etc.)
	□ Participation in recreational sports, heavy outdoor activities, snow shoveling etc. at least 4 hours a week
	□ Participation in hard training or sports competitions regularly several times a week

This question has also been used in the Tromsø Study (Tromsø 1-6). A study by Emaus et al. validated this question used in the Tromsø Study against objective measures of physical activity, and found the validity to be good[74]. For convenience, the levels of physical activity (ranging from low to high) will be referred as "sedentary", "somewhat active", "active" and "very active" in the presentation of results and in the discussions.

2.3.3 Covariates

Confounding is always a risk in observational studies, and occurs when the outcome of interest is affected by one or several factors other than the chosen predictor variable [75]. Based on the literature regarding both physical activity and perceived health, following available variables were considered as potentially confounders and included in the multivariate logistic regression analysis: *Chronic disease*: "No" (0), "Yes" (1). *Chronic pain*: "No" (0), "Yes" (1). *Sufficient sleep* (A question on whether the students felt that they got enough sleep): Graded

1-5 as follows: “Yes, absolutely enough”, “yes, normally enough”, “no, somewhat insufficient”, “no, clearly insufficient” and “no, far from sufficient”. *Total screen-time outside school during weekdays*: Graded 1-6 “Half an hour or less”, “About 1 to 1,5 hours”, “About 2 to 3 hours”, “About 4 to 6 hours”, “About 7 to 9 hours and “10 hours or more”. Originally, this variable included 7 categories, with “never” being the lowest response alternative. However, due to few responses in this category this was combined with “half an hour”, which represents the lowest category (1 = “half an hour or less”) in the analyses. *Smoking status*: Graded 1-3 “No never”, “sometimes” or “daily”. *Alcohol frequency*: Graded 1-5 “Never”, “Once per month or less”, “2-4 times per month”, “2-3 times per week” or “4 or more times per week”. *BMI:* Graded 1-3 “Normal weight”, “Underweight” and “Overweight/Obese”. *Social network* (From the statement “I have many friends”): Graded 1-4 “Highly incorrect”, “somewhat incorrect”, “somewhat correct” or “highly correct”. *Socioeconomic status:* Mothers and fathers education level (Number of years of education), Graded 0-5 “Don`t know”, “Primary school, 9 years”, “Occupational high school”, High school”, “College less than 4 years” or “College 4 years or more”.

2.4 Statistics

All analyses were performed using IBM SPSS (Statistical Package for Social Sciences) for Windows (version 19.0). Most analyses were performed by gender stratification, in order to examine possible gender differences. Two-sided p-values <0.05 were considered statistical significant in the analyses. In addition, 95% CI was presented in the results of the logistic regression analyses.

The analyses consisted of two parts. The first part involved the descriptive statistics, while the second part was examining the association between leisure time physical activity and perceived health. Age distribution is presented as frequencies (%), mean and standard deviation (SD). The independent two sample t-test was used testing for statistical gender

difference. As all the other variables were on the categorical level, these were examined using crosstabs. This included distribution of leisure time physical activity against all covariates (Appendix 2), distribution of perceived health, leisure time physical activity and all covariates against gender and distribution of perceived health against leisure time physical activity. Statistical gender differences were tested using Pearson`s chi square test. Results are presented as number of students (n) and frequencies (%).The mean values and frequencies are rounded to the nearest decimal.

The main analysis, examining the relationship between perceived health status and leisure-time physical activity was performed using binary logistic regression. Self-reported leisure time physical activity was included as a categorical variable in the analysis, using sedentary activity (the lowest value) as reference category. Relevant and available confounders were included in the multivariate analysis. Most of these were entered as continuous variables, in order to get a picture of the overall trend of the variables in relation to perceived health. However, the BMI-variable was entered as a categorical variable according to the abovementioned cut-offs, where "normal weight" was selected as reference category. Results are presented in two tables, the first one presenting the unadjusted association between leisure time physical activity and perceived health. The second table presents the results after adjusting for potential confounders. Odds ratio (OR) was used as measure of effect size.

2.5 Ethical considerations

Participation in Fit Futures was voluntarily. Written consent was obtained from all subjects attending the survey. Those below the age of 16 got a written consent from their parents or legal guardians. Each student was assigned a personal item number, connecting them to their respective data and samples. All details regarding the students were obtained from their respective schools and kept anonymous, not possible to identify by any of the researchers. The thesis is approved by the Regional Ethics Committee (REK Nord).

3 Results

The main objective of this thesis was to examine the association between habits of leisure time physical activity and perceived health among adolescents in the municipalities of Tromsø and Balsfjord. In addition, distribution of perceived health as well as habits of leisure time physical activity was examined in the descriptive analyses. This part presents the results from the statistical analyses.

3.1 Descriptive analyses

3.1.1 Demographic characteristics

Age distribution for the total sample (n = 914) and by gender is presented in Table 5. A majority (79.3%) of the students were 16 years old. On average, girls were slightly older than boys (p = 0.125). A somewhat higher proportion of the sample were males (51,8%).

Table 5: Age distribution for the total sample and by gender

Gender, *n* (%)	**Age**					
	15	**16**	**17**	**18**	**Total**	**Mean (± SD)**
Girls	11 (2.5)	357 (81)	66 (15)	7 (1.6)	**441 (48.2)**	16.2 (± 0.46)
Boys	33 (7)	368 (77.8)	61 (12.9)	11 (2.3)	**473 (51.8)**	16.1 (± 0.53)
Total	44 (4.8)	725 (79.3)	127 (13.9)	18 (2)	**914 (100)**	16.1 (± 0.49)

The distribution of all covariates against the different levels of leisure time physical activity is presented in Appendix 2. In short, BMI ($p<0.001$), number of friends ($p<0.001$), screen-time during weekdays ($p<0.001$), smoking ($p<0.001$) and parental education level ($p<0.001$) was significantly associated with leisure time physical activity for the total sample.

Students who were underweight and overweight/obese were less physical active than those who were normal weighted. Adolescents with many friends were more physical active in their leisure time than those with few friends. Not surprisingly, students who spent more time in

front of a screen during weekdays were less physical active than the students who spent less time in front of a screen. Smokers were less physical active than non-smokers, while those having parents with college education were more physical active than those having parents in lower education levels.

Table 6 presents the frequency distribution of all variables in the analysis for the total sample and by gender. The following two sections present the results of the descriptive analyses regarding perceived health and habits of leisure time physical activity.

Table 6: Frequency distribution of all included variables for the total sample and by gender

Variables		**Total Sample (*n* = 914)**	**Girls (*n* = 441)**	**Boys (*n* = 473)**	**Gender difference *(P)***
Dependent variable		***n* (%)**	***n* (%)**	***n* (%)**	
Perceived health					0.244
	Good	672 (73.5)	332 (75.3)	340 (71.9)	
	Bad	242 (26.5)	109 (24.7)	133 (28.1)	
Predictor variable					
Leisure time physical activity					**<0.001**
	Reading, watching TV or other sedentary activities	204 (22.3)	61 (14.3)	136 (29.8)	
	Walking, cycling or other forms of activity at least 4 hours a week	293 (32.1)	176 (39.9)	117 (24.7)	
	Participation in recreational sports and heavy outdoor activities at least 4 hours a week	234 (25.6)	127 (28.8)	107 (22.6)	
	Participation in hard training or sports competitions regularly several times a week	183 (20)	75 (17)	108 (22.8)	
Covariates					
BMI					0.192
	Underweight	66 (7.2)	27 (6.1)	39 (8.2)	
	Normal weight	651 (71.2)	326 (73.9)	325 (68.7)	
	Overweight/ Obese	197 (21.6)	88 (20)	109 (23)	
Chronic pain					**0.002**
	Yes	220 (24.1)	126 (28.6)	94 (19.9)	
	No	694 (75.9)	315 (71.4)	379 (80.1)	
Chronic disease					**0.046**
	Yes	270 (29.5)	144 (32.7)	126 (26.6)	
	No	644 (70.5)	297 (67.3)	347 (73.4)	
Have many friends					0.257
	Highly incorrect	11 (1.2)	3 (0.7)	8 (1.7)	
	Somewhat incorrect	46 (5)	18 (4.1)	28 (5.9)	

	Somewhat correct	342 (37.4)	172 (39)	170 (35.9)	
	Highly correct	515 (56.3)	248 (56.2)	267 (56.4)	
Screen Time					**<0.001**
	≤ 30 min per day	36 (3.9)	20 (4.5)	16 (3.4)	
	1-1.5 hours per day	150 (16.4)	97 (22)	53 (11.2)	
	2-3 hours per day	350 (38.3)	169 (38.3)	181 (38.3)	
	4-6 hours per day	297 (32.5)	123 (27.9)	174 (36.8)	
	7-9 hours per day	61 (6.7)	29 (6.6)	32 (6.8)	
	>10 hours per day	20 (2.2)	3 (0.7)	17 (3.6)	
Smoking					0.436
	No, never	715 (78.2)	352 (79.8)	363 (76.7)	
	Sometimes	169 (18.5)	74 (16.8)	95 (20.1)	
	Daily	30 (3.3)	15 (3.4)	15 (3.2)	
Alcohol					**0.008**
	Never	256 (28)	104 (23.6)	152 (32.1)	
	Once per month or less	378 (41.4)	203 (46)	175 (37)	
	2-4 times per month	265 (29)	127 (28.8)	138 (29.2)	
	2-3 times per week	12 (1.3)	7 (1.6)	5 (1.1)	
	4 times or more per week	3 (0.3)	0	3 (0.6)	
Sleeping status					**0.004**
	Yes, absolutely enough	55 (6)	17 (3.9)	38 (8)	
	Yes, normally enough	350 (38.3)	158 (35.8)	192 (40.6)	
	No, somewhat insufficient	347 (38)	176 (39.9)	171 (36.2)	
	No, clearly insufficient	96 (10.5)	59 (13.4)	37 (7.8)	
	No, far from sufficient	66 (7.2)	31 (7)	35 (7.4)	
Fathers education					0.827
	Don`t know	262 (28.7)	125 (28.3)	137 (29)	
	Primary school, 9 years	79 (8.6)	38 (8.6)	41 (8.7)	
	Occupational high school	167 (18.3)	74 (16.8)	93 (19.7)	
	High school	114 (12.5)	60 (13.6)	54 (11.4)	
	College less than 4 years	122 (13.3)	59 (13.4)	63 (13.3)	
	College 4 years or more	170 (18.6)	85 (19.3)	85 (18)	
Mothers education					0.053
	Don`t know	235 (25.7)	99 (22.4)	136 (28.8)	
	Primary school, 9 years	53 (5.8)	25 (5.7)	28 (5.9)	
	Occupational high school	115 (12.6)	68 (15.4)	47 (9.9)	
	High school	139 (15.2)	61 (13.8)	78 (16.5)	
	College less than 4 years	158 (17.3)	81 (18.4)	77 (16.3)	
	College 4 years or more	214 (23.4)	107 (24.3)	107 (22.6)	

3.1.2 Perceived health

Most of the adolescents in the material seem to perceive their health as good (73.5%). Even though a slightly higher proportion of the girls (75.3%) than the boys (71.9%) perceived their health as good, the gender difference was not significant ($p > 0.05$). However, frequency distribution of the original variable perceived health (table 7) revealed some differences.

Before dichotomizing the variable, perceived health was significantly different between girls and boys (p = 0.009). Boys (27.3%) more often than girls (20.4%) perceived their health as excellent, whereas girls (54.9%) more often than boys (44.6%) perceived their health as good. Only small differences between the genders were observed in the lower scale (very bad and bad) of perceived health.

Table 7: Distribution of the original variable perceived health against gender

Variable	**Total Sample (*n* = 914)**	**Girls (*n* = 441)**	**Boys (*n* = 473)**	**Gender differences *(p)***
Perceived health	***n* (%)**	***n* (%)**	***n* (%)**	0.009
Very bad	6 (0.7)	1 (0.2)	5 (1.1)	
Bad	45 (4.9)	24 (5.4)	21 (4.4)	
Neither good nor bad	191 (20.9)	84 (19)	107 (22.6)	
Good	453 (49.6)	242 (54.9)	211 (44.6)	
Excellent	219 (24)	90 (20.4)	129 (27.3)	

3.1.3 Habits of leisure time physical activity

In total, almost 80% of the adolescents engaged in some level of leisure time physical activity. There was significant differences (p<0.001) between male and female students regarding habits of leisure time physical activity (Table 6). Boys were far more sedentary than girls, but also higher represented in the very active group. A substantially larger proportion of girls (≈ 40%) than boys (25%) reported to be somewhat active and they also more frequently reported to be active.

