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Young & Active:

Development and evaluation of an Internet intervention
to increase fitness and health-related quality of life in
adolescents with overweight and obesity

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“YESSS! I finally reached my goal! Kind of proud of myself!”

-Participant, Young & Active, 2013

Sammendrag

Bakgrunn

Overvekt og fedme kan ha negative konsekvenser for ungdoms helse og helserelaterte livskvalitet. Overvekt er også assosiert med redusert fysisk aktivitet og fysisk aerob form. Det har vist seg utfordrende å finne fram til effektive forskningsbaserte intervensjoner for å forebygge og behandle overvekt og fedme blant ungdom. Internettbaserte intervensjoner har potensiale for å bidra til å støtte helseatferd som for eksempel fysisk aktivitet, ved å inkludere individuelt tilpasset feedback.

Hensikt

Den overordnede hensikten med denne studien var å utvikle og evaluere en internettintervensjon for å motivere ungdom med overvekt og fedme til å øke og vedlikeholde selvbestemt fysisk aktivitet og dermed bedre sin fysiske form og helserelaterte livskvalitet.

Metode

Studien ble gjennomført i to faser med ulike metodiske tilnærminger og utvalg. I den første fasen ble internettprogrammet «Young & Active» systematisk utviklet i samarbeid med representanter for målgruppen. Programmets brukervennlighet ble testet gjennom sekvensiell brukertesting. Flere etiske problemstillinger dukket opp underveis og resulterte i en grundig etisk vurdering av intervensjonen i studiens andre fase. Vi analyserte også assosiasjonene mellom hovedvariablene. Fase to inkluderte videre en kontrollert studie for å undersøke kortidseffektene av intervensjonen.

Resultat

Designet og innholdet i Young & Active støttet seg på prinsipper hentet fra selvbestemmelsesteori (SDT) mens veiledningen lånte elementer fra motiverende intervju og autonomistøttende veiledning forankret i SDT. Brukertestene viste at programmet ble godt mottatt. Den etiske diskusjonen konkluderte med at det er etisk forsvarlig å gjennomføre en intervensjon som i så stor grad vektlegger individuelt tilpasset autonomistøttende veiledning. Analyser av baselinedata konkluderte med at fysisk form var positivt assosiert med helserelatert livskvalitet og at denne sammenhengen var mediert av selvbestemt motivasjon for fysisk aktivitet og trening. Den kontrollerte studien viste at etter 12 uker, hadde intervensjonen gunstige effekter på aerob kapasitet, helserelatert livskvalitet og kroppsmasseindeks (KMI).

Konklusjon

Så langt vi vet, er denne studien den første i sitt slag som har utviklet og evaluert en sekundærforebyggende internettbasert intervensjon for ungdom med overvekt og fedme i en skolehelsetjenestesetting. Intervensjonen ble jevnt over godt akseptert av målgruppen, og korttidseffektene på fysisk form, helserelatert livskvalitet og KMI virker lovende. Funnene må imidlertid bekreftes i en større studie sammen med en evaluering av hvorvidt intervensjonen er praktisk og økonomisk gjennomførbar i primærhelsetjenesten.

Summary

Background

Overweight and obesity among adolescents may have consequences with potentially lasting effects on health and health-related quality of life (HRQoL). Excess weight is also associated with decreases in physical activity and cardiorespiratory fitness (CRF). Research presenting effective interventions for prevention and treatment of overweight and obesity in adolescents is limited. Internet interventions may provide opportunities for low threshold counseling using feedback to guide and support health behavior, including increased physical activity (PA).

Aim

The overall aim of the present study was to develop and evaluate an Internet intervention for motivating overweight and obese adolescents to increase and maintain self-determined physical PA and thereby enhance their CRF and HRQoL.

Method

The study was conducted in two phases. Different approaches, samples, methods for collection of data and outcome measures were applied depending on the phases and objectives. In the first phase, the Internet intervention called “Young & Active” was systematically developed. To assess the program’s usability, we applied an iterative usability testing approach. In the second phase, we analyzed the baseline data to gain increased knowledge about the associations between the main outcomes of the study. We also performed a thorough ethical evaluation of the intervention as several ethical issues became apparent in the early stages of the study. Lastly, the second phase included a controlled trial to investigate the short-term effects of the intervention.

Results

The design and content of Young & Active was informed by perspectives from self-determination theory (SDT) while the counseling was based on inputs from Motivational interviewing and autonomy supportive counseling grounded in SDT. The results from the development and usability testing found that the program was well accepted among representatives of the target group and ready for further evaluation. The ethical discussion argued that the intervention can be justified based on its emphasis on tailored autonomy-supportive feedback. Investigations of associations between the study variables at baseline showed that CRF was positively related to HRQoL and that this relationship was mediated by self-determined motivation for PA and exercise. When testing the

effect of the Internet intervention in a 12-week controlled trial, we found that Young & Active had beneficial short-term effects on CRF, HRQoL and BMI.

Conclusion

This thesis is to our knowledge, the first to report on results from the development and evaluation of a secondary preventive Internet intervention for adolescents with overweight and obesity in a school health setting. The intervention was generally well accepted by the participants, and the short-term effects on CRF, HRQoL and BMI seem promising. However, the findings have to be confirmed in a large scale study. Moreover, further research on ethical, practical as well as financial feasibility of implementation in clinical practice is needed.

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Denne studien ble gjennomført ved Høgskolen i Oslo og Akershus (HiOA), fakultet for helsefag, institutt for sykepleie, i perioden 2010-2014. Prosjektet ble initiert og skissert av professor Sølvi Helseth og dosent Knut Løndal, og har vært finansiert av Extrastiftelsen Helse og Rehabilitering gjennom Norske Kvinners Sanitetsforening.

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Kirsti Riiser

List of papers

This dissertation is based on the original research papers:

- I Riiser K, Løndal K, Ommundsen Y, Sundar T, Helseth S (2013) Development and usability testing of an Internet intervention to increase physical activity in overweight adolescents. *JMIR Research Protocols* 2: e7.
- II Riiser K, Løndal K, Ommundsen Y, Misvær N, Helseth S (2014) Targeting and tailoring an intervention for adolescents with overweight: Some ethical concerns. *Nursing Ethics* Published online 8. April.
- III Riiser K, Ommundsen Y, Småstuen M, Løndal K, Misvær N, Helseth S (2014). The relationship between fitness and health-related quality of life and the mediating role of self-determined motivation in adolescents with overweight. *Scandinavian Journal of Public Health*. Published online 30. September.
- IV Riiser K, Løndal K, Ommundsen Y, Småstuen MC, Misvær N, Helseth S (2014) The outcomes of a 12-week Internet intervention aimed at improving fitness and health-related quality of life in overweight adolescents: The Young & Active controlled trial. *PLoS ONE* (Accepted).

Abbreviations

HRQoL	Health-related quality of life
CRF	Cardiorespiratory fitness
PA	Physical activity
BMI	Body mass index
SDT	Self-determination theory
MI	Motivational interviewing
MET	Metabolic equivalent of task
IOTF	International Obesity Task Force
CI	Confidence interval
OR	Odds ratio

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1 Introduction

In 2010, the Norwegian Directorate of Health launched new national guidelines for standardized measurement of weight and height, and for prevention, identification and treatment of overweight and obesity in children and adolescents in primary care [1,2]. These guidelines came as a response to the increasing prevalence of overweight and obesity and the potential consequences of excess weight in the child population. However, as acknowledged by the health authorities as well as authors of several reviews and reports, research presenting effective interventions for prevention and treatment of overweight and obesity among children and adolescents is limited. Although it seems that the field of primary preventive interventions is moving forward [3], and beneficial effects of programs on BMI have been found [4], very few secondary preventive studies targeting those already overweight have been conducted in primary care.

Overweight and obesity among adolescents may have several adverse consequences, with potentially lasting effects on health-related quality of life (HRQoL) [5]. Among overweight youths, largest impairments are consistently documented in physical and social dimensions of HRQoL [6]. Although substantial research has been carried out to document the relationship between body mass and HRQoL, little is known about variables associated with *good* HRQoL in overweight populations. There is, however, some research pointing to associations between physical activity and HRQoL showing that higher levels of habitual physical activity (PA) and higher levels of physical fitness are associated with increased HRQoL and that the influences of physical fitness are greater than that of overweight [7,8]. Thus, it seems highly relevant to investigate if improving PA and fitness could be a strategy for improving HRQoL among adolescents with overweight and obesity.

In the search for new effective and efficient programs to change and maintain health behavior, Internet and mobile interventions are becoming increasingly popular. Such interventions provide excellent opportunities for low threshold counseling using feedback to support and guide health behavior among adolescents, as adolescents are familiar with the use of the Internet. Internet interventions for prevention and management of overweight and obesity in children and adolescents have shown promise in terms of health behavior change and maintenance [9].

Based on these arguments and findings, the present study was initiated to develop and investigate the usability and effectiveness of an Internet intervention for overweight and obese adolescents for use in a school health setting. We decided that the intervention should focus on increasing and maintaining self-determined PA to reduce or stabilize body mass, but primarily on enhanced cardiorespiratory fitness (CRF) and HRQoL. This is a novel research area, with limited previous

research and experiences to lean on. Thus, we pursued the development of the intervention systematically, using available evidence and appropriate theory through a carefully phased approach. This thesis describes the rationale, development and the first evaluation of “Young & Active”, a 12-week Internet intervention in a primary care setting intended to increase CRF and HRQoL among overweight and obese adolescents.

2 Background

2.1 Overweight and obesity in adolescents

The prevalence of overweight and obesity has increased dramatically in both adult and child populations throughout the world during the last decades and have been categorized as one of this century's major health threats [10,11]. In Norway, the prevalence of overweight and obesity among children and adolescents has been estimated at 14%–17% [12-14]. Health authorities are obviously concerned about the health of the nation's young populations including the potential consequences of overweight and obesity [2]. Due to changes in body composition, behavioral changes in diet and physical activity (PA), sedentary behavior and psychological health, the adolescent years are a critical period in the development and persistency of overweight and obesity [15]. Thus, efforts to improve health, to prevent poor health behavior and the onset and continuation of obesity throughout the life span, are called upon.

While *overweight* technically refers to excess of body weight, *obesity* refers to excess of fat. Because methods used to measure body fat directly are unavailable in daily practice, obesity is based on excess weight and assessed by means of indirect estimates [16]. The most widely accepted method used to screen for adiposity is calculation of body mass index (BMI). BMI is equal to the body weight in kilograms divided by the height in meters squared [17]. For children and adolescents, age- and sex-specified cut-off values are calculated based on the percentiles that match the adult cut-offs of 25 ("overweight"), 30 ("obesity") and 35 ("severe obesity") [17,18]. The current thesis focuses on adolescents in primary health care with age and gender adjusted $BMI \geq 25$, however not so obese that they are referred to treatment. Thus, "adolescents with overweight"/"overweight adolescents" and "adolescents with overweight and obesity"/"overweight and obese adolescents" are used interchangeably, meaning otherwise healthy adolescents with age and gender adjusted $BMI \geq 25$.

Despite extensive research, the mechanisms for weight gain are not fully understood [19]. The simple answer is that energy intake exceeds energy expenditure. This process is found to be influenced by energy-balance related behaviors, e.g. lack of physical activity (PA), high levels of television viewing, high intakes of sweetened beverages, fat and carbohydrates, and lack of sleep [19-21]. However, the underlying multiple factors resulting in a discordant energy balance are complex. Evidence has been found to support an association between genetic factors and low physical activity with excessive fatness, while mixed results were found for variables like dietary intake, sedentary behavior, family factors and community environment [22].

2.1.1 Physical and psychosocial consequences of overweight and obesity

Cross-sectional studies in youth have documented a relationship between BMI and morbidity, particularly in metabolic and cardiovascular risk [23,24]. However, recent research has found obesity not to be an independent risk factor, but dependent on the tracking of BMI from childhood to adulthood [25]. Studies consistently report an increased risk of overweight children to become overweight adults with an even higher risk for overweight adolescents [26]. Thus, one of the most important long-term consequences of childhood overweight is the tendency for excess weight to persist [27]. The relationship between BMI in childhood and adverse adult outcomes has been documented to be linear [28,29]. However, although studies generally have suggested moderate to strong stability of BMI and obesity during childhood [30,31], there is evidence of striking amounts of shifting between BMI categories during middle school years, both from higher BMI categories to lower and vice versa. BMI shifts are found to be associated with significant changes in cardio metabolic risk factors, showing that staying obese was associated with significant risk, while staying in the healthy weight range over time was associated with the most favorable levels across risk factors [32].

Most adolescents seem not particularly concerned about the potential medical issues following overweight. Instead, they worry about psychosocial issues like social relations and appearance [33]. There is a growing literature demonstrating that obese children and adolescents are victims of bias, stereotyping and stigmatization and that these experiences can affect their social and emotional development [33,34]. A review of qualitative studies found that obese children and adolescents frequently reported that they had been taunted or bullied by their peers and that this had led them to isolation, peer anxiety, low self-confidence and body dissatisfaction [35]. Obesity is also shown to be associated with depressive symptoms and feelings of shame [36]. A comprehensive review by Griffiths et al. [6] found that pediatric obesity affected self-esteem. Of the assessed sub-domains of self-esteem, athletic/physical competence and physical appearance revealed the greatest impact. Adolescence is a time of dramatic change in physical appearance and thus a young person's self-image is closely tied to his or her body image [37]. Body image can be defined as "the individual, subjective sense of satisfaction or dissatisfaction with one's body and physical appearance" [38]. Body composition is shown to be a powerful predictor of body dissatisfaction among adolescents with overweight and obesity [39]. A longitudinal study of children in elementary school, found that girls whose body fat increased, also reported increased body dissatisfaction. Cross-sectional evidence for an association between body dissatisfaction and percent of body fat was also found in boys, but only in relation to physical function [40]. Qualitative studies elaborate on such findings by allowing for more in-depth knowledge of overweight and obese young people's experiences around body size.

A report by Rees et al. [33] based on a systematic review of qualitative research about the perspectives of young people on body size, shape and weight, found that overweight adolescents experience size-related abuse and difficulties with social activities and friendship. In terms of promoting weight control, young people found it insufficient to be provided with education and advice only, and emphasized the need for encouragement, support, motivation and the freedom from persecution and stigma in order to pursue successful attempts at weight loss [33].

2.2 Physical activity and fitness

Physical activity among adolescents with overweight and obesity is an important issue as overweight is found to be associated with decreased PA and fitness [41,42]. Although PA and exercise alone is not sufficiently powerful to significantly prevent or reduce overweight, PA is associated with prevention of weight gain over the life span and is therefore considered a key component in both prevention and treatment of overweight and obesity [3,4].

Physical activity is defined as “any bodily movement produced by skeletal muscles that results in energy expenditure” [43] and includes sports, exercise, play, physical education, household, active transportation (e.g. walking to school) and other activities. PA can be described by type, intensity, frequency and duration [44]. A variety of instruments is used to assess PA in children and adolescents. This includes subjective measures like self-report, proxy-report, interviews, diaries and observation, and objective measures such as accelerometry, pedometry and heart rate monitoring [44,45]. Objective tools are more valid, however often too resource-demanding, at least in large-scale studies [46], making the choice of instrument a trade-off between feasibility and validity [44]. For research purposes, the intensity of physical activity is commonly described in terms of metabolic equivalents (MET). One MET equals 3,5 mL O₂/kg body weight/minute, which is the equivalent to resting metabolic rate. Activities that are more intensive require increases in oxygen. Thus, activities can be quantified in terms of multiples of resting oxygen consumption [47]. A compendium, with a coding scheme classifying PA by rate of energy expenditure, has been developed for both adults and youths [45,48]. This scheme makes it possible to quantify the energy cost of self-reported PA by linking categories and types of PA with their respective MET intensity values. Activities with values <3.0 METs are characterized as low intensity activities, while 3.0-6.0 METs are moderate and >6.0 are vigorous or high-intensity activities.