3.2 Leisure time physical activity and perceived health

3.2.1 Unadjusted model

Table 8 presents the unadjusted association between perceived health and leisure-time physical activity. The table also presents the frequency distribution of perceived health against each levels of physical activity for girls and boys.

Compared with being sedentary, being somewhat active was not significantly associated with perceived health for either girls or boys. However, being active and very active was significantly associated with perceived health for both boys and girls before adjusting for potential confounders. For the very active girls the odds of perceiving health as good was 9,2 times higher than the odds of perceiving health as bad (p<0.001), compared with being sedentary. Among very active boys the odds ratio in favor of good health was 7,5 (p<0.001), compared to sedentary boys. The frequency distribution of girls` and boys` perceived health against the different levels of physical activity reveals the same pattern; more of the active adolescents perceived their health as good compared to their sedentary peers. Conversely, more of the sedentary adolescents perceived their health as bad compared to their active peers.

Table 8: Logistic regression with good perceived health as dependent variable, including frequencies of perceived health against leisure time physical activity

Gender	Leisure time physical activity (LTPA)	Perceived health *n* (%)		Odds Ratio (OR)	*P*	95% CI
		Bad	Good			
Girls	*Sedentary*	25 (22.9)	38 (11.4)	1		
	Somewhat active	61 (56.0)	115 (34.6)	1.24	0.476	0.69 – 2.24
	Active	18 (16.5)	109 (32.8)	**3.98**	**<0.001**	**1.96 – 8.09**
	Very active	5 (4.6)	70 (21.2)	**9.21**	**<0.001**	**3.26 – 26.01**
Boys	*Sedentary*	65 (48.9)	76 (22.4)	1		
	Somewhat active	42 (31.6)	75 (22.1)	1.53	0.098	0.92 – 2.52
	Active	15 (11.3)	92 (27.1)	**5.25**	**<0.001**	**2.77 – 9.93**
	Very active	11 (8.3)	97 (28.5)	**7.54**	**<0.001**	**3.72 – 15.28**

3.2.2 Adjusted model

Table 9 presents the results of the logistic regression model after adjusting for potential confounders. Compared with being sedentary, being active or very active remained significantly associated with good perceived health for both girls and boys. However, the strength of the relationship weakened somewhat more among girls than among the boys after including the covariates. The strongest association with perceived health was found for those who were very active, which was evident for both girls (p = 0.002) and boys (p <0.001).

Compared with being sedentary, very active girls had an odds ratio of 5.9 in favor of perceiving health as good. For the active girls, the odds of perceiving health as good was 2,7 times higher than the odds of perceiving health as bad, compared to sedentary girls (p = 0.013). Very active boys had an odds ratio in favor of perceiving health as good of 5,4, compared their sedentary male peers (p <0.001). Active boys had a 4,2 times higher odds of perceiving health as good than the odds of perceiving health as bad (p <0.001), compared to sedentary boys.

Table 9: Logistic regression with good perceived health as dependent variable

Gender	Variable	Odds Ratio (OR)	*P*	95% CI
Girls	*LTPA*			
	Sedentary	1	<0.001	
	Somewhat active	1.04	0.900	0.55 – 1.98
	Active	**2.66**	**0.013**	**1.23 – 5.76**
	Very active	**5.86**	**0.002**	**1.95 – 17.66**
	Chronic disease	0.70	0.175	0.42 – 1.17
	Chronic pain	0.65	0.117	0.38 – 1.11
	Sleep	0.78	0.055	0.61 – 1.00
	Screen time	0.85	0.211	0.67 – 1.09
	Smoking	0.72	0.172	0.45 – 1.16
	Alcohol	1.15	0.434	0.82 – 1.61
	BMI			
	Normal weight	1	0.105	
	Underweight	0.64	0.345	0.25 – 1.62
	Overweight/obese	**0.57**	**0.041**	**0.33 – 0.98**
	Have many friends	1.11	0.580	0.76 – 1.64
	Mothers education	0.99	0.985	0.86 – 1.16
	Fathers education	1.14	0.098	0.98 – 1.33
Boys	*LTPA*			
	Sedentary	1	<0.001	
	Somewhat active	1.38	0.251	0.80 – 2.36
	Active	**4.17**	**<0.001**	**2.09 – 8.32**
	Very active	**5.44**	**<0.001**	**2.52 – 11.75**
	Chronic disease	**0.60**	**0.050**	**0.36 – 1.00**
	Chronic pain	0.67	0.157	0.38 – 1.17
	Sleep	**0.70**	**0.003**	**0.56 – 0.89**
	Screen time	**0.76**	**0.026**	**0.60 – 0.97**
	Smoking	0.66	0.075	0.42 – 1.04
	Alcohol	1.05	0.735	0.78 – 1.43
	BMI			
	Normal weight)	1	0.062	
	Underweight)	0.85	0.686	0.39 – 1.87
	Overweight/obese)	**0.53**	**0.018**	**0.31 – 0.90**
	Have many friends	**1.43**	**0.035**	**1.02 – 1.99**
	Mothers education	0.99	0.954	0.86 – 1.15
	Fathers education	1.01	0.896	0.87 – 1.18

Figure 1 illustrates gender-specific odds of having good versus bad perceived health for the different levels of leisure time physical activity. Boys seem to have the largest profit of improving perceived health if moving from being somewhat active to getting active. For girls the highest increase in odds ratio in favor of better perceived health was observed between the active level and the very active level. For both girls and boys higher habitual level of leisure time physical activity seem to result in better perceived health.

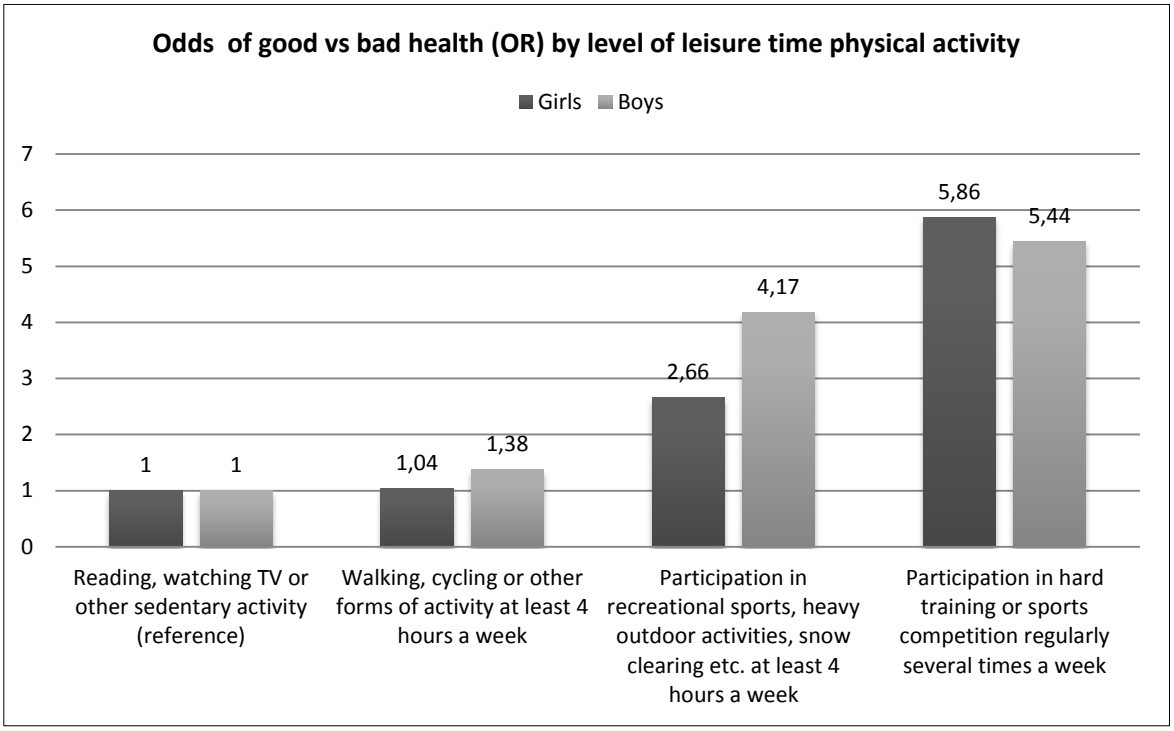

Figure 1: Odds ratio in favor of good perceived health by gender and different levels of leisure time physical activity

4 Discussions

4.1 Main findings

The results from this thesis demonstrate a significant association between habits of leisure time physical activity and perceived health among 15-18 year old adolescents. For both genders, the odds ratio in favor of perceiving health as good increased with increasing level of leisure time physical activity reported. The findings were significant even after adjusting for potential confounders.

4.1.1 Perceived health

Not surprisingly, the findings in this thesis show that most students perceive their health as good. This corresponds with previous studies investigating perceived health among adolescents [25, 37, 41, 71]. No significant gender difference in perceived health was observed ($p>0.05$). Previous studies on adolescents have found that girls typically reports significantly lower ratings of health than their male peers [25, 37, 41]. The dichotomy of perceived health is probably a reason that this was not found in this thesis. Dichotomizing perceived health naturally precludes the possibility to differ between "good" and "very good" perceived health. Other studies have included all response alternatives in their analyses, thus being able to capture responses in all different categories of perceived health. As shown by Nesheim and Haugland, only the highest rating of health ("very good") was more frequently reported among 15-year old boys (31%) compared to their female peers (14%), while ratings of "good" was more frequently rated among girls (70%) than among boys (60%)[41]. The same pattern was found by Vingilis and colleagues; a higher proportions of girls reported to have "good "and "very good" self-rated health, while boys more frequently reported "excellent" self-ratings of health [37]. When examining the original variable, similar patterns were also seen in this thesis. Frequency distribution of this variable (table 7) revealed that boys more often than

girls perceived their health as "excellent", whereas girls more often than boys perceived their health as "good". Therefore, it seems that the higher proportion of girls reporting "good" perceived health in this population might have outweighed the higher proportion of boys who reported "excellent" health when dichotomizing the variable.

4.1.2 Habits of leisure time physical activity

In total, almost 80% of the adolescents in the eligible material reported to engage in some physical activity during their leisure time. This is quite similar to the results found by Nesheim and Haugland [41], and somewhat higher than what was observed in the Norwegian report from the HBSC survey [6]. On the other hand, more than 20% of the total sample reported to be sedentary. These numbers were higher than expected, as previous findings from Nordic studies have found somewhat lower frequencies of sedentary behavior [11, 41, 76].

Not surprisingly, significant gender differences were observed regarding level of leisure time physical activity, and as expected boys more often than girls claimed to be very active. This is in compliance with prior studies investigating level of physical activity among Norwegian adolescents [6, 12, 55], although one study did not find any gender difference among 15-year olds [13]. The most evident gender difference in this thesis was observed in the sedentary category, where 30% of the boys reported to be compared to less than 15% of the girls. In fact, this was the most frequently reported category among boys, while among girls it was the least frequently reported category. This is somewhat surprisingly as other Norwegian studies have found adolescent girls to be more sedentary than their male peers[12, 41]. Part of the contradictory findings related to habits of physical activity may be attributed to different methods or questions used when assessing leisure time physical activity. For instance, Klasson-Heggebø[12] assessed leisure time physical activity objectively by use of accelerometer, while Nesheim and Haugland[41] used one question which considered the frequency (how many times a week) of leisure time physical activity.

4.1.3 Leisure time physical activity and perceived health

A clearly positive association between habits of leisure time physical activity and perceived health was found in this thesis. For both boys and girls, the odds of perceiving health as good was significantly higher than the odds of perceiving health as bad when being active and very active, compared to being sedentary. However, the size of the effect and the significance level of the association differed somewhat between girls and boys. The difference was most evident for those who were active, where the odds ratio in favor of perceiving health as good was 2.7 for girls and 4.2 for boys, compared to those who were sedentary. Nevertheless, for both genders the odds ratio in favor of perceiving health as good exceeded 5 when being very active compared to being sedentary, with a slightly higher odds ratio found among the girls in this group.