Physical activity guidelines are provided internationally and nationally for all age groups with the intent of recommending the least amount of PA for good health. New Norwegian recommendations were launched in 2014. The guidelines state that children and adolescents should perform at least 60 minutes each day of moderate to vigorous-intensity activities. At least three days a week, they

recommend including muscle and bone strengthening activities. They also emphasize that sedentary behaviors should be reduced [49].

Physical fitness is commonly described as consisting of muscle strength, endurance and motor ability, and is a prerequisite for performing daily activities without fatigue and for enjoying leisure activities [50]. Muscular fitness is the capacity to carry out work against a resistance and is tested by a variety of maximal-, explosive-, endurance- and isokinetic strength tests. Cardiorespiratory fitness (CRF), also called cardiovascular fitness or maximal aerobic power, is the overall capacity of the cardiovascular and respiratory systems and the ability to carry out prolonged strenuous exercise [51]. The maximal oxygen consumption (VO_2max) attained during graded maximal exercise to voluntary exhaustion is most commonly used as an indicator of CRF. VO_2max can be estimated by direct or indirect methods using maximal or submaximal tests. In studies involving larger groups of young people, a commonly applied test for assessing CRF is the 20-meter shuttle run test (20mSRT) [52]. Test results can be given in shuttles completed or running speed at each level. VO_2max can also be indirectly estimated from the scores obtained on this test [53].

2.2.1 Physical activity and fitness among overweight adolescents

As already addressed, body weight gain is multifactorial. However, the fundamental physiological cause is a positive energy imbalance over time caused by higher intake than expenditure. Hence, higher energy expenditure through increased PA has the theoretical potential of protecting against weight gain [54]. This is reflected in the many preventive initiatives carried out to increase PA in the population with the aim of reducing BMI or body weight. A number of studies have aimed to document relationships between adiposity and physical activity. Inverse relationships between PA and overweight are found, but there are also studies struggling to document such a relationship [41,55]. Studies documenting associations between inactivity and adiposity tend to be interpreted as “inactivity leads to overweight”. However, an association could just as well result from the inverse, with adiposity leading to inactivity. A longitudinal study on children has reported such an inverse association between baseline fatness and follow-up PA, indicating that fatness leads to inactivity [56]. There have also been attempts to describe differences in activity intensity levels between normal weight and overweight. A study by Olds et al. [57] showed that adolescents’ PA level did vary with weight status and that the differences depended on time devoted to moderate to vigorous PA and participation in sports activities. Among obese adolescents, sport constituted 38 % of total daily energy expenditure, compared to 46% in normal weight. The differences in moderate to vigorous PA and sports participation were calculated to be equivalent to 6–7% of total daily energy expenditure which would amount to a variation of about 8–9 kg of body fat over the course of a year [57,58]. This difference in sports participation may be explained by the many barriers to participation reported by

overweight youth. For example, in a study synthesizing 15 qualitative studies, it was found that overweight adolescents experienced a range of barriers for PA in addition to barriers commonly experienced by adolescents in general [59]. Physical discomfort, fatigue and negative self-perceptions were apparently exacerbated by the weight status. Being overweight predisposed to higher levels of victimization and difficulties in relation to forming peer relationships [59]. It has also been documented that gender has an effect on body-related barriers, with overweight girls reporting greater barriers than boys [60].

The relationship between physical fitness and overweight seems more apparent compared to the relationships between PA and overweight. This has been concluded in a review of both cross-sectional and longitudinal studies investigating the interrelationships between PA, PF and overweight [41]. While data on the relationship between PA and overweight was inconsistent, an inverse relationship between fitness and overweight were observed in all studies. However, due to the small number of longitudinal studies, it is for the time being impossible to determine the type of interrelationship among the variables overweight, PA and physical fitness [41]. CRF seemed to be more strongly related to BMI than motor fitness, meaning that adolescents with lower CRF were more likely to be overweight or obese [41]. Longitudinal studies have shown that the level of physical fitness during childhood and adolescence largely determines one's physical fitness during adulthood and that poor physical fitness during early stages of life is associated with later cardiovascular risk factors [61,62].

Whatever the direction of causality, if inactivity leads to overweight or vice versa, the consequence is that in the long run, inactive overweight adolescents miss out on positive health effects of PA and fitness [63]. In addition to having a potentially preventive effect on overweight, PA and fitness may also positively influence a number of health factors, factors that have shown to outweigh the negative effects of excess fat. Adults with high BMI and good aerobic fitness have a lower cardiovascular mortality compared with individuals with normal BMI and poor fitness [64]. Findings from studies reviewed by Ortega et al. [51] suggests that adverse effects of high fatness (e.g. risk of cardiovascular disease) in children and adolescents could be counteracted by high levels of CRF.

2.3 Health-related quality of life

Quality of life (QoL) is a concept closely related to well-being, and often interchangeably used in the literature. QoL is a subjective phenomenon and a normative concept based on the individual's beliefs, expectations and goals. Moreover it is a multidimensional concept which includes physical, psychological, social and existential dimensions of life [65]. Health is an important aspect of quality of life. Thus, in health research, quality of life is commonly conceptualized as *health-related quality of*

life (HRQoL) [66]. Traditionally, HRQoL has been linked to patient outcomes, generally focusing on functioning. In contrast, subjective well-being holds affective and cognitive resources as key components [67]. However, more recent definitions of HRQoL take on a holistic perspective by describing HRQoL as a construct covering physical, emotional, mental, social and behavioral components of well-being and functioning as perceived by patients and/or other individuals [68,69]. Thus, assessments of HRQoL can present a means of comparing and integrating the importance and satisfaction of different life domains (e.g. school, friends and family) during adolescence with the overarching assessment of how well is life going on [70].

2.3.1 Health-related quality of life in overweight and obese adolescents

The adolescent years involve many dramatic changes: physically, psychologically and socially, changes that are likely to influence overall HRQoL [37]. Research has shown that in general populations, adolescents rate their HRQoL lower than younger children do [71]. There is strong evidence that overweight impacts HRQoL and that HRQoL decreases with increasing BMI [72,73]. Additionally, overweight adolescents who become non-overweight are shown to report significantly higher HRQoL than those who remain overweight or obese [74,75]. Although most dimensions of HRQoL are affected in overweight and obese children and adolescents, some of the sub-dimensions of HRQoL seem particularly influenced. Studies consistently report that obese young people have impaired physical and social functioning [6,76], and that physical and school dimensions appear to be particularly sensitive in clinical samples, indicating that increasing weight has an adverse effect on these dimensions [5]. Studies investigating the associations between gender and HRQoL have revealed somewhat different patterns of impairment. While some studies have documented that adolescent overweight girls reported poorer HRQoL than boys [71,77,78], a recent study found the opposite [74]. Studies also provide evidence that HRQoL among the obese varies with age, but the results have been inconsistent, making it impossible to describe a clear trend [5].

The relationship between body image and HRQoL has not been extensively investigated. However, studies do show lower HRQoL scores for physical appearance among overweight compared with normal weight [5]. A Norwegian study revealed that in a general adolescent population, body image and not BMI had the strongest impact in terms of explained variance in HRQoL [79]. The study suggested that the subjective sense of satisfaction or dissatisfaction with one's body was actually a more important predictor for HRQoL than objectively measured BMI. Moreover, a German study found that adolescents who considered themselves overweight reported lower HRQoL than adolescents who actually were obese, a finding that underlines the complexity of issues related to body weight [80].

2.3.2 *Physical activity, fitness and health-related quality of life*

As a construct that gives insight to how an adolescent's life is going, HRQoL can provide a useful adjunct to the study of PA and exercise in adolescence [70]. HRQoL and PA have long been associated, although research linking PA behavior to the stable construct of HRQoL is limited compared to studies on acute effects of exercise on well-being (e.g. feeling better after a PA session), or chronic effects of a physically active lifestyle [81]. However, there is some research documenting positive associations between PA and HRQoL as well as between fitness and HRQoL among children. A study including overweight children showed that those who met the recommended PA-guidelines reported significantly higher HRQoL compared to those who did not [7]. Another study investigating the influence of muscular fitness and CRF on HRQoL among 8–11 year olds, found that muscular fitness in boys and CRF in girls more strongly influenced HRQoL than excess weight did [8]. Yet another study found that CRF was a mediating mechanism of the inverse relationship between BMI and HRQoL in adolescents. In the case of this study, the highest values were found in models of mediation for the corporal self-esteem dimension emphasizing the importance of body self-esteem connected to physical activities for overweight adolescents [82]. The relationship can be understood as increased physical capacity allowing individuals to feel more confident in their ability to manage everyday tasks and to have a more positive perception of themselves, which in turn influences self-esteem. This is supported by research showing that exercise can promote physical self-worth and other physical self-perceptions such as body image and global self-esteem [83].

2.4 **Interventions to prevent and reduce overweight and obesity**

The primary aim of obesity prevention is to reduce the number of new cases. An important secondary aim is to delay or prevent the onset of obesity in those who are already overweight. The literature commonly differentiates between *universally preventive population approaches* or *primary prevention* which aim to benefit the whole child and adolescent population, and *indicated prevention* or *secondary prevention* for those who are overweight or obese, but do not meet the diagnostic criteria for severe obesity requiring *treatment* [84].

2.4.1 *Interventions in schools and primary care*

Schools have the opportunity to reach all children and adolescents and are thus a logical setting for implementing universal obesity prevention interventions. Such interventions typically include modification of energy intake and/or increased PA [85]. Interventions have yielded mixed results, and the impact on weight-related behavior and BMI has been modest [3,86]. It may seem, however, that the field of school based interventions to prevent overweight and obesity is advancing. Compared to the review published in 2005, the revised Cochrane review from 2011 found evidence for the beneficial effects of obesity prevention programs on BMI [3]. It has to be noticed, though,

that this was primarily found in studies for children aged 6–12 and to a lesser degree in studies directed towards adolescents. However, a review by Stice et al. [87] documented the opposite, namely that studies aimed at adolescents tended to report larger effects than did studies for preadolescents. The authors explained this by the maturity of adolescents compared to preadolescents and that adolescents theoretically have developed better self-regulatory skills and are therefore more able to control their food and physical activity choices.

The equivocal evidence of effect of universal prevention programs has led researchers to argue for more aggressive interventions to increase PA and adopt healthier eating behavior in order to impact body composition. Additionally, there are good reasons to request an increased focus on psychosocial aspects in these interventions. An extensive review aiming to gain insight into the extent to which studies of obesity-preventive programs included measurement of psychosocial variables, revealed that only a minority reported on such effects [88]. Thus, it is not clear if these interventions had either positive or negative side effects. It may seem as if interventions that incorporate strategies for improvement of psychosocial well-being, not only behavior modification, yield the most promising results [88]. One possible adverse consequence of obesity-preventive interventions offered to everyone may be that adolescents with overweight and obesity avoid getting involved because they feel stigmatized [89]. If studies do not evaluate effects of programs on aspects of well-being, it is not possible to draw conclusions on the overall intervention effect.

Arguments for targeting and engaging overweight adolescents in individual or group interventions are based on the belief that closer follow-up with the aim of improving knowledge and skills is necessary to effectively handle weight-related problems [90]. Only two settings, schools and primary care, meet children regularly enough to provide indicated secondary preventive programs [84]. Still, primary care prevention programs for groups of overweight children and adolescents have so far been poorly tested and have no currently confirmed beneficial effects. Individually targeted interventions are found to be effective in different clinical settings. Through literature reviews, it appears that multi-disciplinary, comprehensive behavioral interventions of medium to high-intensity are most effective [4,91]. However these interventions are carried out and evaluated in specialist health care and they primarily enroll obese children and adolescents rather than the overweight [92].

2.4.2 Guidelines for measurement and follow-up of overweight and obesity

Despite lack of evidence-based practice and interventions, several countries have published evidence-based guidelines and recommendations for addressing weight issues in primary health care. In Norway, primary health care was quite recently provided with guidelines for standardized measurement of weight and health and for prevention, identification and treatment of overweight

and obesity in children and adolescents [1,2]. The aim is to monitor weight development of the child population and to ensure professional standards in overweight-related issues. The guidelines cover strategies for both universal and indicated prevention and provides suggestions on follow-up according to the comprehensiveness of excess weight. It is recommended that children and adolescents with an age- and gender-adjusted BMI exceeding 25 should be followed with frequent monitoring of weight development and measures provided by the school nurse with the intent of preventing obesity through health behavior changes. These measures should contain mapping and advices on diet and PA for the child or adolescent and the family. If age- and gender-adjusted BMI exceeds 30, further examination by the general practitioner (GP) is recommended, and referral for specialist health care should be considered. Age- and gender-adjusted BMI above 35 requires follow-up by specialist health care [1,2]. In the extent to which follow-up is provided by primary care for the time being, this is to the best of our knowledge based on the guidelines described and on the school nurse's or GP's experience and knowledge. However, even though health professionals perceive childhood obesity as an important issue, it seems evident that there are many barriers among the health practitioners for addressing the topic of overweight. Such barriers include lack of time, resources and institutional support [93-95]. School nurses also report that individual factors like self-perceived competence, negative past experiences, personal weight challenges, fear of stigmatization and others' reactions limit their ability to promote and support health behavior [93]. The many barriers follow along with the challenges of translating guidelines into effective overweight and obesity interventions in primary health care.

2.5 New means of communication

In the search for new effective and efficient strategies to change and maintain health behavior and reduce weight, web-based and mobile interventions are becoming increasingly popular. Internet interventions including both web-based and mobile health interventions [96] are defined as:

"(...) typically behaviorally or cognitive-behaviorally-based treatments that have been operationalized and transformed for delivery via the Internet. Usually they are highly structured; self or semi-self-guided; based on effective face-to-face interventions; personalized to the user; interactive; enhanced by graphics, animations, audio, and possibly video; and tailored to provide follow-up and feedback" [97].

This description emphasizes how Internet interventions are distinguished from patient education web sites, which contain information only. Even though Internet interventions may vary significantly given their focus of behavior or disorder, their content, framework, features and mode of delivery, they all aim to influence health behavior by individualizing messages to the user [98].

2.5.1 *Benefits and challenges of Internet interventions*

One great advantage of Internet interventions compared to face-to-face interventions is their wide-reaching potential [99]. Internet interventions also have the ability of reaching populations that may otherwise not be reached, and provide the users with anonymous and unlimited access to the program [100]. In addition, Internet provides the health promoter with opportunities for continuous maintenance and updating of the intervention [99]. Smartphones and tablets are becoming increasingly available and popular. Like computer-based interventions, mobile devices provide expanded opportunities to access health information. However they can also direct the user to the web site, facilitate collection of personal data and cue behavior at the most appropriate times [101].

One of the challenges of Internet interventions is that their actual reach is lower than expected and that the attrition rate is often high [100]. Given that there is a dose-response relationship between use and effectiveness, it is decisive to improve the interventions to increase adherence [99]. Extensive use of theory and use of multiple behavior change techniques in Internet interventions have been found to be associated with larger effect sizes [102]. Also, combining several strategies has proven to be associated with better exposure [103]. “Strategies” is defined as a way of organizing, operationalizing and delivering a method, e.g. targeted and tailored communication, facilities to support the participants, different ways of interactive delivery, use of reminders and incentives [103]. Due to most studies’ limited description of the efforts taken to facilitate exposure to Internet interventions, it is difficult to study the effectiveness of a single strategy. However, it has been suggested that feedback, peer or counseling support, email/phone contact and regular updates, can potentially contribute to better exposure [100,103]. Moreover, it has been indicated that effectiveness is improved when interventions are embedded in an existing structure like schools or health care [99].