Few previous studies have investigated the relationship between leisure time physical activity and perceived health among adolescents. However, the findings in this thesis support the limited scientific knowledge within the topic. For instance, Nesheim and Haugland, who investigated the association between leisure time physical activity and perceived health among Norwegian 11-, 13- and 15-year olds found similar results using data from the HBSC study 1997/1998. After adjusting for age and gender, they found that 15-year olds who were physical active 2-3 times a week and those who were physical active >4 times a week had 2 (CI 1.6-2.6) and 3.8 (CI 2.9-5.0) times higher odds, respectively, of rating their health as good compared to those who engaged in physical activity only once a month or less[41]. Using data from the Spanish part of the HBSC study 2006, Galàn and colleagues found that increasing the frequency of moderate-to-vigorous physical activity was significantly associated with better self-rating of health among Spanish adolescents, and a stronger association was found among boys than among girls[71]. In addition, they found a dose-response relationship between physical activity and self-rated health, where the positive effects on self-rated health increased

with higher frequencies of physical activity with a significant association found already among those who reported the lowest frequencies of physical activity. However, as these two studies used question referring to frequency (number of times) of leisure time physical activity, comparison should be made with caution. Other studies have also shown a positive association between sports participation and self-rated health, as well as between exercise and self-rated health [68, 69;25].

The question used in this thesis has a cut-off point at 4 hours a week between being sedentary and being somewhat active, in which the latter are considered as a moderate category of physical activity. However, there was no significant association between being somewhat physically active during leisure time and perceiving health as good in this thesis. Thus, the results indicate that this cut-off point is not sufficient for adolescents to experience any better perceived health compared to being sedentary. Only those with habits of leisure time physical activity equivalent to the two highest categories rated their health significantly better compared to their sedentary peers. Nevertheless, the findings do in accordance with the findings from the abovementioned studies, imply that the likelihood of perceiving health as good increases with increasing levels of leisure time physical activity for both female and male adolescents (see figure 1). This trend supports the known dose-response relationship regarding health benefits from regularly physical activity [43]. However, an important difference to this should be noticed. Instead of no lower dose limit found for general health benefits of physical activity, the results in this thesis indicates a lower limit of at least 4 hours a week of recreational sports (the active level) to have significant gains in terms of better perceived health. One explanation to this might be that perceived health is a highly subjective matter, influenced by several other aspects besides physical activity during leisure time. In addition, most of the adolescents in this sample perceived their health as good, indicating a relatively

healthy population, whereas the general health benefits from low doses of physical activity are most often seen among more unhealthy people.

Irrespective of the relationship between habits of leisure time physical activity and perceived health shown in this thesis, the general health benefits from regularly physical activity are undisputable. Regularly physical activity has been found to reduce the risk of many physical [9, 43, 44] as well as mental health problems [9, 46-48]. Based on the knowledge of the broad set of health dimensions embedded in the single item perceived health, which includes both qualitative (e.g. well-being) and quantitative (morbidity and mortality) aspects of health, the strong association between leisure time physical activity and perceived health found in this thesis supports the well-documented positive health effects from regularly physical activity. That is, engaging in recreational sports (the active level) and hard exercise or sports competition (the very active level) at least 4 hours a week may pose a substantial improvement on adolescents overall health status. However, it should be stressed that more than 50% (those being sedentary and somewhat active) of the total study sample did not engage sufficiently enough in leisure time physical activity to experience any significantly improvement in perceived health. At the same time trends in physical activity levels among adolescents in Norway the past years show that only 50% of 15-year olds comply with the Norwegian recommendations of at least 60 minutes of daily moderate to vigorous physical activity [12, 13]. As such, the results in this thesis should emphasize the importance of these recommendations with regard to the government's focus on physical activity as an important public health investment.

Bad perceived health is connected to increased demand for health care among adults [19]. Little is known about whether the positive association between physical activity and perceived health shown in this thesis remains into adulthood. However, it is known that adolescents who engage in physical activity are more likely to be physically active as adults, compared to their

inactive peers [32, 52, 53]. Assuming that the positive association found among adolescents in this thesis remains into adulthood, physical activity may not only contribute to the benefit of adolescents` overall health; it may also contribute in reducing the national health care costs as a result of less demand for health care in the future. After the initiation of the Coordination Reform (Samhandlingsreformen) giving more responsibility to the municipalities, this may result in fewer patients in need of healthcare from local authorities and accordingly reduced costs for the municipalities. However, this is merely assumptions and more research on the topic is needed in order to find out if this might be a realistic scenario.

An interesting aspect of the results is the observed gender difference in the association between leisure time physical activity and perceived health. While Galàn and colleagues[71] found boys to have consistently higher odds ratio in favor of perceiving health as good compared to girls for all levels of physical activity, the results from this thesis revealed something else. Except from the highest level of leisure time physical activity, girls in this sample were generally more physical active than boys. However, girls who reported to be very active were found to have a higher odds ratio than boys in favor of perceiving health as good, compared to their sedentary peers. In other words, the only category where girls were less represented in leisure time physical activity than the boys was the only category where they at the same time had a higher odds ratio than boys in favor of perceiving health as good. A closer look at the regression analyses might give an explanation to this. In the unadjusted logistic model, girls reporting to be in the highest level of leisure time physical activity had a higher odds ratio (OR 9.2) in favor of perceiving health as good than their male peers with the same activity level (OR 7.5). This stronger association among girls almost disappeared after including the covariates. However, more of the covariates were significantly associated with perceived health among the boys. For girls, only BMI (overweight/obese) was significantly associated with perceived health apart from leisure time physical activity. For boys on the

other hand, BMI (overweight/obese), having insufficient sleep, chronic disease and spending more time in front of a screen during weekdays were negatively associated with perceived health. In addition, having many friends was positively associated with perceived health among boys. Therefore, it seems like participation in high levels of leisure time physical activity have a greater importance in girls` perceived health than for boys.

Among girls body image has been shown to be more important in relation to perceived health in this age group compared to boys [38]. Increased self-perception and self-efficacy are also shown to be associated with physical activity among adolescents [11]. As normal weighted girls are more likely to be satisfied with their body compared to overweighted/obese, this may also explain the significance of BMI in relation to perceived health among the girls. As such, the higher odds ratio in favor of perceiving health as good among the very active girls might have been mediated through the importance of improved body image and self-perception, despite that a smaller proportion of girls than boys reported to be in this category of leisure time physical activity.

Three of the covariates that were significantly associated with perceived health among boys, namely BMI, having many friends and time spent in front of a screen during weekdays, were also significantly associated with habits of leisure time physical activity for the total sample (see Appendix 2). These variables might have been more important for boys` participation in leisure time physical activity than for the girls. Especially for the boys who participate in sports, friends is most likely an important part since this has been connected to higher social status [21]. This may be the reason why friends were more important for their perceived health than it was for girls. Regarding BMI, overweight boys are most likely less engaged in sports, thus influencing perceived health negatively both as a result of less physical activity and lower social status among their peers. In addition, since the boys spent more of their leisure

time in front of a screen, this might have influenced both leisure time physical activity and perceived health negatively.

However, even though leisure time physical activity seems to be more important for girls` perceived health than for boys, the results suggest that girls in general need engage in a higher level of physical activity in their leisure time than boys in order to reach the same improvement in perceived health compared with being sedentary. This is also in accordance with Galàn and colleagues[71], who suggested the same from their findings.

4.2 Methodological considerations

4.2.1 Design

The Fit Futures survey is a cross-sectional study, which is suggested to be the study of a *"geographically defined, representative sample of the population studied within a slice of time and space"* [77 p. 297]. Since the Fit Futures survey investigated the health among a defined population (adolescents) from a defined geographical area (the municipalities of Tromsø and Balsfjord) during a short time frame (from September 2010 until April 2011), it meets this ideal criterion of cross sectional study designs. Cross-sectional designs are suitable for seeking associations, which was the aim of this thesis. However, the nature of the cross-sectional design precludes the possibility to provide information about causal interference [75], which is a major limitation of this thesis. That is, the results do not tell us the direction of the association between perceived health and leisure-time physical activity. It might be that those with poorer perceived health tend to engage less in leisure time physical activity, and not the other way around. Idler and Benyamini highlights this issue in their review of self-rated health and mortality, where they found several examples suggesting that adults with poor self-rated might engage less in preventive actions and self-care[2]. This pattern may also have been

present among boys in this sample, as variables such as screen-time during weekdays and BMI was significantly associated with both perceived health and physical activity.

Another aspect to consider in the use of data from a cross-sectional survey is the fact that adolescence is a period of time characterized by radical physical and psychosocial changes [21]. Even though the study sample has about the same age, there might be large differences within the sample regarding pubertal maturity. For instance, those with early and late pubertal maturing have shown to score higher in depression symptoms compared to their peers with "on time" maturing [30], and this might have affected the adolescents perceived health. In this thesis, differences in maturity are not taken into account. Due to the cross-sectional nature of the Fit Future survey, one cannot rule out the possibility that differences in the maturity of the adolescents in this material might have confounded the results.

4.2.2 Statistics

In this thesis I chose to perform most of the statistical analyses separately by gender. This enabled comparisons between boys and girls in the descriptive analyses regarding perceived health and habits of leisure time physical activity. Moreover, it gave a more nuanced overview of the association between leisure time physical activity and perceived health, as it gave a visual insight of the difference between the genders. From a methodological point of view, it also omitted gender as a potential confounder. However, due to the decreased sample size in each group, this may have weakened the statistical power of the results.

As discussed previously, dichotomizing the dependent variable precluded the possibility to capture differences in ratings of perceived health in the descriptive analyses. That is, some information regarding gender differences in perceived health may have been lost. However, according to Manor and colleagues, dichotomizing perceived health for the purpose of using logistic regression does not affect the results compared to using other statistical methods

where the ordered nature of the variable is kept[78]. Thus, it is not reason to believe that the results of the main analysis should have been distorted by this method.

A potential weakness of the results is the use of odds ratio as effect measure in the logistic regression analysis. It has been suggested that odds ratio is not comparable across gender if the prevalence of exposure (i.e. physical activity) differ between the two groups [77 p. 253]. Since habits of physical activity differed significantly between girls and boys in this material, this may have influenced the results. However, the comparison of odds ratio across gender in this thesis is not statistically tested, only interpreted by a visual imaging. Even though this may not provide any accurate picture of the gender differences in the association between physical activity and perceived health, it gives an overall image of the differences.

Entering the covariates as continuous variables is a discussed issue in regression analysis. Preferably, categorical variables should be treated in their original form. However, the purpose of including the covariates was adjusting for potential confounders and entering them as continuous variables gives an overall picture of the trend of these variables in relation to perceived health.

4.2.3 Internal and external validity

Two important questions have to be considered when evaluating the results of a study: (1) is the study measuring what it was intended to measure (i.e. is it believable?) and if it is, (2) are the results generalizable to the target population (i.e. the general adolescent population)? Both of these questions relates to the validity of the study, the former representing the internal validity and the latter representing the external validity of the study [79]. This section discusses both according to the aims and methods used in this thesis.

Delgado-Rodriguez et al. [80 p. 635] defines the concept of bias as *"the lack of internal validity or incorrect assessment of the association between an exposure and an effect in the target*

population". It is worth mentioning that in cross-sectional study designs the terms "exposure" and "effect" should be used with caution, as the sequencing of the two are not possible to assess [81]. Nevertheless, errors and biases represent a potential threat to the internal validity in observational studies and they are commonly divided into three main groups: (1) selection bias, (2) information bias and (3) confounding [77].

4.2.4 Selection bias

Selection bias arises from the choice of the study population, and leads to a distortion of the results as a result of how the participants are included or recruited to the study [75 p. 272]. Due to the voluntary nature of cross-sectional studies, participation is virtually never 100%. When people chosen for a study do not participate, a type of selection bias called non-response bias occurs [77]. Since the decision to take part or not is not random, the risk of non-response bias is always present in these studies. However, such bias can be reduced with high response rates, as well as by collecting as much information as possible about non-participants so that comparison between them can be done [82].

Non-response bias may threaten the internal validity because non-responders are likely to differ from responders [77]. Factors such as male sex, younger age, lower socioeconomic status and problems with alcohol and drugs have been associated with non-response in cross-sectional studies [82]. If any of these factors are associated with either the exposure (i.e. physical activity) or the outcome (i.e. perceived health) in this thesis, selection bias is likely to be present. As the results in this thesis revealed that socioeconomic status (i.e. parental education level) was highly associated with level of physical activity, this might have contributed to biased results if those who did not participate differed from those who participated regarding their parents` educational level. It is not reason to believe that gender and age should have biased the results in this thesis, since the age of the total sample was

similar (16.1, ±0.49) and because boys were slightly overrepresented among those who participated.

Another aspect to consider is that non-responders are more likely to be sick or have a disease than those who choose to participate [82]. If this is the case among those who did not participate in this study, it may have affected the results by an underestimation of those with chronic disease or chronic pain. Neither of these two variables was associated with physical activity. However, crosstabs analyzing these variables against perceived health revealed that they were significantly associated with perceived health. As such, this might have been a source of selection bias.

Because no information about the non-participants was available for the Fit Futures study, comparisons between non-responders and non-responders were not possible. In conclusion, this means that one cannot rule out the possibility of selection bias in this thesis, as responders and non-responders may have differed in some of the important characteristics. However, due to the high participation-rate of the Fit Futures survey (92%), it is should be reasonable to assume that this did not cause any large impact on the results.

4.2.5 Measurement bias (Information bias)

Measurement errors or biases belong to the category of information bias, and are especially common and important in epidemiological studies due to their subjective nature, where judgments from the study participants trough self-reports are often required [77]. Measurement bias results from incorrect determination of either exposure or the outcome, or both of them [79 p.249]. Thus, measurement bias relates to the way the information used in the study is gathered. Such biases occur as a result of erroneous measurement when an individual is put into the wrong category (misclassified) and can be either random or systematic [77]. Random measurement errors are typically referred to as non-differential misclassification bias, while

systematic measurement errors are referred to as differential misclassification bias [77]. Misclassification is a most relevant issue when measuring a complex behavior such as physical activity or a subjective matter like perceived health. For instance, self-reports of physical activity using questionnaires have been associated with response biases from recall problems and a tendency to overestimate the amount of activity [57, 59].

4.2.5.1 Validity of perceived health assessment

A crucial issue to consider in measuring health status is how suitable the measure is for the purpose it is meant to be used. Of course, the validity is always important. However, different methods may be equally good, depending on the purpose and the design of the study. In this regard, Ware points out three key aspects important to consider: (1) the practicality, (2) the reliability and (3) the validity of the measure[83]. In terms of the practicality, measures of perceived health are commonly obtained from self-administered questionnaires, which are easily applied to large studies, require relatively small resources, are time saving and represent a small burden for the subjects. Unfortunately, the favorable practicality compromises both the reliability and the validity of the assessment. The reliability of single-item measures like perceived health may be poorer compared to multi-item scales [83], thus representing a potential weakness of the assessment of perceived health in this thesis. However, using several items represent a higher burden for the respondents, which may increase the number of non-response in large surveys [84]. As mentioned above, validity of a measure indicates to which extent the instrument is able to measure what it is meant to measure. Perceived health is proved to be a multidimensional measure, encompassing several aspects of people`s subjective assessment of health. Thus, when investigating factors affecting adolescents overall health status, perceived health should be a suitable choice. Ware[83] also highlights the advantage of using perceived health because of its positive oriented view of

health, as opposed to physiological measures of health which is often negatively oriented and mainly focuses on limitations in people`s health.

As with any self-reported data one cannot rule out the possibility of reporting bias, as adolescents most likely emphasize different aspects of their health when answering the question. However, for the purpose of this thesis one might conclude that the validity of the assessment of perceived health seems to be sufficient, even though the reliability might be somewhat poor.

4.2.5.2 Validity of physical activity assessment

Physical activity is a complex behavior, which makes it a complicated task to quantify. This is also the reason why so many different methods and techniques have been developed for assessing physical activity and energy expenditure [56]. As seen previously, these methods includes both objective (Doubly Labelled Water Method, calorimetry, heart rate- and motion monitors) and subjective (direct observation, questionnaire/self-report, interview and diary) assessments. Due to the practicality, cost-effectiveness and low participant burden of using self-administered questionnaires [57, 58], this has been the most common method for assessing physical activity in epidemiological studies such as Fit Futures. However, for assessing physical activity this method has its disadvantages related to recall errors, misinterpretations and social desirability [57]. The question used in this thesis was initiated for use among men about 45 years ago by Saltin and Grimby [85], and further developed for self-report by Wilhelmsen et al. [86]. Since then the question has been widely used in several epidemiological studies [87-89], including the Tromsø Study (www.tromsostudy.com).

For children and adolescents, direct observation has been suggested to be the best criterion standard for validating physical activity and this method has shown high correlation with direct measurements like oxygen uptake and heart rate [57]. However, these methods are

expensive and unpractical for use in epidemiological studies. Therefore, secondary objective measures like heart rate monitors, accelerometers and motion sensors are considered as more appropriate criterion standards for validating subjective measures of physical activity [57]. Since accelerometers may capture both frequency, duration and intensity of physical activity [60], validating the question against this might also give an indication of whether it captures the total volume of the measured physical activity.

A recent study by Emaus and colleagues [74], using data from the sixth Tromsø study validated the same self-reported leisure time physical activity question used in this thesis against objectively measured physical activity (accelerometer), resting heart rate, and physical fitness (VO_{2max}). To be comparable with the self-reported data, the accelerometer was categorized by intensity based on validated cut-off values of activity counts according to the different levels of self-reported leisure time physical activity [74]. They found the self-reported leisure time physical activity question to positively correlate with leisure time physical activity measured with accelerometer among males and females aged 40-44 years. In addition, they found a strong positive association with VO_{2max} and a negative correlation with resting heart rate. Using the same instruments, they also measured the proportion of participants who met the national recommendations for physical activity for adults. As such, they were able to compare the proportion of participants who met these recommendations across the different methods of leisure time physical activity assessment. These results showed a clearly higher proportion meeting the recommendations according to self-reported leisure time physical activity (level 2-4) compared to the proportion according to accelerometer (counts/min ≥30 min/day of moderate to vigorous physical activity and steps per day >10 000). These findings indicate, as expected, that the self-reported leisure time physical activity question used in this thesis probably overestimates the actual level of leisure time physical activity. However, an overestimation of physical activity will most likely underestimate the real effects of physical

activity on the outcome (i.e. perceived health), which implies that the association with perceived health may be even stronger than found in the results. In addition, this thesis has a relatively large sample size, which is suggested to reduce problems resulting from imprecise classification, thus allowing demonstration of physical activity-related benefits of improved health as well as reduced morbidity and mortality [59].

Despite that this thesis is based on data among adolescents, it should be reasonable to assume that the assessment of leisure time physical activity does not pose any large threat to the internal validity in the results of this thesis.

4.2.6 Confounding

The word confounding has its origin from a Latin word meaning "to mix together", which is close to the everyday meaning of the word," to confuse" or "puzzle" [77 p. 93]. Confounding is a complex matter, and perhaps the most difficult to grasp among potential errors. In epidemiology, Bhopal [77 p.93] defines confounding as *"the error in the estimate of the measure of association between a risk factor and disease, which may arise when there are differences in the comparison populations other than the risk factor under study"*. If confounding is present the observed association may represent a correlation between any variable and the outcome, rather than between the exposure of interest and the outcome [90]. This of course represents a major problem, as the association then in reality may have a completely different explanation than what is observed in the results.

There are mainly two ways of reduce confounding in observational studies: (1) restriction or matching in the design and (2) adjustments in the statistical procedure by stratification or multivariable techniques [81]. Both these methods require the confounders to be known and measured. Unfortunately, this was not possible for this thesis. In addition, due to the cross-sectional design and since the data used in this thesis was already collected matching was not

an option. However, restriction in age was performed by excluding students above the age of 18. As such, age is not considered as a confounder in this thesis, which strengthens the internal validity.

Essentially, I had to rely on the multivariate analysis to control for confounders in this thesis. Naturally, the eligible data material with its limited collected variables constrained the available potential confounders. For this thesis, those variables found to be most associated with perceived health and physical activity based on the available literature was chosen. In addition, most analyses were examined stratified by gender, as this is a common confounder and because I was interested in examining gender differences. Still, there are most likely other potential confounders which was either not measured in the Fit Futures survey or not included in this thesis, such as pubertal maturity, body image and dietary habits. Thus, one cannot rule out the possibility that the observed association between perceived health and leisure time physical activity might have be confounded and explained by unknown associations with perceived health. However, the association between perceived health and physical activity remained strong in both genders, even after adjusting for several potential confounders and this ought to favor the internal validity.

4.2.7 External validity

External validity has to do with how well the results obtained from the study population can be generalized to the target population [77]. External validity depends on the internal validity, but does not guarantee internal validity [80]. Thus, it is only relevant to discuss the generalizability if the results are found to be valid. So far I have assessed the internal validity and despite that some errors may be present, the internal validity should not represent a major threat to the results. This last part of the section addresses the generalizability of the results.

Based on the available information regarding methods and characteristics of the study population in the Fit Futures survey, I have strived to give the best description as possible on demographics (age and gender), socio-economic status (parental education level), social status (friends), behavior (physical activity, screen-time, smoking and alcohol) and health status (perceived health and BMI) of the study population. As such, the results should be comparable to the target population within these aspects.

The source population of the Fit Futures survey was adolescents, where all first grade high school students in the two municipalities were invited. Such choice of population is suggested to be fairly representative of their age group [77 p. 90]. As pointed out above, the restriction of the study sample to those aged 15 to 18 years should strengthen the internal validity. On the other hand, this may have compromised the external validity as it precludes extrapolation to target populations with many students above the age of 18. Regarding gender, the study population should be representative. The proportion of girls in the thesis was 48.2%, which is close to the nationwide proportion of girls (50.4%) in high school education in Norway in 2011[91] .

One of the strengths of this thesis is the relatively large study sample eligible for analyses. It is suggested that the sample size should be at least 15 times the number of variables used in the statistical analyses [92]. This paper included 914 subjects and a total of 12 variables. Thus, the sample size in this thesis should be more than large enough according to this criterion. In addition, the participation rate of 92% is a major strength of the study.

5 Conclusions, implications and future research

5.1 Conclusions

In general, adolescents in the municipalities of Tromsø and Balsfjord seem to perceive their health as good. Gender does not seem to play any significant role in this respect.

Most of the adolescents engage in some level of physical activity in their leisure time. However, girls and boys in this sample seem to have different habits of leisure time physical activity. Whereas most of the girls seem to engage in moderate levels of physical activity, more boys seem to be sedentary but at the same time they are also more regularly active in sports and competition in their leisure time compared to girls.

The main finding in this thesis is that leisure time physical activity seems to have a positive impact on adolescents` perceived health, as perceived health increases with increasing amount of leisure time physical activity. However, less than 50% of the total sample was sufficiently physical activity in their leisure time to experience any improved perceived health. The importance of leisure time physical activity on perceived health seems larger for girls than for boys, but at the same time it may look as if girls have to engage in a relatively higher level of physical activity in their leisure time compared to their male peers to achieve the same improvements in perceived health.

5.2 Implications

The results of this thesis should emphasize the role of leisure time physical activity in improving adolescents overall health. This might have a great value from a public health perspective, as perceived health is a predictor of morbidity and mortality and connected to health service attendance in adulthood.

For adolescents to achieve positive impacts on their perceived health it requires habits including at least 4 hours a week of recreational sports or heavy outdoor activities during leisure time, which implies that the present recommendations of at least 60 minutes of moderate to vigorous physical activity per day should still be emphasized as an important part of the Norwegian public health policy.

A relatively large proportion of adolescents are either sedentary or somewhat active in their leisure time, which have no significant impact on perceived health. This implies that more resources should be directed towards facilitation of physical activity in people`s local environment, supporting children and adolescents to choose a more active lifestyle in their leisure time.

5.3 Future research

The direction of the association between leisure time physical activity and perceived health remains uncertain. In order to conclude about causal relationship, longitudinal follow-up studies among adolescents would be necessary. This may also facilitate examining how the association between leisure time physical activity and perceived health remains into adulthood.

Future research should also consider using additional objective assessments of physical activity when possible, like accelerometers. This would allow examining the intensity, frequency and duration of physical activity, which enables more accurate calculation of total volume of physical activity needed for achieving better perceived health. Objective measures are also considered as criterion standards for validating subjective measures of physical activity, which would be useful for upcoming studies within the field.

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Appendix

1. The Fit Futures Protocol
2. Table A: Frequency distribution of all covariates against leisure time physical activity
3. The Fit Futures questionnaire (via link in Questback.com)

Appendix 1

FIT FUTURES

EN DEL AV TROMSØUNDERSØKELSEN

PROTOKOLL 3. SEPTEMBER 2010

Innholdsfortegnelse *Fit futures*

1. Sammendrag

Fit futures er en somatisk helseundersøkelse blant ungdom på første trinn i videregående skole i Tromsø region (Tromsø og Balsfjord kommuner, totalt ca 1100 elever) i 2010-11 Forskergrupper med prosjekter i tidligere Tromsøundersøkelser samarbeider om undersøkelsen. Utvalget i den siste Tromsøundersøkelsen (Tromsø 6) var begrenset nedad til 30 år, og hovedhensikten med denne undersøkelsen er å supplere dette datamaterialet med tilsvarende data fra en yngre kohort. Inklusjon av elever på VG1 legger til rette for oppfølging underveis i den videregående opplæringsperioden foruten ved framtidige befolkningsundersøkelser.