2.5.2 *Tailoring*

The opportunity for professionals to offer interactive standardized feedback to large numbers of people and at the same time to be able to make the messages relevant to each visitor by considering the individual needs of the user, is regarded one of the many major benefits of web-delivered programs [98-100]. *Tailored* health behavior interventions use information or change strategies intended to reach one specific person based on individual-level factors derived from an individual assessment and related to the outcome of interest [104]. Tailoring works by increasing the personal relevance of health messages with the expectation that such individualization will produce greater response to the communication [105]. Internet interventions have proven to be especially well suited to deliver tailored health messages and have contributed significantly to the sophistication of tailoring [98].

2.5.3 Internet interventions for prevention and management of overweight

A recent review of reviews documented that the majority of Internet interventions were aimed at overweight-related behaviors [99]. For obese adults, interactive computer-based interventions were found to be effective for weight loss and weight maintenance, however the amount of weight lost was relatively small and of brief duration [106]. So far the small number of studies and large heterogeneity, makes it difficult to draw conclusions on effectiveness; however higher usage of website features have been associated with positive change in weight status [107]. A review carried out to evaluate the effectiveness of overweight preventive interventions delivered via web reported improvements, though not significant, in moderate to vigorous PA level, fruit intake and positive change in psychological factors [108]. Web-based interventions for prevention and management of overweight and obesity in children and adolescents have also been evaluated, showing some form of significant outcome, either in dietary and/or PA behavior [109,110]. The quality of studies was relatively poor, with limited information on which intervention characteristics produced the effects [109,110]. However, tailoring, increased frequency of personal contact and extensive use of theoretical frameworks were recommended [109].

Obesity-preventive interventions most commonly include strategies to increase PA. Thus, they contain obvious overlaps with internet-delivered interventions for PA enhancement specifically. Two reviews covering the period of 1998 to 2010 including studies on “advanced information and communication technology interventions” to promote PA behavior in children and adolescents [111] and “computer- and web-based interventions” to increase preadolescent and adolescent PA [112] documented that Internet interventions are a feasible way to increase PA in children and adolescents. These reviews included studies of both home-based and school-based interventions. The authors emphasized that to increase effect, interventions should employ theory and theory-based strategies to design the intervention. To determine underlying mechanisms for success or failure, intervention studies should include evaluation of mediating and moderating variables, measure of changes in theoretical constructs, and the use of objective measures of PA. Again, the importance of investigator-initiated strategies and tailored messages was underlined [111,112].

2.6 Theoretical framework for the intervention

There is an increased recognition that interventions aimed at changing health behavior should draw on theories of behavior and behavior change [113]. In interventions containing several interacting components, typically described as complex interventions, it is an important task to develop a theoretical understanding of the likely process of change [114]. Theory can inform interventions in a number of ways, from identifying theoretical constructs or mechanisms underlying particular techniques for behavior change, to selecting participants likely to benefit [102]. Extensive use of

theory in the development of Internet interventions is shown to be associated with larger effect sizes, while Internet interventions incorporating more behavior change techniques tend to have larger effects than those including fewer techniques [102].

2.6.1 Self-determination theory

Self-determination theory (SDT) provides a theoretical framework increasingly used to study motivation in PA and exercise, both in terms of predicting PA and in the development of PA interventions. The main contribution of the theory is the distinction that is made between different types of motivated behavior. SDT introduces the issue of quality of motivational drive by proposing that motivation is multidimensional and can be understood as lying on a continuum (Figure 1).

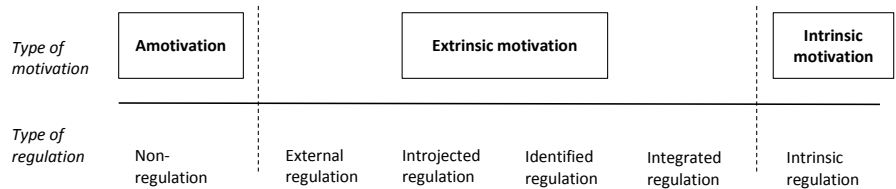


Figure 1. The self-determination continuum [115].

At one end of the continuum is *amotivation*, which describes the lack of intention to engage in a behavior. Amotivation is seen to be the result from an individual not valuing the target activity, not feeling competent to perform the activity and not expecting the activity to lead to a desired outcome. At the other end of the continuum is *intrinsic motivation*, referring to when a behavior is performed for its own sake, for the enjoyment and satisfaction inherent in taking part. Between amotivation and intrinsic motivation is *extrinsic motivation* which reflects motivation to act in order to achieve outcomes that are separable from the behavior itself [115].

Behaviors that are extrinsically motivated vary according to their relative autonomy from non-autonomous, controlled forms of behavioral regulation (external and introjected regulations) to completely autonomous forms (identified and integrated regulations) [116]. *External regulation* describes behaviors that are performed to avoid punishment or gain a reward. An adolescent participating in physical activity only to get a reward from his or her parents or better grades in PE, may be compliant as long as the external control of the reward is in operation. However, the effort and quality of the performance may be low and the interest lies not in the behavior itself [117].

Introjected regulation involves a feeling of obligation. Behaviors are carried out to avoid feelings of guilt. By putting pressure on himself or herself to exercise, the adolescent will feel pride when succeeding and shame when failing. Introjected behaviors can thus be described as being intrapersonally controlled and are not really experienced as a part of oneself [115]. *Identified regulation* refers to doing something based on the value of its consequences and is therefore a much more self-determined form of regulation. In this case, the adolescent feels free to act and he or she does so because the outcomes, i.e. becoming a better soccer player, are personally valued. The difficulties in maintaining the behavior are overridden by conscious acceptance of the behavior being important to achieve the outcome [117]. The most autonomous form of extrinsic motivation is *integrated regulation*. Integration occurs when a behavior is coherent with a person's other core values, personality and sense of self. Although integrated actions have an internal locus of causality, they are performed to obtain a separable outcome rather than as a goal in themselves and are thus still seen as extrinsic [118]. Autonomous regulation of behavior is held to be more stable and enduring and to have more positive effect on human well-being than controlled regulation [115].

SDT also seeks to outline the factors that may hinder or facilitate different types of motivation, which may form the basis of interventions to encourage more autonomous forms of motivation. According to SDT, these factors are referred to as *basic psychological needs*, consisting of *autonomy*, *competence* and *relatedness* [119]. Autonomy reflects the need to participate in activities with a feeling of choice. Competence represents the need to be optimally challenged, and relatedness the degree to which an individual feels connected to and understood by others [119]. Developing a sense of autonomy and competence is essential to make a person more self-regulated and able to sustain behavior, while any factor that diminishes feelings of autonomy or competence is theorized to undermine intrinsic motivation [116,120]. Although not being as essential as the need of autonomy and competence, a feeling of connectedness and belonging is important for intrinsic motivation to thrive [116].

SDT specifies that three dimensions of the social environment can support the needs for autonomy, competence and relatedness, that is *autonomy support*, *structure* and *intrapersonal involvement* [121]. If present, these variables can facilitate behavior adoption and maintenance. This is also demonstrated within the physical activity and exercise domain [122]. Autonomy support involves helping the adolescent to recognize that there are choices regarding the behavior. When choice is limited, autonomy support involves giving a meaningful rationale for the requests being made. An autonomy supportive context also acknowledges the adolescent's perspective and minimizes control and pressure [117,122]. Being an autonomy supportive teacher, trainer, or counselor, involves seeing the situation from the adolescent's perspective, and encouraging self-determined decisions.

Structure relates to whether the counselor is able to make behavior-outcome contingencies understandable and expectations clear, and provide informational feedback on the behavior [122,123]. To provide such structure, clear goals have to be set for the activities, but in order to be autonomy-supportive, the adolescent must be involved in the process of goal setting [124]. Involvement in the supportive environment refers to the quality of the relationship between individuals and to which degree an authority is willing to dedicate time, energy and affection to an individual and if and how this is perceived by the individual. A counselor should try to recognize the adolescent's interest and disinterests. In case of problems, the counselor must attempt to counter the difficulties and re-engage the adolescent in the activity [125].

An increasing number of PA promotion interventions grounded in SDT have been developed and evaluated over the last years. A goal of such interventions has been to test the sequential steps of the motivational process model proposed by SDT (Figure 2). Starting with the intervention, this model depicts the sequential causal mechanisms as pervading lasting behavior change and beneficial psychological well-being [126]. SDT proposes that satisfaction of the basic psychological needs will promote a greater sense of well-being in PA and exercise contexts [126]. However, research addressing the influence of psychological need-satisfactions on well-being promotion in the exercise area has been limited [127].

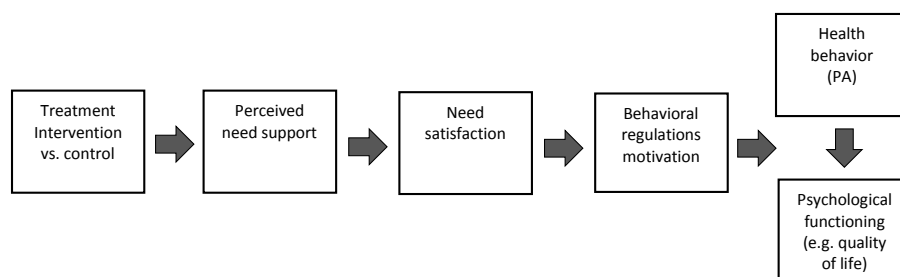


Figure 2. The SDT process model for health behavior change in intervention research [126].

Inclusion of HRQoL as an outcome measure in the present thesis serves several important functions. First, it provides a measure to investigate if chosen psychosocial mediators can explain an association between CRF and well-being. Secondly, HRQoL is an outcome measure for the effect of the intervention built over an SDT framework incorporating principles of autonomy, supportive

counseling and MI. Thirdly, it reflects a firm belief that obesity preventive interventions should emphasize well-being just as much as physical health gains and weight reduction.

2.6.2 Motivational interviewing

Although SDT offers a theoretical basis for development of interventions and an understanding of the mechanisms through which the interventions are efficacious, a challenge for this research has been to translate the theoretical concepts into clinical techniques [128]. Motivational interviewing (MI) is a counseling approach that can be conceptualized and understood in terms of SDT [117,129]. MI is defined as a collaborative, person-centered form of guiding to elicit and strengthen motivation for change [130]. Intrinsic motivation to change is considered to arise from within a person as opposed to motivation imposed by others and thus equated with autonomous motivation as described by SDT [129]. Four general principles underpin the specific techniques and strategies to support change: expression of empathy, development of discrepancy, rolling with resistance and support for self-efficacy [117]. Counselor empathy is seen as especially important as behavior change is only possible when the individual, in this case the adolescent, feels personally accepted and valued [117]. A more recent conceptualization of the principles for use in health care specifically emphasizes that it is critical that practitioners should “resist the righting reflex”, engage to understand and explore the patient’s motivations, listen empathically and empower the patient [128]. It can be argued that the elements of MI are consistent with support of psychological needs for competence, (e.g. by using strategies to explore and support confidence), autonomy, (e.g. by allowing individuals to explore their own reasons for change) and relatedness (e.g. by being empathic and showing interest) [128].

Evidence illustrates that MI can be successful in helping individuals to increase their PA level [131]. Although being a novel area of research, MI techniques have informed some SDT interventions to date, focusing PA promotion as well as weight control or reduction among adults [132,133]. A small study of obese adolescents found that when a MI-based intervention was assessed to a standard weight loss program, BMI decreased and PA practice increased compared to standard treatment only [134].

2.7 A complex intervention

Health behavior change interventions are often categorized as complex, involving many interacting components [135]. A number of frameworks exist for various aspects of design and evaluation of complex interventions. Most commonly, the research takes on a pragmatic approach driven by the nature and context of the research question. A key question in evaluation of complex interventions is whether they are effective in everyday life [136]. The Medical Research Council (MRC) framework for complex interventions states that whenever possible, evidence should be combined from a variety of

sources that do not share the same weaknesses [114]. In addition to mixing methods and designs, complex interventions are usually described as containing several components, approaching different behaviors, including heterogeneous target groups, and measuring a range of different outcomes. Moreover, their purpose is to optimize patient care and improve health and quality of life [136].

The development and evaluation process was informed by the framework given by MRC [114]. This framework includes four stages (Figure 3): (1) development, (2) feasibility and piloting, (3) evaluation, and (4) implementation [136]. However, the stages do not necessarily follow in a sequential or cyclical order and the process of development and evaluation can take a wide range of different forms.

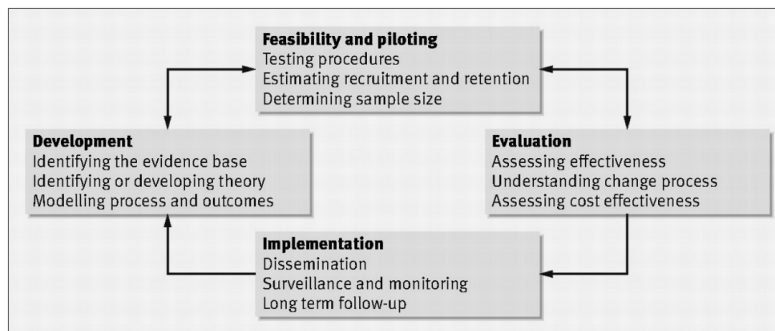


Figure 3. Key elements in a complex intervention [114].

The current study presents data from the first stages of this model, including development, usability testing and preliminary evaluations of effectiveness as presented in the next section. Due to time limits, long-term results of the study are not included in this dissertation. An ongoing doctoral thesis focusing on adolescents' experiences from being overweight and participating in the study will supplement our findings. Additionally, a qualitative study investigating school nurses' attitudes towards working with this particular target group will contribute to an understanding of potential barriers to recruitment and implementation. Altogether, the results will inform the decision of whether to perform a future full-scale evaluation and eventually whether to implement the intervention in practice.

3 Aim

The overall aim of the study was

- 1) to systematically develop an Internet intervention aimed at motivating overweight and obese adolescents to increase and maintain physical activity and thereby enhance their fitness and health-related quality of life and
- 2) to evaluate the effect of the intervention

Figure 4 illustrates how we planned the intervention Young & Active, informed by self-determination theory and incorporating principles from MI, to stimulate the adolescents to participate in self-determined PA and thereby increase their CRF and HRQoL.

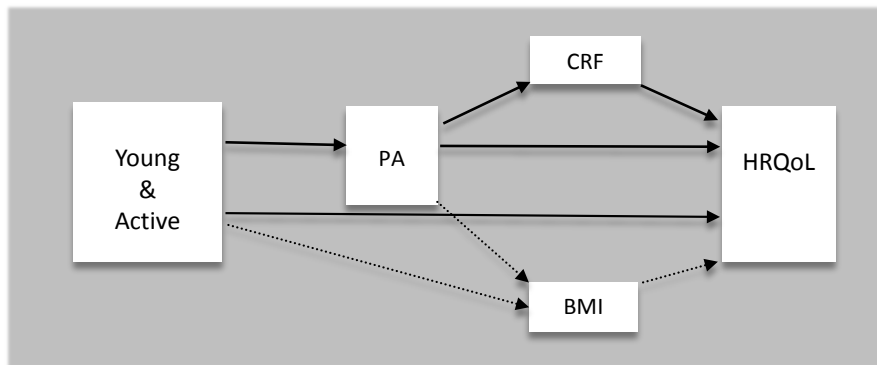


Figure 4. Planned model for the intervention.

4 Design and methods

4.1 Design of the study

The aim of the study was addressed using different methods and included two phases (Figure 5). In the first phase, we intended to design and develop a program in a transparent and systematic way based on existing literature and a theoretical framework, and to increase its usability by involving representatives of the end users in development and testing. The purpose of the second phase was to perform evaluations of the intervention. Initially we analyzed the baseline data to gain increased knowledge about the associations between the main outcomes of the study. We also performed a thorough ethical evaluation of the intervention, as several ethical issues became apparent in the early stages of the study. Lastly, the second phase included an investigation of the short-term effects of the Internet intervention.