Undersøkelsen inkluderer kartlegging av forekomst og risikofaktorer for kronisk smerte, vitamin D-mangel, diabetes og prediabetes, kolonisering med gule stafylokokker og hudsykdom, lav beintetthet, lavt nivå av fysisk aktivitet og fysisk form, immunologiske reaksjoner mot transgene proteiner fra kosten, jernmangel, øresus, overvekt, miljøgifter i hår og blod, karies, samt frafall og drop-out fra videregående opplæring. Kartlegging av helse og livsstil i overgangen fra barn til voksen åpner for verdifull forskning i forhold til sårbarhet for sykdom og forståelse av sykdomsutvikling. *Fit futures* vil gi økt kunnskap om utsatte grupper og livsløp. Med dette vil forskningen støtte tiltak i forhold til forebygging og tidlig diagnostikk av kronisk sykdom som er et av hovedverktøyene i Regjeringens Samhandlingsreform for å sikre bærekraftig helsetjeneste til befolkningen. Frafall i videregående opplæring er definert som et folkehelseproblem fordi fullført grunnutdanning er et avgjørende utgangspunkt for god helse gjennom livet - *Fit futures* vil gi ny kunnskap om hva som er suksessfaktorene for en god utdanningsbasis.

Tromsøundersøkelsen er Nord-Norges største helseforskningssatsning og har bidratt til å bygge opp sterke medisinske forskningsmiljøer og klinisk spisskompetanse. Ungdom i nord har i liten grad vært del av nasjonale kartlegginger av helse og helseadferd. Studien inkluderer delprosjekter med bred rekruttering til forskning og doktorgradsarbeid fra de kliniske fagmiljøene ved Universitetssykehuset Nord-Norge, samt tverrfaglig samarbeid og kompetanseheving (psykiatri, somatikk, miljømedisin, forebyggende medisin). Undersøkelsen er forankret i solide forskningsmiljøer med mangeårig vitenskapelig erfaring, produksjon og internasjonalt samarbeid. Tilhørighet både til Universitetssykehuset Nord-Norge og Universitet i Tromsø sikrer translasjon av forskningsresultater fra populasjonsbaserte epidemiologiske og bio-medisinske analyser til klinikk og praktiske folkehelsestrategier.

Fit futures er godkjent for gjennomføring ved Forskningsposten, Klinisk forskningssenter, Universitetssykehuset Nord-Norge, høsten 2010/våren 2011. Fylkesutdanningssjefen i Troms og regionsrektormøtet i Tromsø støtter prosjektet, og det er etablert samarbeid med hver enkelt skole. Infrastruktur for gjennomføring av *Fit futures* er finansiert av Universitetssykehuset Nord-Norge HF, Helse Nord RHF, og Det helsevitenskapelige fakultet ved Universitetet i Tromsø.

2. Styringsgruppe og ledelse

Undersøkelsen ledes av en styringsgruppe som består av følgende personer:

- Anne-Sofie Furberg, dr.med. Universitetssykehuset i Nord-Norge (prosjektleder)
- Guri Grimnes, stipendiat, Universitetet i Tromsø
- Christopher Sivert Nielsen, PhD, Nasjonalt folkehelseinstitutt

Styringsgruppen vil lede gjennomføring av datainnsamlingen. Videre vil gruppen ha overordnet myndighet når det gjelder rettigheter til bruk av data. Det lages egne avtaler med prosjekter som deltar i undersøkelsen.

3. Tema og målsettinger

3.1. Delprosjekter
Følgende forskergrupper inngår i studien:

3.1.1. Tromsø Pain Study
Forskergruppe: Audun Stubhaug, dr.med., overlege, Rikshospitalet; Christopher Sivert Nielsen, PhD, forsker, Nasjonalt folkehelseinstitutt; Roger B Fillingim, PhD, Professor, University of Florida, Gainesville; Roland Staud, PhD, professor, University of Florida, Gainesville. Det er p.t. knyttet to post.doc. stillinger og tre stipendiatstillinger til prosjektet, hvor av to er ved Universitetssykehuset i Nord-Norge.

Studien har som overordnet mål å kartlegge forekomst og konsekvenser av kronisk smerte, samt risikofaktorer for utvikling av kroniske smertetilstander. Sentrale lidelser som vil studeres i denne undersøkelsen er Fibromyalgi og Irritabel Tarm Syndrom. Utkommevariable inkluderer symptomer på angst og depresjon, søvnproblemer, medikamentbruk og skolefravær (ungdom) og sykefravær og uførhet (voksne). Av relevante risikofaktorer studeres bl.a. smerteølsomhet, blodtrykksmediert endogen smerteregulering, kjønnshormoner, og kirurgiske inngrep.

3.1.2. Vitamin D in adolescents
Forskergruppe: Rolf Jorde, professor, UNN/UiT; Nina Emaus, dr.scient, UNN; Yngve Figenschau, dr.med, UiT/UNN, Rune Blomhoff, professor, UiO; Guri Grimnes, PhD student, UiT. Det planlegges i første omgang en stipendiatstilling og en post.doc.stilling knyttet til dette prosjektet.

Studien har som overordnet mål å beskrive forekomst av vitamin D mangel hos unge, risikofaktorer for dette, og relasjoner til fysisk og psykisk helse. Fokus vil i første omgang være på skjeletthelse, kroppssammensetning og depressive symptomer. Studien danner grunnlag for longitudinell oppfølging gjennom registerdata eller gjentatte undersøkelser med tanke på å kartlegge betydning av vitamin D status i ung alder for fremtidig somatisk og psykisk helse.

3.1.3. Diabetesscreening i en ungdomskohort
Forskergruppe: Rolf Jorde, professor, UNN/UiT; Inger Njølstad, professor, UiT; Henrik Schirmer, dr.med, UNN; Yngve Figenschau, dr.med, UiT/UNN; Ragnar Joakimsen, dr.med, UNN; Guri Grimnes, PhD student, UiT.

Studien har som overordnet mål å kartlegge forekomst av diabetes, prediabetes og insulinresistens i en ungdomskohort, samt risikofaktorer for dette. Nytteverdien av å bruke HbA1c som screening i ung alder opp mot andre mål på hyperglykemi og insulinresistens vil vurderes. Studien vil også danne grunnlag for langtids oppfølgingsstudier av hvordan livsstilsfaktorer og metabolsk profil i ungdomsårene predikerer utvikling av diabetes definert gjennom Reseptregisteret og NPR.

3.1.4. Tromsø Staph and Skin Study (TSSS)

Forskergruppe: Anne-Sofie Furberg, dr.med., overlege, UiT/UNN; Johanna U Ericson Sollid, professor, UiT; Arnfinn Sundsfjord, professor, dr.med., UiT/UNN; Gunnar Skov Simonsen, professor II, dr.med., UiT/UNN; Hanne Husom Haukland, dr.med., overlege, UNN; Karina Olsen, PhD student, overlege, UiT/UNN; Lars Småbrekke, cand.pharm., UiT; Bjørg Haldorsen, fagbioingeniør, UNN; Kjersti Danielsen, PhD student, lege, UiT/UNN; Gisli Ingvarsson, PhD student overlege, UiT/UNN; Anne Olaug Olsen, dr.med., overlege, Universitetssykehuset Oslo Rikshospitalet; Lennart Emtestam, dr.med., professor, Karolinska Institutet; Anne-Merethe Hanssen, post.doc., UiT; Mona Johannesen, professor, UiT; Raul Primicerio, dr.scient., UiT; Lars Småbrekke, førsteamanuensis, UiT; Pål Haugen, PhD student, UiT.

Gule stafylokokker (*Staphylococcus aureus*) er vanligste årsak til infeksjoner i hud og bløtvev generelt og sårinfeksjoner hos kirurgiske pasienter spesielt, og også en antatt risikofaktor for hudlidelser (eks atopisk eksem). Oftest er det pasientens egen nesebakterie som er årsak til infeksjoner med gule staf. Økt forekomst av antibiotikaresistens krever nye tiltak for å forebygge bærerskap og påfølgende infeksjon. TSSS har som mål å kartlegge den naturlige utbredelsen til gule staf i befolkningen og utforske hvordan forhold hos vert (livsstil, kliniske faktorer, genetisk variasjon i medfødt immunforsvar), mikrobe og miljø fremmer kolonisering og infeksjon. Forekomsten av nesebærerskap antas å være høyest blant ungdom og særlig blant unge menn. Per i dag finnes det imidlertid ingen populasjonsbaserte data for ungdom. Forskergruppen Host-Microbe-Interactions ved UiT gjør genetisk analyse av alle gule staf bakterieisolater i undersøkelsen. Det genetiske kartet for bakteriepopulasjonen vil bli koblet til kart for sosialt nettverk for å studere smittespredning.

3.1.5. TROST (Tromsø Osteoporose Studie)

Forskergruppe: Nina Emaus, PhD, Forsker, UiT; Lone Jørgensen, dr.scient, UiT; Luai Awad Ahmed, dr.med, UiT; Bente Morseth, PhD student UiT; Svanhild Waterloo, PhD student UiT; Guri Grimnes, PhD student UiT; Rolf Jorde, professor, UiT; Nina Emaus, dr.scient, UiT.

TROST har som overordnet mål å kartlegge forekomst av og risikofaktorer for osteoporose og brudd. Beinhelse og bruddrisiko i alderdommen avhenger i stor grad av hvor god beinmasse man bygger opp gjennom oppvekts og ungdomsår. Vi har ingen data på beinmasse fra Tromsøs befolkning under 25 år og lite er også gjort internasjonalt blant unge. I studien måles beintetthet i hoften for å kartlegge beinmasse hos gutter og jenter, samt hvilke livsstilsvariabler og hormoner (Vitamin D, kjønnshormoner) som predikerer beintetthetsnivå.

3.1.6. GenØk-Senter for biosikkerhet - Serologiske reaksjoner på inntak av genmodifisert mat

Forskergruppe: Terje Traavik, dr.philos. forskningssjef, professor II, GenØk/UiT; Bjarne K. Jacobsen, professor, UiT; John Fagan, professor/forskningssjef Genetic ID, Iowa, USA; Kaare M. Nielsen, Professor, UiT/GenØk; Per Brandtzæg, professor, UiT; Martinus Løvik, professor, Folkehelsa/UiT; David Quist, seniorforsker, GenØk/UC Berkeley; Trilochan

Swain, postdoc, GenØk; Camilla Hauge, PhD-student, GenØk; Elisabeth Olsen, ingeniør, GenØk. GenØk/IFA driver allerede beslektede prosjekter i India, Kina, Brasil og Sør-Afrika. Prosjektet inngår i et internasjonalt samarbeidsprosjekt (Gateways-programmet, finansiert av Norad, MD og Norges forskningsråd, samt finansieringskilder i samarbeidslandene). Det er kjent at de to viktigste transgene proteinene som nå er inne i globaliserte mat- og fôrvarer (Bt-toksinet Cry1Ab og Roundup-resistens proteinet EPSPS) kan gi immunologiske reaksjoner, i noen tilfeller ledsaget av kliniske symptomer på for eksempel matallergi og –intoleranse samt reproduktive problemer, i forsøksdyr. Det er ikke publisert noen serologisk baserte undersøkelser av mennesker eller husdyr. Sammen med samarbeidspartnere undersøker vi nå sera fra mennesker, husdyr, og frittlevende dyr mht spesifikke antistoffer mot Cry1Ab og EPSPS, samt sirkulerende cytokiner som kan indikere "uønskede" immunreaksjoner. Serologisk screening av deltagerne i denne ungdomsundersøkelsen kan danne grunnlaget for prospektive studier av immunologiske reaksjoner på transgene matprodukter, og vil i verdensmålestokk representer den første undersøkelse av sitt slag. Den vil, fordi GM mat eksponeringen hittil må antas å ha vært lav i Norge, representere en basislinje for senere undersøkelser av transgene produkters innflytelse på human helse.

3.1.7. Physical Activity among Teenager (PAT) study

Forskergruppe: Inger Thune, dr.med, overlege, Oslo Universitetssykehus, Ullevål; Anne-Sofie Furberg, dr.med., overlege, UiT/UNN; Jorid Degerstrøm, stud.med., studentstipendiat, UiT; Tom Wilsgaard, dr.scient., 1. amanuensis, UiT; Anne-Elise Eggen, dr.scient., 1. amauensis, UiT; Maja Lisa Løchen, professor, dr.med., UiT; Inger Njølstad, professor, dr.med., UiT

Studien vil kartlegge fysisk aktivitet i en ungdomsgruppe ved subjektive (spørreskjema) og objektive målinger (ActiGraph akselerometer: intensitet, frekvens og varighet av bevegelse). Således kan vi se på sammenhengen mellom selvrapportert og objektivt målt fysisk aktivitet, fysisk form/metabolsk profil (blodfettprofil, insulinsensitivitet, kroppssammensetning, blodtrykk) og kroniske sykdommer (eks. brystkreft). Videre vil vi studere determinanter for fysisk aktivitet og fysisk form hos ungdommer og legge til rette for å studere endringer i fysisk aktivitet over tid i befolkningen. Dette vil ha praktisk nytte for forebygging helsearbeid. Forskergruppen har siden 1980-tallet arbeidet med betydningen av fysisk aktivitet og helse i normalbefolkningen (TU og andre) og blant pasienter, med en rekke publikasjoner av fysisk aktivitet i relasjon til biomarkører for kroniske sykdommer, endepunkt kroniske sykdommer og overlevelse.

3.1.8. Miljøgifter i en nordnorsk befolkning

Forskergruppe: Inger Njølstad, professor, UiT; Jan Brox, professor, UNN/UiT; Yngve Figenschau, førsteamanuensis, overlege UNN/UiT; Thorjørn Larssen, forsker, NIVA. Øvrige medarbeidere i Human Health and Environment Research Network: Odd Nilssen, Jon Øyvind Odland, Arild Vaktskjold, Anne-Sofie Furberg, Tormod Brenn, Maria Averina, Alexei Kalinin (Arkhangelsk), Ole Fuskevåg, Lars Otto Reiersen, Salve Dahle, Tatiana Savinova, Anita Evenseth, Guttorm Christensen, Thorjørn Larssen, Sigurd Rognerud, Marthe Jenssen, Torkjel Sandanger.

Miljøgifter akkumuleres i næringskjeden, hvor mennesket sammen med andre predatorer er på topp. Nordgående luft- og havstrømmer transporterer industriutslipp fra Vest-Europa og Russland til Nord-Norge og medfører betydelig høyere konsentrasjoner i våre områder enn lengre sør, eksempelvis Sør-Skandinavia. Man vet at forekomsten i marine dyr, fugler og fisk er på et "høyt nivå" i nordlige områder. Derimot er forekomsten av disse stoffene i vår befolkning for en stor del ukjent. De fleste studiene er små og gjelder mor og/eller barn, eller

morsmelk. Avdeling for medisinsk biokjemi, UNN, er i gang med å ta i bruk ny analytisk teknologi (massespektrometri) som vil kunne gi presis informasjon om forekomst av ulike miljøgifter i mennesket, også i svært lave konsentrasjoner. Vi ønsker å kartlegge nivå av miljøgifter i serum og hår og relatere til kjønn, alder, geografi, kosthold, hjerte- og kar risikoprofil og sykdom, kreft risikoprofil og sykdom, hormoner, vitamin D og genetiske faktorer. I Tromsø 6 (voksne) er det lagret serum for analyse av miljøgifter inkl. tungmetaller og hårprøve for analyse av kvikksølv. *Fit futures* vil gi verdifull informasjon om miljøgifter i en aldersgruppe som man hittil ikke har data fra.

3.1.9. Overvekt og fedme

Forskergruppe: Ane Kokkvoll, phd-stipendiat, overlege, Hammerfest sykehus; Sameline Grimsgaard, dr.med. UNN; Inger Njølstad, professor, UiT; Trond Flægstad, professor, overlege, UiT/UNN; Elin Evensen, masterstudent, UiT.

Studien vil kartlegge forekomst av overvekt og fedme i en ungdomskohort definert i forhold til IOFT grenser for kroppsmasseindeks, samt kartlegge overflødig fettmasse målt ved helkropps-skan og bukfett ved økt midjemål. Det vil bli innhentet data fra førskolekontroll (5-6 år) ved helsestasjon fra de samme ungdommene for å studere utvikling av overvekt og fedme i barne- og ungdomsårene. Studien vil undersøke metabolsk profil og risikofaktorer for kronisk sykdom (blodtrykk, kolesterol, blodsukker, insulin) i ulike vektgrupper. Forskergruppen driver prosjektet Aktivitetsskolen blant overvektige barn i Finnmark og Tromsø. I *Fit futures* vil vi studere aktivitets- og kostvaner hos ungdom med overvekt og fedme sammenlignet med normalvektige. Vi vil også studere hva som er bestemmende for fysisk inaktivitet.

3.1.10. Jernbehov og jernmangel i ungdomsalder

Forskergruppe: Trond Flægstad, professor, overlege, UiT/UNN, Ane Kokkvoll, phd-stipendiat, overlege, Hammerfest sykehus.

Ungdomstida har økt jernbehov pga økt blodvolum og økt muskelmasse. Det antas at det er økt forekomst av jernmangel i denne aldersgruppa, spesielt hos de mest fysisk aktive og de med begrenset inntak av kjøtt. Hvilken betydning jernmangel har på symptomer som utholdenhet og læring er ennå ikke fullt ut forstått, men ved alvorlig jernmangelanemi ser en klar bedring av disse parametrene etter jerntilskudd. Risikofaktorer for jernmangel er høy fysisk aktivitet, vegetardiett, underernæring, kronisk sykdom, høy kroppsmasseindeks, store menstruasjonsblødninger. Det anbefales at jenter og gutter i bør screenes i ungdomsårene. Vi vil kartlegge jernstatus og jernmangelanemi i en ungdomskohort ved målinger i blod. Data vil kobles til opplysninger om levevaner og andre utfall (ernæring, trening, skoleprestasjoner osv).

3.1.11. Frafall i videregående opplæring

Forskergruppe: Andrew Kristiansen, Førsteamanuensis, Institutt for lærerutdanning og pedagogikk, HSL-fakultetet, Universitet i Tromsø; Ellen K. Dahl, forsker, Institutt for lærerutdanning og pedagogikk, HSL-fakultetet, Universitet i Tromsø.

Frafall i videregående opplæring er både et samfunnsproblem og et problem for de elever det gjelder. Det er dokumentert en klar sammenheng mellom utdanningsnivå, framtidig tilgang på velferdsgoder og helse. Vi vil innhente informasjon om hvor mange som faktisk vurderer å avbryte utdanningen de er i gang med allerede på undersøkelsestidspunktet. Ved å sammenholde svarene innhentet i undersøkelsen med antall frafall/avbrudd/utsettelse vil vi få

kunnskap om de elever som til tross for å ha overveid å slutte, velger å fullføre. I motsetning til gruppen elever som faktisk slutter / avgryter, er det lite forskning på denne gruppen. Vi vet verken hvor stor den eller hva som kjennetegner disse elevene.

1. 3.1.12. Tinnitus (øresus) og smerte

Forskergruppe: Bo Engdahl, PhD, Professor, Avdelingsleder, Nasjonalt folkehelseinstitutt; Norunn Hjertager Krogh, PhD, post.doc, Nasjonalt folkehelseinstitutt; Christopher Sivert Nielsen, PhD, forsker, Nasjonalt folkehelseinstitutt

Undersøkelsen har som formål å undersøke forekomst av øresus blant ungdom, samt om øresus er vanligere blant personer med kronisk smerte. Kliniske studier at kronisk smertepasienter har svært høy forekomst av øresus, men dette har ikke vært undersøkt i befolkningsundersøkelser tidligere.

2. 3.1.13. Tannhelse

Forskergruppe: Claes-Göran Crossner, professor, Institutt for klinisk odontologi (IKO), Universitetet i Tromsø; Ivar Espelid, professor, leder Tannhelsetjenestens kompetansesenter for Nord-Norge TkNN.

Nasjonale rapporter viser at ungdom i Nord-Norge har dårligere tannhelse enn ungdom ellers i landet. Klinisk odontologisk forskning basert på befolkningsundersøkelser er svært relevant for å forstå forskjeller i tannhelse og utvikling over tid. tannhelseundersøkelse i *Fit futures* – en del av Tromsøundersøkelsen. Tannhelseundersøkelsen i *Fit futures* vil kartlegge objektivt vurdert oral helse (tenner og tannkjøtt), egenhygiene, holdninger til egenhygiene, egenvurdert tannstatus/utseende av tenner og tannlegeangst i en generell ungdomspopulasjon. Dette vil være basis for studier av oral helse og allmenn helse, medisinering, sosioøkonomi, kostvaner, fysisk aktivitet, kunnskap og holdninger, ungdommenes selvfølelse og sosiale nettverk, smerteføl somhet, uro/angst og tannlegeskrekk. Tannmodeller og kliniske foto vil bli bruk til prospektive studier av endringer i tannstatus over tid.

3.2. Synergieffekter

Selv om de ulike delprosjekter representerer fagområder av relativt forskjellig art, er det betydelig mulighet for synergieffekter mellom faggruppene. Eksempelvis er mål på fysisk aktivitet og fedme av betydning for nær sagt alle prosjekter, kjønnshormoner er av betydning for osteoporose og smerte, og D-vitamin mangel er assosiert med økt forekomst av muskel/skjelettsmerte, diabetes, samt økt risiko for infeksjoner og hudlidelser. Styringsgruppen oppfordrer til denne typen tverrfaglig samarbeid.

3.3. Relasjon til Tromsøundersøkelsen

Fit futures er en utvidelse av Tromsøundersøkelsen som er godkjent av REK Nord, Datatilsynet og Helsedirektoratet. Data og materiale i *Fit futures* vil lagres i Tromsøundersøkelsens database i Eutro og forskningsbiobanken Tromsøundersøkelsen ved Universitetet i Tromsø.

Tromsøundersøkelsen (TU) er en longitudinell befolkningsundersøkelse som har vært gjennomført seks ganger. Den sjette Tromsøundersøkelsen (Tromsø 6) ble gjennomført i 2007-2008 med totalt 12.984 deltakere i alder 30 – 87 år. TU er unik i norsk sammenheng ved at den inkluderer omfattende klinisk undersøkelse av deltakerne, noe som gir bedre grunnlag for forskning på veldefinerte diagnoser og på basale sykdomsmekanismer enn befolkningsstudier som i hovedsak baseres på spørreskjema. En svakhet ved studien er

imidlertid fravær av yngre deltakere. Den primære hensikten med ungdomsundersøkelsen er derfor å utvide datagrunnlaget fra Tromsø 6 med en yngre alderskohort. Data fra undersøkelsen vil bli analysert i sammenheng med data fra Tromsø 6 også når det gjelder kobling til andre nasjonale registre.

4. Utvalg og rekruttering

Samtlige elever på første årstrinn ved videregående skole (VG1) i Tromsø kommune og Balsfjord vil bli invitert til å delta, ca 1100 elever, alder 15 år og eldre. Undersøkelsen gjennomføres som hovedregel i skoletiden. Erfaring med tidligere skoleundersøkelser tyder på at slike undersøkelser får høy oppslutning dersom de gjennomføres i skoletiden, og det anses som realistisk å oppnå et deltakertall på 8-900 elever. Rekruttering vil skje klassevis med felles muntlig orientering på skolen. Skriftlig informasjonsbrosjyre med forespørsel om å delta i undersøkelsen deles ut på skolen, og elevene vil bli bedt om å ta med brosjyren hjem som informasjon til foreldre og foresatte. Informasjonsbrosjyren vil også bli gjort tilgjengelig på skolens nettside (via Fronter). Elever som er interesserte i å delta, bekrefter dette på internett via lenke sendt til hver enkelt elevs e-post adresse. Deltakere som har fylt 16 år, undertegner skriftlig samtykke til å delta når de møter til undersøkelsen ved Forskningsposten UNN. For yngre deltakere kreves i tillegg skriftlig samtykke fra foreldre/foresatte som eleven tar med til undersøkelsen. Deltakerne vil motta et gavekort á kr 200 per oppmøte ved Forskningsposten. Se også ”Etiske vurderinger”.