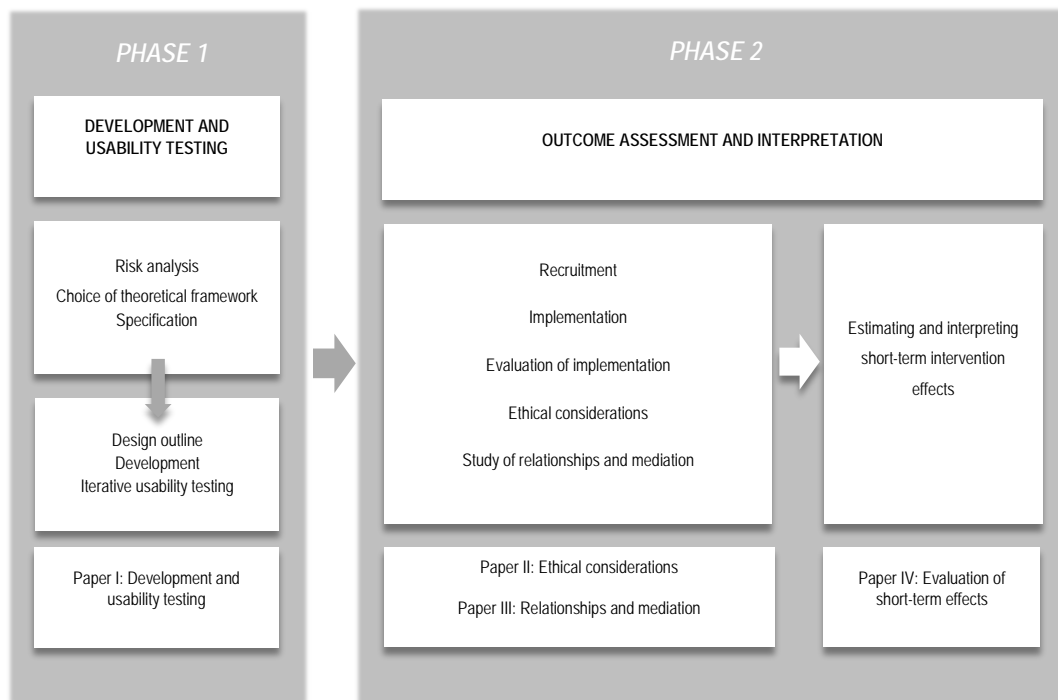


Figure 5. Project outline.

Paper I describes the developmental process of the Internet program Young & Active and the evaluation of the program's usability. An interdisciplinary team of health and education researchers, graphical designers and application developers designed and developed the program together with

representatives from the target group. To assess the program’s usability, we applied an iterative usability testing approach in two sequences, first in the lab and second in the field.

Relying on an ethical framework for overweight interventions and based on the research group’s experiences during planning and implementation of the study, ethical issues are identified and discussed, both in general and concerning the present intervention specifically, and presented in Paper II.

Paper III includes investigations of the associations between CRF and HRQoL by analyzing baseline data (T0) from the entire sample. In the controlled trial presented in Paper IV, the short-term effects of the intervention are evaluated. The participants were recruited directly to either an intervention group that were given access to the Young & Active program, or to the control group receiving standard follow up by the school health service. Originally, we planned for a randomized controlled trial (RCT). However, the design had to be abandoned due to practical and ethical reasons as discussed later in this thesis. An overview of the design of the control-group study is provided in Figure 6.

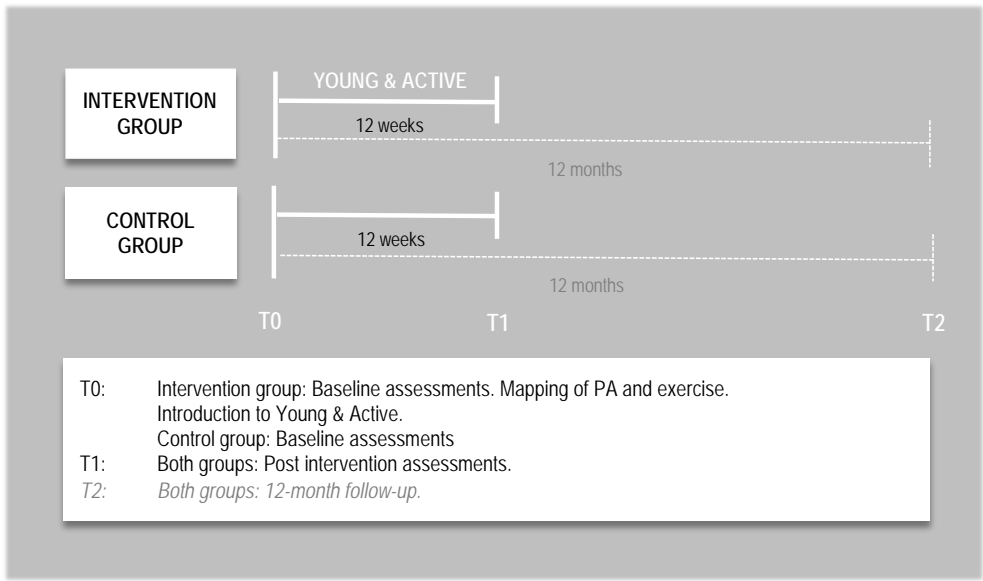


Figure 6. Design of the control-group study (Paper IV).

4.2 Samples

4.2.1 Paper I

Strategic sampling was conducted among adolescents who were expected to give valuable feedback on development and usability of the program. The number of participants were decided upon

according to an appraisal of achieved saturation of qualitative information [137]. A group ($n=4$) was recruited from an ongoing project for obese youth to participate in a workshop to decide on design, content and functionalities in the program. This first group was extended with pupils from a nearby lower secondary school to participate in a lab test for assessment of use and experiences in the first program draft ($n=7$). A last sample ($n=8$) was recruited from an exercise group for overweight and obese adolescents. Over a period of two weeks, these eight adolescents tested and evaluated the program as it appeared in field after the first usability test in lab.

4.2.2 *Papers III and IV*

Paper III and Paper IV report on the same sample. This sample included adolescents with age- and gender adjusted BMI recruited through the school health service. Based on results from standardized screening of weight and height in eighth grade or follow-up measurements in ninth grade [1], eligible participants were allocated to the intervention group or the control group. The inclusion criteria for the study were:

- Age- and gender adjusted BMI ≥ 25
- Eighth or ninth grade
- Not participating in other projects focusing on PA, exercise, diet or weight reduction
- Not participating in treatment programs or receiving follow-up by specialist health care

The sample size in the original RCT-protocol was estimated to 96 in each group based on an effect size of 0.5, a power of 0.80, a level of significance 0.01 and the use of a two-sided t -test for statistical analysis. A 5 % significance level reduced the sample size to 64 per group.

We requested permission from primary health care head nurses of municipalities in three counties in eastern Norway to engage their school nurses in the recruitment of participants. Despite the fact that a great majority of the head nurses gave their permission, most school nurses declined our request, giving reasons such as lack of resources, no priority given to weight screening, or reluctance to discuss the topic of overweight with adolescents and their parents. Twenty-five of 146 nurses (17%) volunteered to recruit, and became responsible for issuing information and obtaining informed consent from participants and their guardians. Participants were allocated to intervention and control groups sequentially. Recruitment of the intervention group was completed first, in February and March 2012, and between November 2012 and March 2013, and the control group between November and March the following school year. In total, 120 adolescents from both urban and rural districts agreed to participate. We intended to match the participants in the intervention group with controls from the same schools. However, recruitment issues as described above made it necessary to extend the number of control schools. Due to time limits, we did not manage to recruit sufficient

participants to the control group resulting in two unequally large groups. Hence, 84 and 36 were allocated to the intervention and control groups respectively (Figure 7).

At baseline, there were no statistically significant differences between the intervention and control groups, except for self-determined motivation for PA and exercise as indicated by the relative autonomy index (BREQ2), which was significantly higher in the control group ($P=0.04$). Only eight of 84 adolescents withdrew from the intervention group during the intervention period. Among the control participants, three discontinued participation. Eight of the 12 who discontinued participation, were boys. There were no statistically significant differences between the discontinuers and the continuers on any of the study variables.

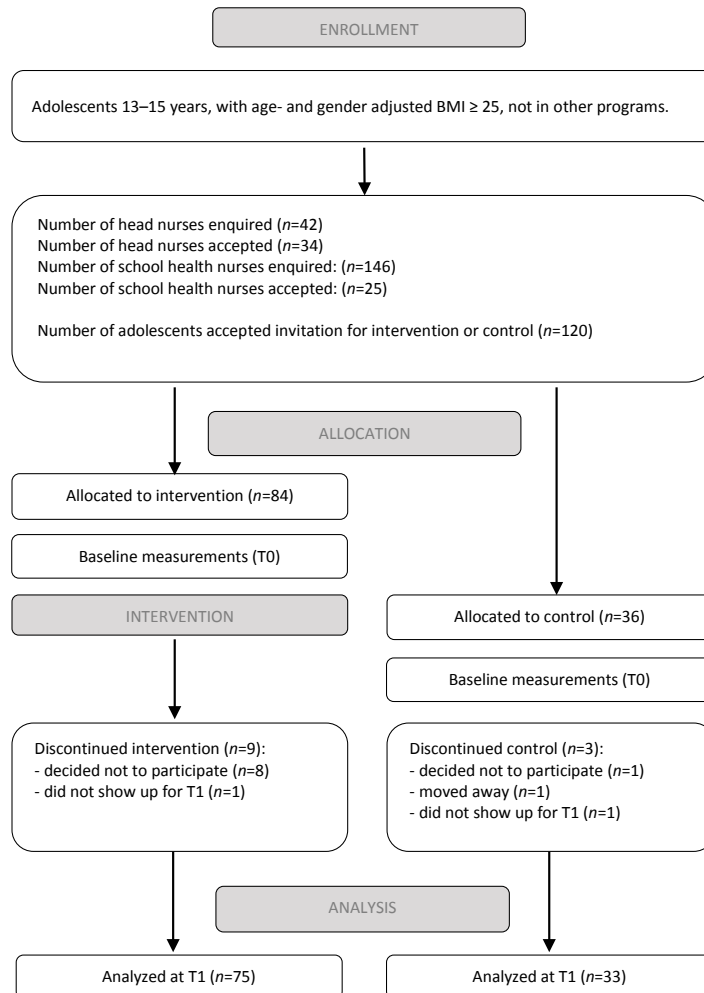


Figure 7. Participant flow.

4.3 Data collection

4.3.1 Paper I

Data for the development-and usability study was collected on all three occasions; during the workshop, and during and after the two usability tests. In order to strengthen the trustworthiness of the information, several research methods were used to triangulate data [138]. Different types of qualitative information about usability were gathered through observations, questionnaire and focus group interviews (Appendix 3). Informed consent was obtained from all participants and their guardians (Appendix 2).

4.3.2 Papers III and IV

Data included in Paper III was collected at T0, while Paper IV reported on data from T0 and T1. The participants in both groups completed self-administered questionnaires at T0 and T1 during school time. A fitness-test was performed individually in the school's gym with only one of the researchers present. Standardized information about how to perform the test was given to every participant. Height and weight were also measured individually, either by one of the researchers or by the school nurse.

The participants in the intervention group underwent additional assessments, as they were interviewed individually by one of the researchers prior to starting registration in the program. The aim was to make the participants initiate reflection on reasons for participation, map current PA and exercise, and outline possibilities for change. Recordings of the interviews will later be used as material for analysis.

Appointments for testing were arranged by the school nurse on behalf of the researchers. At T1, reminders were given both by the school nurse and via SMS by the researchers the day before testing. If a participant did not show up for posttest, a second appointment was made.

4.4 Assessments

Several different methods for assessment were applied to measure the variables in the present work. Questionnaires and guides for observation and interviews are provided in Appendixes 3 and 4 at the end of this thesis.

4.4.1 Usability testing (Paper I)

The Honeycomb model [139] served as a guideline for the usability test consisting of observations, a questionnaire and a semi-structured interview guide. According to this model, the quality of experience of a program depends on whether the users find the program valuable, useful, usable, desirable, accessible, findable and credible. Tasks and questions were grounded in these seven

facets. Questions in the questionnaire, e.g. “Did you like the design?” (desirable) and “Could you see from your plan which activities you had scheduled for this week? (findable), were answered Yes/No/I don’t know. A semi-structured guide was used during the focus group interviews to allow the participants to speak more freely about their impression of the program.

4.4.2 Health related quality of life (Papers III and IV)

The KIDSCREEN questionnaires assess several aspects of children’s health and well-being and exist in three different versions with 52, 27 and 10 items. The 10-item version, which was used in the study reported in Papers III and IV, gives a single index score constructed from the 52-item version [140]. The time frame of the questionnaire refers to the previous week and consists of the following items: (1) felt fit and well, (2) felt full of energy, (3) felt sad, (4) felt lonely, (5) had enough time for yourself, (6) been able to do the things that you want in your free time, (7) parent(s) treated you fairly, (8) had fun with your friends, (9) got on well at school and (10) been able to pay attention. All items are rated on a five-point Likert scale ranging from never to always or not at all to extremely. Negatively worded items were recoded so that higher values indicated better well-being. The long and the short Norwegian versions of the KIDSCREEN questionnaire have previously shown satisfactory validity and reliability [79]. Cronbach’s alpha for the instrument in the current study was 0.79 and 0.83 at baseline and post intervention respectively.

4.4.3 Cardiorespiratory fitness (Papers III and IV)

The 20-meter shuttle run test (20-mSRT) is a reliable and valid test widely used to measure cardiorespiratory fitness in the field [53,141]. The test requires the participants to run between two lines set 20 meters apart at a pace dictated by an audio signal starting at a velocity of 8.5 km/h and increasing by 0.5 km/h every minute thereafter. The test is terminated when the participants do not maintain the set pace or they reach volitional exhaustion. If the participant misses one shuttle, he or she is allowed to speed up to finish the next shuttle within the allotted time. Test performance is commonly calculated as total shuttle counts expressed as level reached plus shuttles run within that level. This shuttle-test score is a meaningful measure for individuals and instructors, and can be used to compare individuals and samples to norm data. However, there is a methodological problem in the analysis of such data, as shuttles do not represent interval level data. Thus, and in accordance with the literature, we used end running speed in the statistical analysis [142].

4.4.4 Physical activity (Paper IV)

Physical activity was measured with a question adapted from World Health Organization Health Behavior in School-Aged Children (HBSC) survey [143], validated in the Young-HUNT study [144]. The question was “Apart from the average school day, how often do you play sports or exercise to the

point where you breathe heavily and/or sweat?” The response alternatives ranging from “every day” to “never” were recoded into three categories so that “low activity” represented “one day a week or less”, “moderate activity” represented “2–3 days a week” and “high activity” represented “four days a week or more” [144].

4.4.5 *Self-determined motivation for physical activity and exercise (Paper III and IV)*

Motivation towards PA and exercise was measured using the Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2) [145]. The questionnaire comprises 19 items relating to the five types of regulation identified by SDT, ranging from the least to the most self-determined: amotivation, external regulation, introjected regulation, identified regulation, and intrinsic motivation. In our version the term “exercise” was replaced with “physical activity *and* exercise” to emphasis the value of increasing PA in general, not only the shorter bouts of exercise. A similar change has previously been made in the Dutch version of the questionnaire [146]. Examples of items are “I am physically active and exercise because other people say I should” (external regulation), “It’s important for me to be physically active and exercise regularly” (identified regulation). Responses were indicated on a five-point Likert-scale, from 0 (“not true for me”) to 4 (“very true for me”). The questionnaire has previously shown satisfactory validity when being tested on Dutch adolescents [146], but has never previously been tested on a Norwegian adolescent sample. Thus, we performed a forward-back-forward translation [147] and a confirmatory factor analysis to confirm the structural model fit of the scale, which showed an acceptable fit for the data (Paper III). Reliability of the questionnaire was confirmed by acceptable levels of Cronbach’s alpha for all subscales both at baseline (T0): amotivation = 0.83, external regulation = 0.76, introjected regulation = 0.78, identified regulation = 0.71 and intrinsic regulation = 0.86 and post intervention (T1): amotivation = 0.86, external regulation = 0.76, introjected regulation = 0.76, identified regulation = 0.79 and intrinsic regulation = 0.87.