Informasjonsarbeid, rekruttering og oppfølging vil skje i tett samarbeid med skolen. Det vil bli etablert fokusgrupper blant elevene i forkant av undersøkelsen, og det legges opp til nært samarbeid med kroppsøvingslærere og naturfagslærere, blant annet ved at det gis tilbud om oversiktstabeller over resultater som kan brukes i prosjektarbeid ved skolen (via Eutro) og kurs i hjerte-lungeredning og førstehjelp. Det avholdes også et halvdagsseminar for lærerne med fokus på aktuelle epidemier (overvekt & fedme, influensa), i tillegg til kurs i hjerte-lungeredning og førstehjelp.

5. Metoder

5.1. Spørreskjema og intervju

Spørreskjema og intervju for undersøkelsen er vedlagt som eget dokument. Det gjennomføres klinisk intervju som dekker:

- Aktuell akutt sykdom /symptomer (eks. pågående infeksjon)
- Kroniske sykdommer
- Bruk av legemidler
- Tid siden siste måltid
- Sosialt nettverk
- Menstruasjon og graviditet (kvinner)

5.2. Kliniske undersøkelser

- Vekt, høyde, hofte-, og midjemål
- Hvileblodtrykk og puls
- Hårprøve for analyse av kvikksølvnivå
- Mikrobiologisk nese- og halsprøve for påvisning av *Staphylococcus aureus*
- DEXA-scanning: bentetthet i hofte og totalkropp, samt kroppssammensetning
- Smerteølsomhet (kulde, varme, trykk)
- Total fysisk aktivitet over en uke med ActiGraph

- Glukosebelastningstest (etterundersøkelse, se nedenfor)
- Tannhelseundersøkelse: bite-wing røntgen av tenner, klinisk undersøkelse av tenner og tannkjøtt, avtrykk av over- og underkjeve, kliniske foto.

5.3. Laboratorieanalyser

Det tas ikke-fastende blodprøve for genetiske analyser (DNA, mRNA og mikroRNA) og følgende serum analyser:

- Fettstoffer: Kolesterol, triglycerider, LDL, HDL
- Sukker: HbA1c, glukose
- Betennelse: Høy sensitiv CRP, cytokiner
- Hormoner og bindingsproteiner: progesteron, testosteron, østradiol, dehydroepiandrostenedione DHEA-SO_4, LH, FSH, SHBG, PTH, albumin
- Vitaminer/mineraler: 25(OH) vitamin D, retinol, calsium
- Jernstatus: Hb, MCV, MCHC, jern, ferritin, transferrin
- Miljøgifter

5.4. Registerdata

Fra skolen innhentes opplysninger om studieprogram, klasse, og kjønn. Antall fraværsdager, karakterer i fagene norsk, matematikk og engelsk, samt skolefravær og drop-out innhentes ved slutten av året. Som for Tromsøundersøkelsen generelt, søkes det om kobling til nasjonale helseregistre (Reseptregisteret, Medisinsk fødselsregister, Norsk pasientregister med flere), registre i Statistisk sentralbyrå, andre sykdomsregistre basert på informasjon fra sykehus og primærhelsetjenesten (f.eks. høyde- og vektdata fra Helsestasjon) og Familieregisteret. Det siste gjøres for å kartlegge biologiske familierelasjoner mellom deltakerne i denne studien og den sjette Tromsøundersøkelsen.

5.5. Praktisk gjennomføring

Elevene fraktes med minibusss til Universitetssykehuset Nord-Norge, puljer á 5 elever. Timelister og transport organiseres av prosjektadministrator. Utfylling av spørreskjema, intervju og de kliniske undersøkelsene vil bli gjennomført ved Forskningsposten UNN og TANN-bygget. Flytskjema for undersøkelsen ved Forskningsposten er vist i Fig. 1. ActiGraph vil bli delt ut ved undersøkelsen og samlet inn på skolen etter en uke.

5.6. Etterundersøkelser

Et utvalg på 80-100 personer med høyest HbA1c verdier, samt et randomisert utvalg på 80-100 av de øvrige deltakere vil bli innkalt til reundersøkelse. Hensikten med denne vil være gjennomføring av glukosebelastningstest for diabetesdiagnostikk der det kan være mistanke om diabetes (høye HbA1c verdier) og for validering av HbA1c som indikator på diabetes og insulinresistens. Videre innkalles 150-200 personer til repetert undersøkelse av smerteølsomhet for estimering av stabilitet over tid, samt repetert staf-prøve for undersøkelse av persisterende bærerskap.

5.7. Longitudinell oppfølging

Undersøkelsen planlegges i første rekke som en tverrsnittsundersøkelse, men det tilrettelegges for longitudinell oppfølging. Dette vil primært skje gjennom kopling til Norsk Pasientregister. Det vil også bli innhentet tillatelse til å kontakte deltakerne igjen ved en senere anledning. På lengre sikt tas det sikte på at longitudinell oppfølging skjer ved rekruttering av deltakerne til en eventuell sjuende Tromsøundersøkelse.

6. Lagring av data og datautlevering

Data vil i innsamlingsperioden bli lagret på server ved UNN med nødvendige datasikkerhetsløsninger ivaretatt av Helse Nord IKT. Etter fullført datainnsamling vil data overføres til Eutro som fungerer som felles databaseløsning for TU. Avidentifiserte data utleveres til enkeltprosjekter etter søknad til styringsgruppen for *Fit futures* og vitenskapelig råd i Tromsøundersøkelsen. Biologisk materiale lagres i forskningsbiobanken Tromsøundersøkelsen, Universitetet i Tromsø.

7. Gjennomføringsevne

Dette er en omfattende undersøkelse der vellykket gjennomføring krever koordinering av mange aktører, opplæring av personale, bruk av avansert teknisk utstyr, og ikke minst en realistisk tidsplan for den kliniske undersøkelsen. Prosjektgruppen ønsker på ingen måte å underslå disse utfordringene. På den annen side bygger gruppen på betydelig erfaring og ressurser:

- Forskningsposten stiller sin stab med teknikere og forskningssykepleiere til disposisjon og har lang erfaring med gjennomføring av tilsvarende undersøkelser.
- Prosjektgruppene som deltar har nylig gjennomført tilsvarende undersøkelser i T6, med nærmere 13.000 deltakere.
- I T6 ble det undersøkt opptil 70 personer per dag, mens det i denne undersøkelsen legges opp til undersøkelse av 10 personer per dag.
- Undersøkelsen drar veksel på betydelig IT-kompetanse ved Forskningsposten (rutiner for innkalling, elektronisk spørreskjema, databasehåndtering), Tromsøundersøkelsen (kvalitetssikring av data, innlegging i EUTRO, datautlevering)
- Forskergruppene har sterke nasjonale og internasjonale vitenskapelige nettverk med betydelig publikasjonserfaring og produksjon.

8. Framdriftsplan

Vår 2009: Prosjektgruppe etablert
Prosjektet godkjent for gjennomføring ved Forskningsposten UNN
Søknader om midler
Høst 2009: Protokoll
Møter med delprosjekter
Etablere samarbeid med skolene
- møte med Utdanningsetaten i Fylkeskommunen (august)
- rektormøte (september)

Søknad om Infrastrukturmidler Helse-Nord (1. september)
Søknad REK Nord (1. september)
Vår 2010: Ansette prosjektadministrator (15.mars. april 2010 –)
Utvikle database for registrering av data fra spørreskjema, intervju, kliniske undersøkelser, laboratorieresultater
Fysisk tilrettelegging av biobank
Pilot
Høst 2010: Gjennomføring av hovedundersøkelsen (ca 25 uker)
Fortløpende klassevise kurs i hjerte-lungeredning og førstehjelp
Seminar for lærere
Vår 2011: Avslutning hovedundersøkelsen (mars)
Etterundersøkelse
Kvalitetssikre og tilrettelegge data i Eutro
Tilbakemelding / undervisningsopplegg (tilgang til Eutro) ved skolene
Tilbakemelding/ foredrag ved Forskningsposten
Seminar for lærere
Høst 2011: Forskningsformidling
Forts kvalitetssikring av data
Rapportskriving

9. Finansiering

Fit futures er godkjent for gjennomføring ved Forskningsposten, Klinisk forskningssenter, UNN, høsten 2010/våren 2011, og disponerer med dette betydelig infrastruktur, personell og materiell for datainnsamlingen.
Øvrig felles infrastruktur; lønn til prosjektkoordinator, prosjektledelse, rekruttering, felles biobank, fag- og forskningsformidling, finansieres ved:
kr 150 000 per år i 2010-11 fra Helse Nord, kr 500 000 fra Helsefakultetet UiT, kontingenter fra delprosjekter (kr 50-100 000 per prosjekt).
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10. Etiske vurderinger

10.1. Behandling av personidentifiserende opplysninger

Fra skolen innhentes opplysninger om navn, personnummer, samt kontaktopplysninger for samtlige elever på VG1. Det tilordnes et løpenummer til hver elev. Disse opplysingene lagres i en atskilt administrativ database til bruk i innkalling, frafallsstatistikk, samt kartlegging av sosiale nettverk (se under) i datainnsamlingsperioden. Løpenummer fungerer som bindeledd til forskningsdatabasen som ikke inneholder personidentifiserbare opplysninger. Ved avsluttet datainnsamling slettes personopplysninger for elever som ikke har samtykket i deltakelse.

Den administrative databases vil etter dette fungere som koplingsnøkkel som lagres separat i henhold til retningslinjer for Tromsøundersøkelsen.

10.2. Kartlegging av sosiale nettverk

Hva er sosialt nettverkskartlegging?
Sosialt nettverkskarlegging i *Fit futures* innebærer at man spør hver deltaker om å oppgi navn på inntil fem VG1 elever som vedkommende har vært i kontakt med i løpet av den siste uka. I tillegg registreres kvalitet av kontakt (fysisk kontakt eller ikke) og arena for kontakt (skole, idrett, hjemme, annet). Ved å gjøre dette får man oversikt over de sosiale relasjonene mellom ungdommene på alderstrinnet.

Hvorfor er det viktig?
Nytteverdien av sosialt nettverkskartlegging vil blant annet være å fastlå i hvilken grad smitte av gule stafylokokker følger vennerelasjoner. Kunnskap om dette vil være av betydning i planlegging av forebyggende arbeid. Videre vil kartleggingen gi mulighet til å undersøke i hvilken grad venner påvirker helseatferd, som for eksempel røyking og fysisk aktivitet. Få epidemiologiske studier har gjennomført slik kartlegging fordi dette kun er mulig i tilfeller der man har 100% sampling rate hos et avgrenset sett individer, slik tilfellet er for *Fit futures*.

Personvernhensyn
Kartlegging vil skje som del av intervjuet som følger:

A. Deltaker oppgir navn på venner og eventuell tilleggsinformasjon (skole, klasse, bosted) i den grad dette er nødvendig for å identifisere individet.

B. Tekniker identifiserer personen i oversikten over elever som går på VG1 (administrativ database) og legger løpenummer, kjønn, skole og klasse for denne personen inn som datapunkt i forskningsdatabasen.

C. Når datainnsamlingen er avsluttet vil kopling mellom personidentitet (navn, personnummer, osv) bli slettet for de personer som ikke har gitt samtykke til deltakelse.

Dette innebærer i praksis at personer som ikke deltar i studien, kan være oppgitt som venn av en eller flere deltakere, men identiteten til disse personene vil ikke være mulig å fastslå etter at datainnsamlingen er avsluttet. Personene er kun er identifisert gjennom et løpenummer uten koplingsmulighet, samt kjønn, skole og klasse.

10.3. Medisinsk sikkerhet
Enhver medisinsk undersøkelse innebærer risiko, men vår vurdering er at denne er svært liten i gjeldende prosedyrer. Sikkerhetsvurdering er gjort i forbindelse med følgende prosedyrer der dette er aktuelt:

A. Blodprøvetakning er vanlig i undersøkelser av både barn og voksne og de fleste vil ha tatt blodprøver i kliniske sammenhenger en eller flere ganger tidligere. Utover allmenne tiltak i tilfelle besvimelse ser vi ikke behov for spesielle foranstaltninger.

B. Smerteundersøkelsen innebærer testing med av varme, kulde, og trykkstimuli. Felles for alle tre metoder er at smertefornemmelsen kommer gradvis og forsvinner fort etter

at testen avbrytes. Alle tester kan avbrytes av deltaker direkte, og det gis beskjed om dette før prosedyren påbegynnes. Vi har erfaring med disse metodene fra Tromsø 6, der mer enn 10.000 personer ble undersøkt. I dette utvalget, som også inkluderte et stort antall personer med svak helse, forekom besvimelse hos 8 personer (0,07%) som eneste komplikasjon. Dette er lavere enn det man typisk ser ved blodprøvetaking.