A Relative Autonomy Index (RAI) score representing self-determined motivation was obtained by summarizing weighed scores from the five subscales described above: (amotivation x -3) + (external regulation x -2) + (introjected regulation x -1) + (identified regulation x 2) + (intrinsic regulation x 3). This score provides an index to the degree to which respondents feel self-determined in PA and exercise, given that the five different motivation types are located on a continuum of ordered variations in self-determined motivation (SDM). The minimum score for the RAI is -24 and the maximum is +20 with more autonomous motivation being indicated by higher positive scores.

4.4.6 Body image (Papers III and IV)

The body image scale used in the study was developed in Norway [38] and consists of four items: (1) I would like to change quite a lot about my body, (2) by and large, I am satisfied with my looks, (3) I would like to change quite a lot about my looks, and (4) by and large, I am satisfied with my body. The adolescents responded to one of the following categories: does not apply at all; does not apply well; applies somewhat; applies fairly well; applies well and applies exactly. The two negatively formulated items were recoded so that higher scores indicated a more positive body image. All four items were summed to construct a body image score ranging from 0 to 20 with higher scores indicating a more positive body image. Previous research has found that the scale has acceptable reliability [148]. In this study, Cronbach's alpha for the scale was 0.87 and 0.90 showing good internal consistency.

4.4.7 Body mass (Papers III and IV)

BMI was calculated for each adolescent based on his or her body weight and height measurements as weight in kilograms was divided by height in meters squared (kg/m^2). Normal weight, overweight and obesity were defined using the international age-and gender-specific BMI cut-off values as proposed by Cole et al. [17]. Body weight was measured to the nearest 0.1 kg with a portable digital weight. The adolescents wore no shoes and only light clothing. Weight was corrected (-0.5 kg) for clothes. Standing height was measured with a stadiometer to the nearest 0.1 cm.

4.5 The Young & Active Internet intervention

The Internet program Young & Active was developed with the aim of motivating adolescents with overweight to increase and maintain PA. The intervention did not emphasize weight reduction. Rather, it drew attention to physical activity, how active the adolescents aimed to be, and how they could make self-determined choices to increase activity throughout the day.

4.5.1 The components of the program

Young & Active included the following components: A home page with log in and contact information, "My page" with profile and graphical presentation of planned and registered PA of the present week, a plan for PA and exercise, a diary for PA and exercise, a page for weekly feedback from the counselor, a forum with PA-related subjects, and a page with age-adjusted information about PA and exercise (Figure 8). In addition, a counselor's page was designed to display all relevant information about the participants and to coordinate feedback and potential messages. Screenshots from the program are shown in Appendix 5.

After logging in, the participant entered "My page", a page that offered an opportunity to customize a profile by selecting a smiley from a set of emoticons expressing different moods and to choose

three favorite activities from a list (physical activities, sports, social activities). This was primarily for personal use, but the participant was able to see the others' profiles in the forum when posting a message. The smiley and the profile information could be changed at any time. In addition, "My page" contained links to the information page, the last feedback from the counselor and the last posting in the forum.

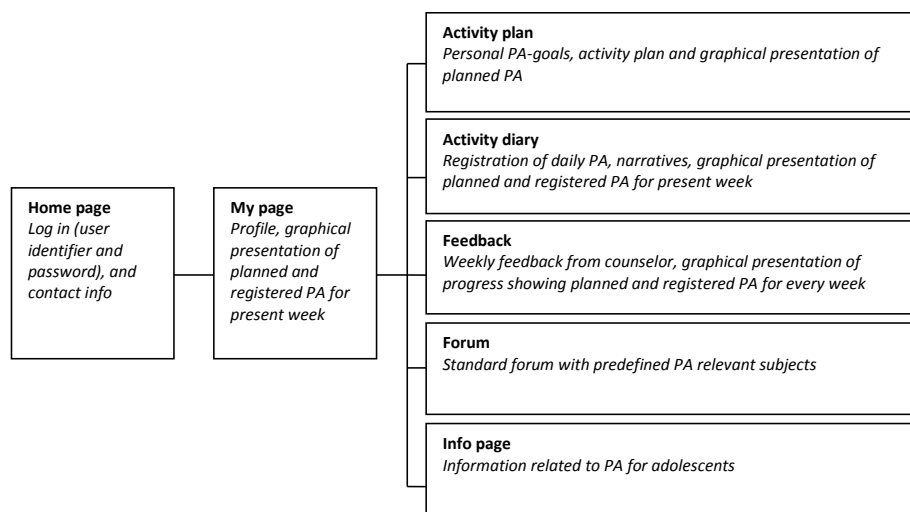


Figure 8. Main content and interactive features of Young & Active.

On the page *activity plan*, the participant filled in up to three self-determined PA and exercise-related goals. These goals were regularly evaluated by the participant and the counselor during the intervention period and could be changed if desired. The activity plan was made out in correspondence with the goals. The participant chose from a list of general activities, exercises and sports activities, and specified the duration of the activity in addition to day and time (morning, during school time, afternoon). The activities were predefined based on MET values [149] with low <3 MET, moderate 3-6 MET and hard >6 MET and listed in a table and expressed in a diagram with columns for light intensity activities (green), moderate activities (blue) and hard intensity activities (red). The activity plan was adjusted along with the goals.

The participant was encouraged to use the *activity diary* to report how active he or she had been during the day. The diary requested registration of type of activity and time spent, in addition to whether the activities were performed alone or with friends. As registrations were made during the

week, the bars in the chart were gradually filled up to reach and even possibly exceed the predefined amount of PA. The diary page provided an opportunity to supplement the registrations with comments on experiences, feelings and thoughts related to PA and exercise and on life in general. The aim of the diaries was to reflect on reasons for PA, encourage awareness of how it felt to be active and to share experiences of success and failures.

Weekly counseling was displayed on the *feedback* page. Individual written counseling was based on the participant's goals, plan, registrations and narratives, provided in an autonomy supportive way by including principles from SDT and MI. The written counseling was announced on "My page" and was saved so the participant could access responses from earlier weeks. The feedback page also contained a historical graph showing the progress through the intervention period. The graph displayed all low, moderate and hard PA registered throughout the week together with total planned and total registered activity.

The *forum* was designed as a standard forum. The participant was encouraged to share PA related experiences and tips, and to ask for feedback and opinions from other adolescents. The counselor acted as moderator. When a message was posted, this was shown together with the participant's profile. New posts were announced in the right margin of every page. The counselor also used the forum to inform about new content on the info page.

Information on PA, exercise and sports activities relevant for the target group was presented on the *info page*. The content was regularly edited and updated by the counselor, but also at the participants' request. New information was presented with a headline and introduction on "My page".

4.5.2 *The counselor's version*

The counselor's version of the program was designed to exhibit all a participant's relevant information on one page. After logging in to the secure page, an opening page was entered, listing all active participants. By choosing one participant, a summary with the historical graph, goals, plan, registered activity and diary notes of the chosen participant was displayed. On top was the graph with information listed chronologically below starting with last week. Further down, earlier weeks' registrations were shown together with their corresponding feedbacks in chronological order. An empty section situated on top of the page under the graph made it possible for the counselor to have all necessary information visible while writing the feedback.

Theoretical constructs from SDT and principles from MI provided the basis for the communication and the techniques used in the counseling to promote behavior change and maintenance in Young &

Active. The techniques were primarily aimed at supporting the participant's goals and attempts to increase their PA frequency and intensity to become and stay more physically active. Table 1 outlines how the different theoretical principles were included in Young & Active.

Table 1. Examples of Autonomy supportive counseling and MI elements in Young & Active.

Principles from Autonomy supportive counseling (SDT):	Principles from Motivational interviewing:	Explanation and examples of practical use:	Relevance for Young & Active
Structure	Give clear information	Give information about what to expect from exercising and what it takes to achieve self-determined goals. Make sure the information is: -neutral and clear (understandable) -sufficient -repeated	-Introduction and mapping -Goal setting and planning -Counseling -Info page
	Develop goals	Help to set goals for PA and exercise. Make sure the goals are: -appropriate -realistic -achievable	-Goal setting and planning -Counseling
	Provide feedback	Follow up goals and plans with regular feedback. Offer advice. Avoid imperatives. Ensure that the feedback is received and understandable.	-Counseling -Introduction and mapping -Counseling
	Support self-efficacy	Make sure to affirm effort, success and progress.	-Counseling
Autonomy support	Avoid coercion	Do not pressure or argue the case for change.	-Introduction and mapping -Counseling
	Roll with resistance	Do not engage in conflict.	-Introduction and mapping -Counseling
	Allow for self-determination regarding what and how to change	Let the adolescent explore his/her own reasons for exercising and how and when to exercise. Let the adolescent choose his or her preferred courses of action.	-Introduction and mapping -Goal setting and planning -Counseling
	Explore options Encourage change talk	Affirm and reinforce expressions of problem recognition, exercise, desire, and intention to change.	-Introduction and mapping -Counseling
Involvement	Express empathy	Display interest in the adolescent and his/her well-being.	-Introduction and mapping -Counseling
	Explore concerns	Reassure the adolescent that concerns are natural, acknowledge and explore worries.	-Introduction and mapping -Counseling
	Demonstrate understanding	See the adolescents' point of view.	-Introduction and mapping -Goal setting and planning -Counseling
	Avoid judgment	Do not blame or criticize the adolescent.	-Introduction and mapping -Counseling

[Adapted from: 117,129]

4.5.3 Introduction and mapping of physical activity

The intervention started with an introductory face-to-face meeting between the participant and one of the researchers. The aim of the meeting was to help the participant to reflect on PA and to explore the reasons and possibilities for change. Together with the researcher, the participant mapped current level of weekly PA, formed goals and made a plan for PA during the day and week. The researcher focused on the value of self-determined goals and activities, and the participant was encouraged to describe, plan and engage in meaningful and fun activities. Finally the participant was given instructions on how to use the program Young & Active, when to make registrations and write the diary, how to interpret graphical feedback and when to expect counseling. Daily registrations and use of the diary were recommended, as was use of the additional features. However, the program allowed for backdating within the same week, so that registrations did not have to be made every day. The following Monday after the introductory meeting, the participant received a reminder via SMS to start registrations and use of the program and to continue doing this for 12 weeks.

4.5.4 Practical and technical information

Only one researcher (author of this thesis) provided written counseling to every participant every week throughout the intervention. New feedback was given every Monday morning. A closing summary was given after week 12. If registrations were missing for an entire week, the participant received a standardized reminder via SMS and a standardized message in the program. A simple mailing system with a message box present on every page gave the participant and the counselor an opportunity to exchange short messages independently of the diary and feedback if necessary. In addition to being responsible for weekly counseling, the counselor gave response to messages from the participant, moderated the forum and provided weekly updates of the info page.

Daily registrations and writing in the diary were estimated to take 5–10 minutes. The counselor spent approximately 20 minutes on written feedback and counseling per participant. All participants regarded themselves as skilled PC-users. Alternative arrangements where the participants were offered to borrow a computer at school could be organized for those without PC- or Internet access. However, this turned out to be unnecessary as all included participants had access to the Internet on computers at home.

Young & Active was developed in eZpublish (version 4.4.0), based on Open Source technology and designed to support PCs, Macs, and newer versions of all browsers. The program also showed acceptable readability for smartphones and tablets.

4.5.5 The control group

The participants in the control group were given follow-up as usual by the school health service. In most cases, such follow-up consisted of opportunities to meet with the nurse on the adolescent's request. In some cases, this included participation in weekly exercise groups arranged by the school health service. However, these groups did not offer more than merely organized exercise comparable to any other typical leisure time sports activity.

4.6 Analyses

4.6.1 Paper I

After each of the two usability tests, data from questionnaires were summarized. Answers from the open-ended questions in the questionnaire and notes from the focus group interviews and the observations were analyzed as text, using simple content analysis [150]. The data were sorted according to the different pages in the program (My page, activity plan, diary, feedback, forum, and info page) and general categories like user performance, visual design, content, functionality, and motivation for use were identified. Conclusions on what to change, remove, add or keep were made based on the results.

4.6.2 Paper II

We utilized an ethical framework for prevention of overweight and obesity as a tool to analyze the ethical implications we experienced during the study [151]. This framework contains eight questions on the morally relevant features of a program: its effect on physical health, psychosocial well-being, informed choice, cultural values, equality, privacy, responsibility and liberty. A supplement to the questionnaire provides possible answers and positive and negative alerts. Table 2 gives an example of one of the eight questions.

Table 2. Example from Supplement to the questionnaire regarding ethical pitfalls [151], p.302

Question: How does the program affect the attribution of responsibilities?	
Values at stake:	
Balance between personal and collective responsibility	
Just divisions of responsibilities	
Answers	Alerts
+ Acknowledgement of responsibilities of various parties is likely	+ A nuanced view is provided of the complex causal factors for obesity
	+ Complexity of responsibilities is explicitly acknowledged
0 Attributing responsibilities is unlikely	+ Responsibilities are freely adopted
– Unbalanced attribution of responsibilities is likely	Δ Responsibility for the causes of overweight is attributed to one single party
	Δ Responsibility for tackling overweight is forced upon individuals, parents, schools, municipalities, social health-care services or commercial organizations

Based on this questionnaire and our experiences during the preliminary stages of the study, we identified and analyzed ethical dilemmas embedded in the intervention approach.

4.6.3 *Paper III*

Confirmatory factor analysis of the BREQ-2 was conducted to test and evaluate how well our data fitted the hypothesized five-dimensional structure of the measure. The model fit was determined by the Satorra-Bentler scale corrected chi-square test, the Comparative Fit Index (CFI), the standardized root-mean-square residual (SRMR), the root-mean-square error of approximation (RMSEA), and the 90 % confidence interval around the RMSEA. Generally, RMSEA values close to .06 represent acceptable fit, and values equal or less than .05 indicate good fit. CFI values of .90 or above, and SRMR values of less than or equal to .08 represent an adequate fit, while CFI values of .95 and above indicate a good fit [152-154]. Factor score determinacy was estimated by Raykov's p by calculating the squared multiple correlation of the proposed indicators for predicting regulation of motivation. This gives information about the extent to which the true factor scores can be determined in the model [155]. The analysis was conducted using Mplus-version 7.

The Mann-Whitney-Wilcoxon test was applied to investigate the differences between boys and girls regarding BMI status and the selected study variables which were not normally distributed. No sum scores were computed if one or more items were missing. Associations between the study variables and the outcome variable were explored using univariate linear regression. A multistage regression approach was used to test for mediation in which three regression equations are estimated. In the first equation, the mediator was regressed on the independent variable, in the second equation the outcome variable was regressed on the independent variable while lastly the outcome variable was regressed on both the mediator and the independent variable [156]. P-values ≤ 0.05 were considered statistically significant. Due to an exploratory nature of our study, we did not correct for multiple testing. The analyses were performed using SPSS©20.0.

4.6.4 *Paper IV*

Due to skewed distribution of the data, non-parametric tests were used to investigate differences in baseline characteristics between the intervention and the control group. Paired samples t -tests were conducted to compare within group differences from T0 to T1 and Independent samples t -tests were used to compare changes between the two groups post intervention (T1). The Cohen's d effect sizes were calculated using the difference between the groups' mean divided by the pooled standard deviation and categorized as small (<0.5), medium ($0.5-0.8$) and large (>0.8) [157]. Missing values were not replaced and all analyses were performed using available cases.

Additional subgroup analysis with Independent samples *t*-tests were performed to compare frequent intervention users and the control group. Finally, binary logistic regression was performed to assess the impact of factors on the likelihood of being a frequent or an infrequent user of the intervention. These results were presented as odds ratio (OR) with 95% confidence interval (CI). A significance level of $p \leq 0.05$ was considered statistically significant and all tests were two-sided. The analyses were performed using SPSS© 21.0.

4.7 Ethical considerations

The study was reviewed and approved by the Regional Committees for Medical and Health Research in Norway. We had to consider the fact that we conducted research on adolescents. All though there is a consensus that it is important to include children and adolescents in research concerning their well-being, involving minors in research requires special attention [158,159]. We emphasized that our informants were given sufficient and understandable information about the study; the purpose, anonymity, the right to withdraw, potential harms and benefits (Appendix 1 and 2). All participants gave written assent to participation, and at least one of their guardians signed an informed consent (Appendix 2).

4.7.1 Ethical issues in overweight interventions for adolescents

During the preliminary stages of our intervention, several ethical concerns cropped up. Despite widespread concern about the obesity epidemic, and explicit national guidelines for follow-up, our initiative to recruit participants through the school health service was met with skepticism. A number of the school nurses were worried about stigmatization and argued against approaching overweight adolescents directly. Thus, an ethical evaluation of the intervention was carried out. The ethical issues were primarily concerned with how to avoid blaming the adolescent while pointing out the individual's responsibility for engaging in activities which promote health. Furthermore, we acknowledge that it could be that the intervention restricted the adolescent's liberty by talking him or her into adopting behavior. Additionally, since overweight and obese individuals are pervasively stigmatized in society, it is possible that the individuals were exposed to discomfort especially during recruitment. Paper II presents a thorough discussion of these identified ethical dilemmas. This article focuses on participation in the intervention group and does not discuss specific ethical considerations regarding participation in the control group. However, we acknowledge that the issue of being identified and enquired to contribute to a study based on BMI was relevant also in the case of the controls. Furthermore, these adolescents were not offered the intervention or any substitute besides standard follow-up by the school nurse. Having said that, the actual efforts required from the control group during the study was limited. We also emphasized that their contribution was of great value to the study. As an expression of gratitude, all control participants received a gift card at T1.

4.7.2 Ethical considerations in interventions online

Internet interventions face a complex range of ethical challenges including concerns relating to confidentiality, privacy and security. Counseling on the web requires privacy to facilitate self-disclosure and ensure confidentiality. Online behavior needs to be monitored to determine if privacy has been compromised. In the case of Young & Active, this required making the participants aware of confidentiality threats, what to write and not write in the diary and on the forum. Based on a thorough risk analysis, appropriate steps were taken, both technically and embedded in the design, to ensure program security and thus security and anonymity of the participants.

5 Summary of results

This section gives a brief summary of the papers I-IV. Detailed information can be found in the original articles at the end of this thesis.

5.1 Paper I

The first paper describes the process of the development and the usability testing of the Internet intervention Young & Active. The intervention, aimed at motivating overweight adolescents to increase and maintain PA, was developed in cooperation with representatives from the target group. An iterative qualitative usability testing approach was applied in two sequences to assess how the adolescents used and experienced the program.

Self-determination theory (SDT) and perspectives on self-regulation informed the theoretical rationale, design and content of the intervention. The program was designed to provide opportunities for self-monitoring through planning and registration of PA and exercise, automatic and continuous graphical response on progress and autonomy-supportive, individualized web-based counseling. Additionally, the program included a forum and an info-page with age-adjusted information on PA, exercise and sports. The counseling was based on theoretical inputs from SDT and motivational interviewing (MI), and was provided as a response to the participants' daily registrations and diary notes on PA and exercise. The second usability test evaluated the program with adjustments from the first test, revealing that the program was well accepted.

Developing an intervention with thorough theoretical foundation, in addition to engagement from the target group throughout the process of development and usability testing is essential to create an engaging program. The results from the study indicated a usable intervention ready for further evaluation in a controlled trial.

5.2 Paper II

In the second paper we discuss ethical concerns relating to overweight interventions for adolescents. The concerns originated from the present Internet intervention and became apparent during development and early stages of implementation. As developers and researchers, we experienced that controversy attended the introduction of our initiative and that our coworkers in primary care hesitated to approach overweight adolescents directly for fear of reinforcing stigmatization. Utilizing an ethical framework for the prevention of overweight and obesity, we identified three particularly prominent dilemmas arising from our intervention study: the attribution of responsibility for health behavior, liberty to choose action, and the effect on the participants' psychosocial well-being. Relying

on ethics theory, the article discusses whether and how measures can be taken to deal with these dilemmas.

Empowering the adolescents to make self-determined choices about PA and exercise has been the core intention of the intervention. By tailoring the feedback to each participant individually using principles from autonomy supportive counseling and MI, we claim that the intervention has a unique potential to help the adolescents make their own ethically anchored decisions about health behavior. However, assuming we can justify the intervention per se, there are still important ethical dilemmas related to the recruitment of the participants. It is evident that the ethical issues were mainly concerned with the vulnerability of adolescents identified as overweight.

For the future, it seems necessary to evaluate how measures can be taken to minimize and avoid blaming when engaging participants. We argue the need for a thorough ethical analysis of the entire range of measurements initiated to prevent development of overweight and obesity among children and adolescents.

5.3 Paper III

The aim of the study reported in Paper III was to examine the relationship between CRF and HRQoL among a sample of overweight and obese adolescents and to test whether a relationship was mediated by body image and self-determined motivation for PA and exercise.

One hundred and twenty adolescents with an age- and gender adjusted BMI ≥ 25 reported on HRQoL, body image and self-determined motivation. Moreover, they completed a 20 m shuttle-run test. Associations were explored using univariate linear regression and mediation was tested by a multistage regression approach. The instrument for measurement of motivation for PA and exercise, the Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2), has not been tested on Norwegian adolescents before. Thus, a confirmatory factor analysis was performed to confirm the structural model fit of the scale. The factor analysis revealed that all items contributed to the measurement of the respective hypothesized corresponding latent constructs, thereby supporting dimensional validity of all five dimensions of regulation of motivation.

Statistically significant associations were found between HRQoL and CRF ($B = 4.16$ [95% CI]; $p < 0.05$) showing that for each 0.5 km/h increase in CRF (running speed), HRQoL increased with 4.16 points. Statistically significant associations were found also between HRQoL and the hypothesized mediators body image and self-determined motivation as shown in Table 3. BMI was not significantly associated with HRQoL.

Table 3. Associations between HRQoL and study variables

Variable	B	95% CI	P value
CRF Running speed	4.16	0.3-8.02	<0.05
Body image	0.74	0.2-1.28	<0.01
Self-determined motivation	0.85	0.41-1.28	<0.001
Body mass index	-0.29	-1.08-0.49	0.458

HRQoL = health-related quality of life; CRF = cardiorespiratory fitness

CRF was not significantly associated with body image in the first mediation equation when controlling for gender, hence body image was excluded from further analysis. When self-determined motivation was introduced as a mediator, the previously significant relationship between CRF and HRQoL was no longer significant ($B = 2.55$ [95% CI $-1.27-6.36$]; $p = 0.19$).

The findings suggest that it is not the physiological effects of being fit as much as the motivational mechanisms related to fitness that explains the association between CRF and HRQoL in overweight adolescents.

5.4 Paper IV

Paper IV presents the short-term effects of Young & Active. We hypothesized that focusing on self-determined PA and exercise through an Internet intervention would have positive effects on the adolescents' CRF and HRQoL. Moreover, we hypothesized that compared to the control group, the intervention group would show increased self-determined motivation for PA and exercise, increased moderate to vigorous PA during leisure time, improved body image and stabilized or reduced BMI after the intervention.

One hundred and twenty adolescents (13–15 years) with age- and gender-adjusted BMI ≥ 25 accepted the invitation to participate, and were allocated to an intervention- or a control group. While the control group received standard follow-up by the school nurse, the intervention group were given 12-weeks access to the Young & Active program, which provided weekly tailored PA counseling applying principles from SDT and MI and continuous graphical response on progress as described in Table 1. Counseling and feedback depended on daily registrations of PA and exercise by the participant. To compare pre-to post-intervention differences within groups, a paired samples t -test was used while crude differences between groups were analyzed with an independent samples t -test. The differences between changes in the intervention group versus the control group are expressed as effect sizes calculated with Cohen's d . In addition, logistic regression was performed to assess the impact of factors on the likelihood of being a frequent user versus an infrequent user of the intervention.

One hundred and eight adolescents completed the study, 75 and 33 in the intervention group and control group respectively. The 12-week intervention managed to influence the intervention group participants' CRF, HRQoL and BMI positively. A small effect was found on CRF (0.14; 95% CI [0.01;0.28]; $P=0.04$) and a moderate effect was found on HRQoL (5.22; 95% CI [0.90; 9.53]; $P=0.02$). Moreover, the control group increased significantly in BMI, yielding a moderate preventive effect on BMI (-0.39; 95% CI [-0.74;-0.03]; $P=0.03$) for the intervention group. The intervention did not have an effect on body image and self-determined motivation (Table 4). Comparing frequent users of the intervention (seven or more weeks of registrations) with the control group, revealed moderate effect sizes on CRF ($P=0.04$), body image ($P=0.04$) and BMI ($P=0.01$). Those with higher initial BMI had about 20% decreased likelihood of using the intervention ($P=0.03$; OR=0.81; 95% CI [0.68; 0.97]), while those with higher initial HRQoL were about 9% more likely to use it ($P<0.01$; OR=1.09; 95% CI [1.03;1.16]).

Table 4. Between-group differences and effect sizes after the intervention (T1)

Outcome measure	Intervention versus control				Per protocol (frequent users versus controls)			
	Mean diff	95% CI	P-value ^a	ES ^b	Mean diff	95% CI	P-value ^a	ES ^b
<i>Primary</i>								
20mSRT	0.14	0.01;0.28	0.04	0.39	0.21	0.01;0.41	0.04	0.55
<i>Secondary</i>								
KIDSCREEN-10	5.22	0.90;9.53	0.02	0.56	4.21	-0.74;9.15	0.09	0.45
Body image	1.29	-0.26;2.83	0.10	0.40	1.68	0.10;3.26	0.04	0.56
Relative aut.index	0.23	-1.92;2.39	0.83	0.05	0.51	-1.86;2.88	0.67	0.11
BMI	-0.39	-0.74; -0.05	0.03	-0.50	-0.52	-0.89; -0.16	0.01	-0.70

^aP-values for independent samples t-tests

^bCohen's d

The results give preliminary support to the efficacy of an Internet intervention for increasing CRF and HRQoL in adolescents with overweight and obesity.

6 Discussion

The present thesis contributes to new knowledge on several areas related to overweight adolescents' fitness and HRQoL. In the following section, the study will be discussed with reference to methodological considerations, main results, and possible implications.

6.1 Methodological issues

Different approaches, samples, methods for collection of data and outcome measures were applied in this study depending on the phases and objectives. A key question in evaluation of complex interventions is about practical effectiveness. Another important question is how the intervention works [114]. By involving our target group and the field of practice throughout development, usability testing and recruitment, we gained knowledge about preferences and barriers. Moreover, by taking on an exploratory approach, we have learned more about associations between outcomes as well as the short-term effects of the intervention, all of which leaves us in a better position to decide on further evaluation and implementation. Methodological issues are discussed in relation to Papers I, III and IV, while Paper II is discussed along with Ethical implications under Main results.

6.1.1 Study design

To increase the likelihood that our target group would choose to visit, use and revisit the program, we actively involved adolescents in development and usability testing of Young & Active. Users should be engaged in all stages of the development, process and analysis of a complex intervention as this is likely to result in better, more relevant science and a higher chance of producing implementable data [114]. Consequently, representatives from the target group were encouraged to express their opinions about ideas presented by the developers and to make suggestions on changes and improvements. Furthermore, the usability testing had a qualitative approach following a design-evaluation-redesign procedure with triangulation of data from observations, a questionnaire and focus group interviews with adolescents. The feedback was expected to give valuable information about the adolescents' experience of the program, which it did. Thus, the active involvement of target group representatives in the development as well as in usability testing, was a major strength of this study.

Paper III presented and analyzed data from baseline assessments of the Young & Active controlled trial. The major aim was to document associations between CRF and HRQoL and to investigate the potential mediating effects of body image and self-determined motivation. Although the mediation model makes theoretical claims about causality [156], the results of statistically testing a mediation model are insufficient for making such assumptions because of the correlational nature of the data.

The original protocol for the evaluation study described in Paper IV included a randomized controlled design for evaluation of intervention effects. Randomization of two groups serves to make them comparable at baseline which consequently makes it easier to quantify the impact of the intervention while minimizing effects from confounding factors [160]. However, due to the various environmental and clinical settings, lack of random assignment is quite common within the field of web-based health behavior interventions [112]. As it turned out, there were weighty arguments for abandoning randomization in our study as well. We relied on the school nurses to assist in recruitment following routine height and weight screening in eighth grade. However, the majority of nurses we contacted either did not have the resources to perform measurements or refused to approach overweight adolescents directly for ethical reasons. This heavily reduced the number of potential participants and gave us very little control over the number and location of available schools. Even more important, several school nurses found it difficult to approach a sensitive topic like overweight by introducing the adolescents to an intervention they signed up for and hoped to receive, but perhaps ended up *not* receiving. By choosing a control-group design without randomization, we were able to consider the practical and ethical issues that arose. The amount of information was reduced and adjusted specifically to the two different groups and the adolescents would immediately know in which group they were offered participation. We included all interested participants in an intervention group the first year, while aiming to match the intervention participants with controls from the same schools the following year.

The problems we experienced regarding recruitment in the initial part of the second phase of the study forced us to take a step back to consider the need and possibilities for alternative strategies. We entered a novel field of research with little to no previous empirical knowledge and studies to lean on. Enhancing our knowledge of the potential effects of tailored web-based counseling for the target group was always a main objective. However, actions to evaluate whether the intervention could prove feasible and at all legitimate, had to be taken. Thus, the study was supplemented with qualitative analysis of possibilities and barriers for implementation, and a theoretical evaluation of ethical pitfalls, the latter of which is included in the present thesis.

The MRC framework for complex interventions emphasizes the value of a thorough feasibility and piloting stage as evaluations are often undermined by problems of acceptability, compliance, delivery of the intervention, recruitment and retention [114]. Although the present controlled trial qualified as more than a typical feasibility test or a pilot trial, it is evident that a thorough evaluation of direct and indirect effects requires a larger study sample and a more solid design. Nevertheless, there are steps to be taken to increase the inferential power of quasi-experiments so that the internal validity is enhanced. In the present study we used selected comparison groups and pretest measures taken

on the same outcome variable as the posttest, with the aim of facilitating causal inferences [161]. The baseline differences between intervention and control groups turned out to be marginal, although we cannot prove that selection bias was absent as unmeasured variables at pretest could have been related to the outcome. Internal validity would have been increased if we actually had been able to match all cases with controls from the same schools. Difficulties in recruiting controls made it necessary to extend the number of schools. Additionally, and despite great efforts, we did not manage to recruit sufficient participants to the control group with the consequence of reduced statistical power as well as internal validity. However, one important advantage gained from changing design, was that we avoided spillover effects. As it turned out, friends and even siblings signed up for the study. It would have been possible, and even likely, that the intervention would have contaminated from intervention group participants to control group participants if friends and classmates had been randomized to different groups.

Summing it up, we made ethical and pragmatic choices at the cost of a stronger design. However, taking all limitations of non-randomizing into account, we argue that the present study served its purpose by providing innovative knowledge of tailored web-based counseling as a potentially effective way of enhancing fitness and HRQoL among overweight and obese adolescents.