C. DEXA scan innbærer at deltaker utsettes for svak røntgenstråling (gjennomsnittlig stråledose pr måling for hofte: 0.037 mGy og for helkropp 0.0003 mGy, data fra produsent). Styrken på strålingen er svakere enn den man påføres ved å gå gjennom en vanlig sikkerhetskontroll på flyplasser. Vi har allikevel valgt å ekskludere gravide fra undersøkelsen. Graviditetstest gjennomføres kun med kvinner som oppgir at det er mulighet for at de er gravide. Informasjon om graviditet formidles ikke videre til foreldre.

Det etableres rutiner for rapportering og oppfølging av medisinske avvik. Avviket protokollføres, og beskjed gis til prosjektleder. En dedikert barnelege fra barneavdelingen ved Universitetssykehuset i Nord-Norge vil være ansvarlig for videre oppfølging. Samme lege vil også være ansvarlig for medisinsk oppfølging i tilfelle der blodprøver eller andre undersøkelser avdekker alvorlig sykdom.

10.4. Tilbakemelding om medisinske prøver
Dersom resultatet av prøvene viser at det er nødvendig med oppfølging av lege eller henvisning til spesialist, vil deltaker bli orientert om det. Ved behov for henvisning til spesialist, vil det bli sørget for henvisning og tilbud om oppfølging ved sykehuset. Tilbakemelding om sykdom vil også bli gitt til foreldre/foresatte.

Funn av gule stafylokokker i nese og/eller hals vil ikke kreve oppfølging, heller ikke i spesielle grupper (kronisk syke). Vi kjenner ikke risiko for alvorlige infeksjoner knyttet til bærerskap av gule stafylokokker generelt eller i ulike grupper. Bærerskap av meticillin-resistente *S. aureus* MRSA er meldepliktig til MSIS (fra 2005), men det foretas ikke generell screening for MRSA bærerskap i Norge. Det ble ikke funnet MRSA blant ca 2500 *S. aureus* isolater fra vel 4000 voksne deltakere i den sjette Tromsøundersøkelsen Vi forventer at prevalensen av MRSA i *Fit futures* vil være svært lav (under 0,1%). Det er usikkert hvorvidt et tilfeldig oppdaget MRSA-bærerskap har betydning for helsen til verten eller andre personer i vedkommendes omgivelser. Vi kjenner ikke det naturlige forløp for MRSA-bærerskap. Studier har vist at kolonisering med MRSA og andre *S.aureus* i nesen kan forsvinne spontant. Standard behandling (i henhold til MRSA-veilederen: antibiotika nesesalve, helkroppsvask og daglig skifte av alle klær og sengetøy i 5 dager) er ikke effektiv i alle tilfeller. Identiteten til eventuelle tilfeller av MRSA i *Fit futures* vil ikke være kjent på grunn av kryptering, og tilfellene er således ikke meldepliktige. På bakgrunn av kunnskap vi har per i dag vurderes det således som medisinsk og etisk riktig å ikke melde tilbake til deltaker om bærerskap av verken gule stafylokokker generelt eller MRSA.

10.5. Samtykkekompetanse
Deltakere som er fylt 16 år anses som samtykkekompetente i denne undersøkelsen, da undersøkelsen ikke innebærer legemsinngrep eller legemiddelutprøving (jfr. Helseforskningsloven §17). For deltakere som ikke har fylt 16 år kreves samtykke fra foreldre. Eleven får med seg informasjonsskrivet hjem og bes ta med skriftlig samtykke fra foresatte ved oppmøte til undersøkelsen. I de tilfelle der eleven har glemt å ta med samtykke fra foreldre vil eleven bli spurt om tillatelse til å kontakte foresatte per telefon. Dersom eleven

samtykker i dette vil muntlig samtykke per telefon bli akseptert som gyldig. To forskningsteknikere signerer i så fall på at foreldresamtykke er avgitt.

10.6. Samfunnsnytte

For mange lidelser, især de som påvirkes av livsstil, legges grunnlaget for fremtidig helse i ungdomsårene. Kroniske sykdommer med tidlig sykdomsdebut har dessuten ofte mer alvorlig forløp og større sosiale og økonomiske konsekvenser enn med sykdomsdebut i høyere alder. Ungdom har generelt tettere og mer dynamiske sosiale nettverk, noe som innebærer et annet mønster for blant annet smittespredning enn i den voksne befolkningen. Slike forhold gjør at forskning på helse og helseadferd hos ungdom er vesentlig for å støtte tiltak i forhold til forebygging og tidlig diagnostikk av sykdom som er et av hovedverktøyene i Regjeringens Samhandlingsreform for å sikre bærekraftig helsetjeneste til befolkningen. Flere spørreskjemabaserte befolkningsstudier er gjennomført blandt norsk ungdom i de senere årene, mens ungdom i liten grad har deltatt i større kliniske undersøkelser. Videre har ungdom i nord vært lavt representert i nasjonale helseundersøkelser; eksempelvis var kun 6% av deltakerne i den nasjonale kartleggingsundersøkelsen av fysisk aktivitet blant 9- og 15-åringer 2005-06 fra de tre nordligste fylkene. Den planlagte studien vil derfor bidra med ny kunnskap om ungdommers helse og hvordan denne påvirkes av helseatferd og derved gi datamateriale av direkte relevans for oppfølging av Samhandlingsreformen på kommune- og fylkeskommunenivå.

10.7. Relevans for kvinnehelse

Flere av delprosjektene har spesiell relevans for kvinnehelse. Dette gjelder særlig forskning på kronisk smerte, der nærmere to tredjedeler av smerterelatert uførhet og sykefravær forekommer hos kvinner, og osteoporose som i hovedsak er et kvinnehelseproblem. Høyt østrogennivå hos jenter som kommer tidlig i pubertet antas å være en risikofaktor for smerte – mens oppbygging av skjelettet, som når en peak bone mass i løpet av 20-30-års alder er avhengig av en rekke livsstilsrelaterte faktorer i yngre alder, – noe som understreker betydningen av å studere smerte og beintetthet hos jenter i ungdomsårene.

11. Innovasjonspotensiale

Tromsøundersøkelsen er Nord-Norges største helseforskningssatsning og har over tid bidratt til å bygge opp sterke medisinske forskningsmiljøer og klinisk spisskompetanse. Fra sitt opprinnelige fokus på hjerte- og karlidelser hos eldre mennesker har problemstillingene blitt svært omfattende og utvalget har blitt utvidet til å inkludere yngre voksne. Det primære bidraget av denne studien er en utvidelse av undersøkelsen til også å omfatte ungdom – noe som vil gi økt kunnskap og kliniske kompetanse til å følge opp myndighetenes satsning på forebyggende arbeid, tiltak rette mot sårbare grupper for kroniske livsstilssykdommer og tidlig diagnostikk. Få studier blant ungdom kombinerer spørreskjema, blodprøver og kliniske undersøkelser, med samtidig mulighet for longitudinell oppfølging.

12. Formidling av resultater

Resultater fra studien vil primært bli formidlet gjennom vitenskapelige publikasjoner i internasjonale fagfellevurderte tidsskrifter. Resultater med direkte klinisk eller helsepolitisk relevans vil i tillegg bli publisert i nasjonale kliniske tidskrifter, herunder Tidsskrift for den Norske Lægeforening. Formidling av resultater til publikum vil i tillegg til massemedia bl.a. skje gjennom nettsidene til TU, og nettsidene til delprosjektene som deltar. Skolene som

deltar vil få tilgang på oversiktstabeller over resultater, tilrettelagt for bruk i undervisningen (via Eutro). Det vil i tillegg bli avholdt to halvdagsseminarer for lærere ved skolene.

Appendix 2

Table A: Frequency distribution of covariates against levels of physical activity for the total sample

Covariates		Levels of physical activity, *n (%)*			
		Sedentary	***Somewhat active***	***Active***	***Very active***
BMI* **					
	Underweight	22 (10.8)	28 (9.6)	11 (4.7)	5 (2.7)
	Normal weight	130 (63.7)	191 (65.2)	174 (74.4)	156 (85.2)
	Overweight/ Obese	52 (25.5)	74 (25.3)	49 (20.9)	22 (12)
Chronic pain					
	Yes	50 (24.5)	72 (24.6)	45 (19.2)	53 (29)
	No	154 (75.5)	221 (75.4)	189 (80.8)	130 (71)
Chronic disease					
	Yes	57 (27.9)	88 (30)	62 (26.5)	63 (34.4)
	No	147 (72.1)	205 (70)	172 (73.5)	120 (65.6)
Have many friends* ε**					
	Highly incorrect	5 (2.5)	3 (1)	1 (0.4)	2 (1.1)
	Somewhat incorrect	18 (8.8)	16 (5.5)	9 (3.8)	3 (1.6)
	Somewhat correct	81 (39.7)	129 (44)	77 (32.9)	55 (30.1)
	Highly correct	100 (49)	145 (49.5)	147 (62.8)	123 (67.2)
Screen Time* ε**					
	≤ 30 min per day	5 (2.5)	9 (3.1)	8 (3.4)	14 (7.7)
	1-1.5 hours per day	6 (2.9)	40 (13.7)	51 (21.8)	53 (29)
	2-3 hours per day	57 (27.9)	120 (41)	99 (42.3)	74 (40.4)
	4-6 hours per day	97 (47.5)	103 (35.2)	65 (27.8)	32 (17.5)
	7-9 hours per day	30 (14.7)	17 (5.8)	8 (3.4)	6 (3.3)
	>10 hours per day	9 (4.4)	4 (1.4)	3 (1.3)	4 (2.2)
Smoking* **					
	No, never	145 (71.1)	210 (71.7)	197 (84.2)	163 (89.1)
	Sometimes	48 (23.5)	66 (22.5)	35 (15)	20 (10.9)
	Daily	11 (5.4)	17 (5.8)	2 (0.9)	0
Alcohol ε					
	Never	59 (28.9)	74 (25.3)	60 (25.6)	63 (34.4)
	Once per month or less	83 (40.7)	121 (41.3)	94 (40.2)	80 (43.7)
	2-4 times per month	56 (27.5)	93 (31.7)	77 (32.9)	39 (21.3)
	2-3 times per week	5 (2.5)	4 (1.4)	2 (0.9)	1 (0.5)
	4 or more times per week	1 (0.5)	1 (0.3)	1 (0.4)	0
Sleeping status					
	Yes, absolutely enough	17 (8.3)	19 (6.5)	10 (4.3)	9 (4.9)
	Yes, normally enough	63 (30.9)	111 (37.9)	101 (43.2)	75 (41)
	No, somewhat insufficient	86 (42.2)	103 (35.2)	85 (36.3)	73 (39.9)
	No, clearly insufficient	16 (7.8)	39 (13.3)	23 (9.8)	18 (9.8)
	No, far from sufficient	22 (10.8)	21 (7.2)	15 (6.4)	8 (4.4)
Fathers education* **					
	Don`t know	68 (33.3)	90 (30.7)	66 (28.2)	38 (20.8)
	Primary school, 9 years	26 (12.7)	21 (7.2)	23 (9.8)	9 (4.9)
	Occupational high school	36 (17.6)	69 (23.5)	32 (13.7)	30 (16.4)
	High school	25 (12.3)	35 (11.9)	32 (13.7)	22 (12)
	College less than 4 years	14 (6.9)	39 (13.3)	33 (14.1)	36 (19.7)
	College 4 years or more	35 (17.2)	39 (13.3)	48 (20.5)	48 (26.2)
Mothers education* **					

	Don`t know	71 (34.8)	82 (28)	49 (20.9)	33 (18)
	Primary school, 9 years	15 (7.4)	18 (6.1)	16 (6.8)	4 (2.2)
	Occupational high school	27 (13.2)	46 (15.7)	22 (9.4)	20 (10.9)
	High school	26 (12.7)	42 (14.3)	43 (18.4)	28 (15.3)
	College less than 4 years	20 (9.8)	56 (19.1)	40 (17.1)	42 (23)
	College 4 years or more	45 (22.1)	49 (16.7)	64 (27.4)	56 (30.6)

***** = p<0.001, ε = includes cells with expected counts less than 5**

Appendix 3

Link to the Fit Futures questionnaire:

https://web.questback.com/isa/qbv.dll/ShowQuest?Preview=True&QuestID=4130270&sid=OQgdIDT3Li&print=1