6.1.2 Study samples

The adolescents who participated in development and usability testing were strategically sampled from an ongoing project for obese youth, a nearby lower secondary school and an exercise group for overweight adolescents. A small sample of 8–10 is claimed to be sufficient for detecting the vast amount of usability problems in usability tests [162]. The participants recruited were approximately the same age as our target group. Other than this, they were chosen for convenience. The most obvious limitations of convenience samples is that they cannot be considered representative for the entire population, i.e. in the case of the present study it is likely that those who agreed to participate were more positive toward the intervention. However, since the aim was to test usability and examine our test procedures, a convenience sample was found suitable.

We intended to develop a tool for use in the school health service, which made it essential to evaluate the intervention as close to practice as possible. Pragmatic trials are recommended when evidence is to be used in clinical practice, and intervention effects should be measured in the same setting that the intervention is planned to be implemented [163]. Thus, the sample included in Papers III and IV, was recruited through the school health service. The main objective of pragmatic trials is to maximize external validity and thus ensure generalizability. The previously discussed recruitment issues demonstrate that our target group was difficult to reach and engage. The

prevalence of overweight among children and adolescents has been estimated at 14%–17% in Norway [12,13], which implies that statistically 2–4 pupils in a class of 25 met our inclusion criteria. We approached 146 school nurses of which 25 volunteered to recruit participants. Roughly, six hundred adolescents were eligible, given a presumed mean of six eighth and ninth grade classes per nurse. Among these, one hundred and twenty accepted the invitation. We have no information on adolescents who were not asked or turned down the request to participate. It is very likely that the adolescents who finally accepted were more motivated for behavior change than those who refused to participate. This obviously hampers the external validity of our study and we cannot generalize the results to the entire population of overweight adolescents. However, our sample had comparable characteristics with previous studies of the overweight, showing that they were poorly fit and scored their HRQoL and body image low [79,164,165].

6.1.3 Method for data collection

A disadvantage of the observation approach commonly applied in usability testing is that the participants know that they are being observed, and thus show a different behavior. Moreover, it is impossible to observe user behavior at a later time for the purpose of controlling coded data [166]. More advanced technology than applied in the present trial, may be utilized for accurate registration of keyboard inputs, clicks and mouse motions [166]. However, we did make continuous notes during the lab-test observations and rigorous summaries of registrations from the field test. Thus, we found the observations to be a sufficient foundation for analysis supplemented by questionnaires and notes from the focus group interviews. The Honeycomb model proved to be a suitable model for formulation of tasks and questions, which contributed to focusing user experience specifically and limiting the amount of redundant data.

Data included in Papers III and IV were collected from the participants during school hours or immediately after school. The 20m SRT had to be performed in the school's gym, which in most schools is occupied throughout the day. Thus, pragmatic arrangements had to be made to perform the testing, i.e. using the breaks, which made it difficult to follow a standard procedure to carry out the different assessments (questionnaire, BMI and testing) in the same order. Being interrupted to perform a relatively strenuous running test while answering a questionnaire containing questions about well-being and motivation for exercise, may have affected the response scores. There were some variations in time spent on the questionnaires. A few participants had impaired reading skills and were given extra time to complete the questionnaire. If a participant did not understand a question, the researchers emphasized giving value-free alternative explanations. Collecting data during school hours with assistance from the local school nurse was a great advantage. The school nurse arranged with the school's administration for permission for the adolescents to leave class to

meet with the researchers. She also organized the appointments and told the participants when to show up. In addition, the participants received a standardized reminder-SMS from a researcher the evening prior to re-test. This obviously contributed to the high follow-up at T1, which is one of the major strengths of this study.

6.1.4 Outcome measures

We included a mix of objectively measured variables and variables measured by self-report. While CRF is frequently assessed by field tests, it is recognized that self-reported experiences are the best indicator for quality of life [65,141]. Measurements are constantly hampered by systematic and random errors that threaten to reduce construct validity [167,168]. First, we cannot claim that the indicators we chose for this study gave a complete representation of the constructs we aimed to measure. Moreover, there is always the possibility that some of the indicators are misinterpreted by the participants [168]. The outcome measures in the present work were selected in accordance with the aims of the study, and based on considerations regarding validity and reliability. However, due to time constraints, limited resources and incidents along the way, some pragmatic choices had to be made.

A major strength of the KIDSCREEN, the instrument we selected for measurement of HRQoL, is that it was developed cross-culturally using the same approach and that it is thoroughly tested in terms of reliability and cross-cultural validity across several European countries including Norway [79,140,169,170]. Initially we planned to apply the 52-version of KIDSCREEN. However, we found our sample to be too limited for inclusion of all ten dimensions in the analysis. The 10-item version of the KIDSCREEN provides an index based on sum of scores, and is shown to be a useful instrument for examining overall HRQoL [171,172]. The short version is primarily developed for large population-based studies, but it has proven to permit group comparisons even with small groups [171]. By choosing the index, we lost information on the different quality of life-dimensions, but power was sustained.

The instrument chosen for measurement of self-reported PA had some shortcomings. The items comprising this measure cannot be added up to a sum score, and not all of them were equally relevant for the sake of the present study. Moreover, the undersized sample forced us to limit our total number of variables. Thus, we decided on one single item asking about frequency of moderate to vigorous PA during the week, a choice that most likely led to underrepresentation of the construct of PA. Having said that, there is always a possibility of over- or underestimating PA when it is measured based on self-reports [44]. CRF was selected as primary outcome in the evaluation study (Paper IV) because we expected that objective measurements of maximal aerobic capacity would

capture more reliable data than subjective perspectives on PA. This is supported by research showing that among adolescents, fitness is inversely associated with abdominal adiposity independently of total PA, and that CRF modifies the associations between PA and overweight [173]. The reliability and appropriateness of the 20-mSRT have been discussed in the past, with motivation, competency and perceived worth being mentioned as variables that influence performance [174]. However, several studies and reviews have concluded that the test is a valid and reliable test for estimating CRF in children and adolescents [53,175,176].

BMI is a disputed measure of adiposity since it does not distinguish between overweight due to excess fat mass, and overweight due to excess lean mass. It has been suggested that for PA interventions, outcome measures based on weight and height like BMI may be inappropriate due to a potential increase in lean body mass [177]. Although BMI is an imperfect tool, it is the most commonly used measure for assessing overweight and obesity. Other methods are more accurate, but have limited applicability to screening in primary care [178]. In addition, BMI has shown satisfactory correlation with more direct fatness measures [179]. The present study recruited participants based on routine measurements of height and weight. The Norwegian national guidelines for weighing and measuring employ The International Obesity Task force's BMI age- and gender-adjusted cut-offs [17] to separate between normal weight, overweight and obesity. Thus, we continued to use the same measure for adiposity throughout the study. For obesity-preventive interventions, it has been recommended to apply several estimates of body composition in addition to BMI [180]. However, as BMI was not our main outcome, and the intervention emphasized PA and fitness more than weight, we decided to limit the focus on weight-related assessments by choosing only one measure.

Because our intervention was theoretically informed by SDT, the Behavioral regulation exercise questionnaire-2 (BREQ-2) was an obvious choice for measurement of self-determined motivation for PA and exercise. However, as the questionnaire has not previously been validated in adolescent samples in Norway, we made efforts to investigate the instrument by confirmatory factor analysis. The analysis revealed that the fit indices supported the model fit and found that generally all 19 items contributed to the measurement of the respective hypothesized corresponding latent constructs. One item (number 17) showed a particularly low loading, similar to what has been shown in previous validation studies [146,181]. A possible strategy would have been to exclude this item from the subscale calculation. However, since the item did load on its intended factor, the instrument is strongly validated elsewhere, and we wanted to have the possibility for making comparisons with other studies, we decided to keep the item for calculation of the composite score.

6.1.5 *Choice of data analysis*

In Paper I, simple content analysis was used to describe systematically the characteristics of written, spoken and visual communication about the Young & Active program [150]. The material from observations and interviews was sorted in such a way that what was found to be the essential content, was condensed and preserved in a manageable short text. Inferences about usability were drawn based on appearances of attributes in the communication and supplemented with positive, negative and indifferent responses from the questionnaire. An even more rigorous method for analyzing the data could have been used to ensure the reliability further, e.g. by inter-coding. In our study, only one of the researchers analyzed the material. However, the entire research group oversaw the results of the analysis and concluded on the findings.

A strength of the present study is the relatively small amount of missing values. Because of this, no imputation was considered necessary. Imputation of missing variables is a much-discussed topic. Using only complete cases, as we did, leads to loss of information available on incomplete cases in addition to reducing statistical power. Since our data were generally skewed, we chose median values and range for presentation of sample characteristics in Papers III and IV. Non-normal distribution, in addition to relatively small samples, led to application of non-parametric tests to investigate differences between groups. A consequence of using non-parametric tests is the inability to make assumptions about the population from which the sample has been drawn [182].

As presented in Paper III, we performed a mediation analysis with the aim of explaining if, and how, the variables CRF and HRQoL were related. In the current case, the ratio of subjects to items was considered insufficient to test for mediation by means of structural equation modeling using latent scores. Hence, to test for mediation of self-determined motivation, we applied a BREQ-2 sum-score in a causal-steps approach outlined by Baron and Kenny [156] which is the most commonly used method. Despite wide use, the method has several limitations. One is that the ability to detect mediated effects can be very low, another is that the method does not explicitly provide a numerical value of the strength of the mediated effect, while a third limitation is that it actually requires a significant relationship between the independent and the dependent variable [183]. In the case of our study, we documented a relationship between the independent and dependent variables and we did find an actual mediating effect for self-determined motivation. A test for assessing whether the regression coefficient was significantly reduced after including the mediating variable in the equation was not performed and presented in Paper III. However, subsequent application of the Sobel test [184] revealed that the mediation effect was statistically significant ($z=2.11$, $P<0.05$). It has been argued that the Sobel test works well only in large samples and thus the influence of the mediation effect should be tested in a new and bigger data set [184].

As repeatedly described, the design and sample did not enable sufficient power to complete multivariate analysis or to test our hypothesized model by means of latent scores. Thus, *t*-tests were used to compare pre-to post-intervention differences within groups (Paper IV). The choice of a parametric test was justified as the mean differences from T0 to T1 followed normal distribution. The intervention group and the control group were similar at baseline, and thus we chose not to adjust for possible confounders.

The results presented in Paper IV reflects changes in the groups' means and do not provide information on the participants' individual changes. Including information on clinically significant changes among individuals might have strengthened the study results. However, such data will be supplemented with data from use of the intervention (registrations and diary as well as goals and activity plans) to investigate further the associations between use and individual level results in upcoming articles.

6.2 Discussion of main results

6.2.1 Feasibility of Young & Active

Although the increase in available web-based and mobile technology is thought to be contributing to the overweight epidemic among children and adolescents, technology can also be seen as an opportunity for interventions to improve health and health behaviors. Use of modern technologies allow for tailored messages, increased contact between patient and therapist, self-monitoring and tracking of health-related data, and rapid, adjusted and quality assured information. One of the obvious strengths of Young & Active was the inclusion of several interactive features, with a particular emphasis on tailored response through continuously automatic graphical feedback and individual counseling. The results of the usability study showed that the participants found the program motivating and fun to use. However, they were not entirely united in their response to whether they thought they would adhere to the program for 12 weeks. Some found it time-consuming and hard to remember to make registrations, while others were more convinced they would continue to use the program.

Among the most substantial problems in web-based prevention interventions is the high attrition rate [185]. Thus, a strength of the controlled trial presented in Paper IV was that despite an extensive intervention, the actual attrition was low. Only 11% of the participants actively withdrew or were lost to follow up at T1. However, even among those who continued participation in the study, there was a proportion of non-users. Several factors are known to influence adherence, for example, the degree to which the intervention is perceived as creating any benefit, if it is consistent with existing values, experiences and needs; if it has usability problems, or is difficult to understand and use [185].

An advantage of Internet-based trials compared to other clinical trials is that in many cases they are in a position to detail the usage of the intervention [186]. We had complete control over each participant's registrations, diary notes, forum posts and messages. Gathering objective data on intervention usage is recommended as such data serves as important indicators of intervention effectiveness [187]. Although not included in the present thesis, we also collected data on user experience following the controlled trial. Together with objective user data, the usability data will be included in a process evaluation of the entire intervention.

Use of the program varied considerably among the participating adolescents, from no registrations to daily registrations throughout the intervention period. Because of the endless number of web-based interventions, all with different designs and features, it is impossible to determine what would be "sufficient exposure" of an intervention for an anticipated effect. Thus, based on our clinical expertise, and what we believed to be enough to detect an effect, we made a cut-off at 7 weeks. This provided us with two equally large groups of "frequent users" and "infrequent users" which made it possible to investigate if use increased effectiveness as well as the impact of factors on the likelihood of using the intervention. Comparing the frequent users to the controls as a sort of per protocol analysis, revealed larger effect sizes on CFR, body image and BMI for the frequent users, pointing to a relationship between adherence and the outcomes. Furthermore, subgroup analyses by logistic regression were included to gain some knowledge about the probability of ending up as a frequent or infrequent user of the intervention. Higher initial BMI was found to reduce, while higher initial HRQoL was shown to increase, the likelihood of use. Two thirds of the withdrawers were boys, which could indicate that the intervention was more acceptable to girls. However, according to the logistic regressions analysis, gender did not seem to be a significant factor for intervention use. So far there has been a relative lack of web-based interventions designed for and including boys [112] Hence, inclusion of both genders in development and evaluation is a strength of the study.

Despite having developed a program that showed adequate acceptability in the target group, it is decisive that the intervention also is accepted by those aimed at delivering the intervention. Based on our experiences from recruitment and the generally poor response among the school nurses, it may seem like the field of practice are not quite ready for our initiative. Further advance of the study and an eventual implementation of the intervention in the school health service, is dependent upon acceptability also among those who will subsequently be responsible for organizing and carrying out the intervention.

6.2.2 *The fitness-HRQoL relationship*

Literature broadly suggests that the link between PA and well-being is strong [188]. However, as pointed out by Whitelaw et al. [189], this relationship is complex, as well-being can mask a lot of different issues and cover a lot of different things. There has been a range of attempts to find and distinguish between possible explanations for the relationship without being able to clearly identify the mechanisms [188,189]. One of the many plausible theories on how PA is related to well-being, is the “feel-better” theory, which emphasizes how physically active individuals experience enhanced well-being because they are able to do things more efficiently (e.g. by endurance or strength improvements) [81]. Although this seems like a particularly relevant explanation in the context of HRQoL, it has been difficult to provide evidence for an association between physical advantages gained from increased PA and changes in well-being [81]. A consistent association between higher PA levels and higher perceived HRQoL has been reported among adults as well as among adolescents [190,191]. Additionally, associations between cardiorespiratory and musculoskeletal fitness and dimensions of HRQoL are found among adults and children [8,192]. However, there is still insufficient evidence regarding the relationship between physical fitness and HRQoL in adolescents and among overweight and obese adolescents in particular. Thus, our study is one important contribution to this currently limited field of research.

Finding that increased CRF actually was positively related to well-being (conceptualized as HRQoL), led to further investigation of possible explanations to how a physical state like aerobic capacity can relate to a psychological construct like overall HRQoL. Among numerous potential contributing factors, the present work focused attention on body image and self-determined motivation for PA and exercise as possible mediators. Studies on relationships between body satisfaction and exercise among children have reported that children who engage in low intensity activities had lower perceptions of physical appearance than those participating in more vigorous activities [193], and that participation in PA is found to serve as a protective factor against body image disturbance [194]. Also, body dissatisfaction is shown to be associated with lower levels of CRF [40]. However, investigation of associations between physical fitness and body image among adolescents is lacking in previous work. Probably hampered by a limited sample size, we found no statistically significant relationship between CFR and body image when controlling for gender in our sample. Nevertheless, we argue that this is a relevant subject for further investigation. Adolescents with overweight and obesity show increased risk of a disturbed body image [79,195]. Enhanced knowledge about potential associated factors is highly important. If functional ability can be found to be associated with a more positive body image for overweight adolescents, this should lead to an increased focus

on body function and capacity in overweight interventions, as it may contribute to combating body image concerns and potentially enhance HRQoL.

The fact that self-determined motivation mediated the relationship between CRF and HRQoL indicates that even among relatively unfit overweight and obese adolescents, those who are more fit also experience higher motivation for PA and exercise and higher HRQoL. Although it is impossible to draw conclusion about causality, the result of the analysis is consistent with SDT, which suggests that more self-determined forms of motivation lead to increased well-being [115]. SDT also provides theoretical explanations for how fitness may relate to self-determined motivation for PA and exercise, e.g. by suggesting that being more fit fosters feelings of competence, which again leads to more internal forms of regulation towards PA and exercise. Hence, the result of the present study may provide support for theories emphasizing cognitive appraisals like competence or mastery as underlying the beneficial effects of physical fitness and aspects of well-being [81]. Worthy of further investigation, is also if and how physical capacity may strengthen a sense of belonging through increased opportunities for social interactions with friends, which again may influence exercise motivation and HRQoL.

6.2.3 Efficacy of Young & Active

The results presented in Paper III points to the importance of self-determined motivation in relation to CRF and HRQoL among overweight and obese adolescents. Thus, these findings served as support for the rationale on which we built our intervention study: that focusing on self-determined PA through tailored counseling, would increase fitness, which again would be beneficial for overall HRQoL. We chose to compare pre-to post-test differences in study variables one by one, using parametric tests. This provided information about the direct effects of the intervention on chosen variables, but no information on the potentially indirect effects as planned and depicted in Figure 4 in Chapter 3. Nevertheless, the results are informative, as few other similar interventions have been evaluated in primary care. As shown by the results, the intervention managed to influence the participants' CRF, HRQoL and BMI in a positive direction suggesting that web-based tailored autonomy-supportive counseling can be an effective way of reaching overweight and obese adolescents.

Despite the strong emphasis on self-determined PA in the counseling, no effect on frequency of self-reported moderate to vigorous PA was found at T1. This may be caused by an inadequate instrument or measurement bias as discussed, but also by the fact that the majority of the adolescents fell into the moderate and high activity categories at baseline. It is more difficult to increase the level of PA among adolescents who are already relatively active. Between school, homework and being with

friends and family, there is limited time left for PA and exercise. Hence, the present intervention focused on the importance of increasing intensity and making an effort to utilize the time already devoted to PA and exercise. Improved CRF within the intervention group is thus a probable result of increased intensity, not frequency of PA bouts.

At baseline, the study sample scored notably low on the 20mSRT. The boys had a median of 29 and the girls a median of 20 shuttles completed, which is below the 25th percentile for both genders [52]. As discussed in Paper IV, the greatest health profit for those who are unfit is gained by moving up from the lowest quartile of the fitness range. At T1, the intervention group had a statistically significant increased CRF compared to the control group. Although small, the effect of the intervention on CRF has to be considered of value. However, there is a considerable challenge related to the fact that the intervention seemed to be less attractive to those with the largest initial excess weight, who were the ones that had the most to gain from participating. Studies are consistent in their findings of associations between overweight and physical fitness, particularly CRF [41,57]. Several possible explanations to the effect of excess weight on running performance exists. Fat constitutes an extra load to carry, in addition to incurring extra metabolic maintenance costs. Moreover, psychosocial factors like lower body image, self-esteem and self-efficacy may affect motivation resulting in poorer performance [42]. Although the obese participants did not differ from those defined as overweight with respect to body image, self-determined motivation or HRQoL, it seems important to pay extra attention to obese participants, as they might need a longer run-in period, extended initial mapping and closer follow-up during the intervention.

At T1, we also observed an effect on overall HRQoL. Compared to a Norwegian representative sample of adolescents, the participants in our study reported a lower baseline HRQoL [79]. The number of cross-sectional studies documenting the association between excess weight and impaired HRQoL exceeds by far the number of experimental studies investigating the effect of health-behavior interventions on HRQoL among overweight and obese adolescents. The fact that an intervention focusing on PA and exercise actually managed to impact overall HRQoL, is an important finding. Furthermore, it is interesting that a generic short form instrument, which is previously found to focus more on the mental aspects of HRQoL [171], captured improvements in HRQoL following a PA intervention. This may emphasize the importance of physical performance and participation on well-being for this group. Based on our analysis, it is not possible to determine *how* the intervention affected well-being among the participants, whether it was a consequence of improved CRF or caused by the attention given through the intervention. HRQoL did not increase for frequent users, suggesting that effect on this outcome was not related to exposure to the intervention.

The intervention was also found to have a beneficial effect on BMI. Lack of similar studies makes it difficult to compare our results. However, the effect was considerably larger than the average intervention effects reported in a Cochrane review investigating primary preventive school-based obesity prevention studies, which was -0.09 kg/m^2 (95%CI -0.20 to 0.03) among adolescents aged 13-18 years [3]. Effects on BMI are somewhat difficult to interpret in still growing children and adolescents. A 13 year-old girl is defined as overweight with an age- and gender-adjusted BMI of 23, however she will be of normal weight at the age of 14.5 if BMI remains stable [1]. The effect on BMI turned out to be even larger for frequent users of the intervention. However, we have to take into account that this may have been confounded by the finding that lower baseline BMI was associated with frequent use. Although the intervention stressed diminishing the attention to weight reduction, it is possible that the intervention group in addition to increasing PA intensity, made other health behavior changes (i.e. change of diet and reduced sedentary behavior), which contributed to preventing further weight gain.

The lack of effects regarding self-determined motivation for PA and exercise was not in line with theory expectations and intervention intentions. Even so, it may seem as if the mechanisms of self-determined motivation still generated sufficient efforts in PA and exercise to achieve improved CRF, even in the absence of a statistically significant increase in self-reported autonomous regulation of PA behavior. This may reflect a simultaneous increase in both autonomous and controlled forms of regulation during the intervention. By taking part, the adolescents were expected to utilize the program every day, which may have caused a feeling of pressure to become more physically active. Consequently, potential increases in autonomous regulation were evened out by a potential increase in controlled regulation [146]. This is of course, merely speculation, as we did not analyze data on the different forms of regulation. However, such a presumption has to be considered in relation to all tailored PA interventions, as previous studies have found introjected regulation to relate positively to autonomous forms of regulation [146,196]. For integrated internalization to occur, behavior must emanate from oneself, based on personal goals [123]. A challenge in the present study was to provide support for a young adolescent to build a rationale for increased efforts in PA based on his or her personally meaningful preferences. Moreover, and in line with the fundamentals of MI practice, the adolescents had the choice of not engaging in PA at all. Hence, it was important that the intervention and the counseling in no way forced the participants to change, a situation that, in addition to being ethically irresponsible, would have impeded the autonomy-supportive conditions of SDT. As discussed, our trial may also have been affected by a ceiling effect on the motivational variable. The participants had already acted autonomously by accepting to participate. With high initial autonomous regulation for PA behavior, there was less to gain during the intervention period.

6.2.4 *Applicability of SDT and MI in a web-based intervention*

One of the most interesting implications of the present study is the translation of SDT and MI-based principles traditionally applied in face-to-face settings into a more standardized mode of delivery through the use of Internet. The present work provides evidence for the efficacy of Internet technology as a suitable means for including key elements of autonomy-support. SDT proved flexible in the way that theoretical principles were easily fitted into the components of the intervention and vice versa. By choosing an interactive platform, we were in a unique position to communicate with our participants. The design and content were chosen based on the ability to support basic psychological needs, e.g. allowing for self-determined goals and activities (autonomy support), visualization of progress (structure) and communication through counseling, messages and forum (intrapersonal involvement). According to SDT, it is environments which manage to support the basic psychological needs that can foster more autonomous motivation, as well as adaptive outcomes such as behavioral engagement, persistence and well-being [126]. The intervention's positive effects on CRF, BMI and HRQoL, make it distinctly possible that the intervention context in fact engendered basic need support. Psychological need satisfaction was not directly assessed in the present study. However, data on perceived autonomy support in the counseling was obtained post intervention, and will supplement usability data in the upcoming process evaluation.

Instead of traditional advice-giving and direct persuasion to engage in PA and exercise, Young & Active aimed to activate the adolescent's intrinsic motivation for behavior change and maintenance by applying elements from the person-centered MI-approach. The core intention was to leave it up to the adolescent how to interpret and integrate the information that were received, whether it was relevant for him or her, and to make self-determined choices for PA and exercise. A key-feature of MI is that questions are generally broad and open-ended, providing the clients with room to express themselves [129]. As Young & Active was built around tailored counseling and not automated computer adapted responses, meaningful and individually adjusted feedback messages and questions could be given based on the written input from the adolescent. However, we did not include real-time conversation (chat) as a feature in the program. This was an obvious limitation as the counselor was unable to respond immediately to the adolescent's state and input at the time of registrations. Thus, feedback like "Your goal is to complete what you plan for, and on Wednesday, you really did! Why? What made you do so?" served more as a trigger for reflection than a question that expected an answer.

An issue in behavior change interventions, which may threaten to undermine theoretical principles and techniques, is the tendency for clinicians not to adhere to the intervention protocol and instead implement elements from other more familiar approaches [126]. The Young & Active counseling was

delivered in an unstructured fashion, completely dependent on each participant's input, which made it challenging to ensure sufficient (and equal) implementation of the SDT/MI principles. Thus, despite a relatively specific theory based intervention procedure, delivery fidelity may have been impaired. However, web-based written counseling is highly suited for evaluation of use of intervention techniques and theoretical underpinnings, as all communication is recorded and stored. By reflecting upon the degree to which the intervention utilized the strategies as planned, the ability to make statements about theoretical grounding is strengthened [126,197]. Such evaluations will also be performed with relation to the present work.

6.2.5 Ethical implications

In the preliminary stages of planning the present intervention, we put great emphasis on evaluating the risks involved in the use of the web. We were sensitive to the challenges of the Internet as a means for communication, and concerned about the fact that the existing ethical research guidelines gave limited information about the handling of potential obstacles and security risks. Hence, an extensive analysis was performed to thoroughly examine possible pitfalls and risks related to the use of the Internet. Based on this, precautions were built into the system to reduce the possibility of, e.g. unauthorized access and loss of confidential data. We experienced that the participants were familiar with how to communicate online. There was a possibility that they would reveal information about themselves that they later might regret. However, as it turned out, the participants were generally focused on PA in their communication. Hence, our initial concerns related to disclosure of sensitive information seemed groundless; as did issues related to obtaining and storage of information. Instead, and as repeatedly discussed in the present thesis, the ethical implications of the study ended up being related to the fact that the intervention was targeted at overweight and obese adolescents, not at online security.

In addition to the knowledge of health-effects of PA and physical fitness regardless of body mass, the arguments for less attention to weight reduction in the present intervention served as an attempt to reduce the extensive current focus on body weight in the society. Potential weight reduction following the intervention would instead be an earning of established PA habits. However, none of these arguments prevented controversy from attending the introduction of our initiative among co-workers in primary care. As it turned out, skepticism and opposition seemed partly to reflect a fear of adding to the stigmatization of an already stigmatized group. From the ethical evaluation performed and presented in Paper II, the issue of identifying someone based on their BMI, turned out to be the main ethical dilemma. However, being selected and approached solely based on measures of body weight is not merely an issue in the case of our intervention, as this will be problematic in any intervention for overweight and obese. Through the application of MI-techniques, the counseling

aimed to be empathic, encouraging and supportive in order to empower the adolescents' own reasons for change or maintenance of PA and exercise. The thoroughly executed ethical evaluation concluded that the intervention in itself could be ethically justified, based on its emphasis on tailored feedback. Nevertheless, the ethical issue of selecting and targeting vulnerable overweight adolescents remains. The question is if intervening would prove legitimate despite the risks and threats involved in recruitment, whether it be for a controlled trial like the current or in future primary care practice.

According to the Norwegian national guidelines, height and weight should be routinely monitored among adolescents in lower secondary school, partly for monitoring of population trends [1]. If such data are reported to the adolescents and their parents, monitoring is turned into the realm of screening, meaning that it would be identification of individuals who may benefit from interventions aimed at weight gain prevention or weight management [198]. Consequently, it is arguably ethically problematic *not* to offer any kind of follow-up for those detected as being "at risk". This does not imply that any intervention with potential effect should be implemented, but it raises the dilemma of holding back preventive initiatives for a group of adolescents who have repeatedly shown to have decreased psychosocial and physical health. Then again, applying epidemiological data as arguments for action is problematic as these data represents mean values of *samples* of adolescents. Public health interventions are utilitarian efforts in that they are based on known population risks and preformed to maximize the health and well-being of populations [199]. In interventions like Young & Active, statistical knowledge of risk forms the rationale for the need of *individual* health behavior change, which may threaten individual rights or freedom as it has been thoroughly documented in the current study.

Summing it up; as long as individuals are targeted and offered participation in interventions based on their BMI, we are in danger of compromising their liberty and well-being, at least in cases where the adolescents themselves do not experience their overweight as problematic, are not asking for help or do not want to be helped. However, the overwhelming qualitative and quantitative data on adverse physical and psychosocial effects of overweight and obesity calls for action on all levels of prevention. We thus argue the case for a thorough ethical evaluation of the entire range of initiatives for screening, prevention and management of overweight and obesity. By doing so, important values can be considered and secured. As pointed out by ten Have et al. [200], "such analysis is worthwhile in its own right, and may also contribute to effectiveness".

6.2.6 *Future directions*

The considerable amount of evidence-based knowledge of negative consequences of overweight and obesity, supported by the present work, requires a debate on a more active role of the school health service in secondary prevention. It is a huge dilemma that so far virtually no clear evidence of effectiveness exists about interventions tackling overweight or obesity for adolescents in primary care. The shortage of interventions is, according to primary care professionals, one of many barriers to taking action [84,201]. It is thus a paradox that the majority of school nurses we approached refused to contribute to the study. Based on our experiences from development and evaluation of this trial, it seems that even translating the existing evidence-based guidelines for measurement and follow-up into practice is problematic. The forthcoming qualitative analysis of school nurses' experiences from working with this particular target group will elaborate on our experiences. Furthermore, the ongoing thesis, which includes qualitative studies of a subsample of adolescents from the intervention group, will provide valuable knowledge about how they experienced participation. Together with long-term data and a process evaluation, the totality of this research will constitute a solid basis for settlements on the future of Young & Active. However, based on what we have experienced so far, it seems unrealistic to perform a definitive evaluation study under the same premises as the present study, at least for the time being. Consequently, it is also too early to consider integration of the intervention into school health practice. Nevertheless, making our preliminary findings available to the field of practice and to decision-makers is also an important part of an implementation process [114]. Providing comprehensible information about the promising results of the study may increase enthusiasm among school nurses, which may again encourage engagement in further research on the effect of the intervention. Moreover, this thesis contributes to highlighting important practical and ethical aspects that need to be considered on a political level to ensure equal implementation of guidelines and measures for this particular target group.

Due to the vast speed of technology and program development, doing rigorous research on Internet and mobile interventions including development, usability testing and evaluation, is challenging. What may seem innovative at a preliminary stage, is probably less appealing after several years of testing. Thus, the chances are that a program is experienced as old-fashioned before it is ready to be implemented in practice. During the period of the present study, new innovative software has been made available in numerous variants. Mobile applications for registrations and monitoring of PA and exercise exist by the dozen, free to be downloaded on smartphones and tablets. If Young & Active should be included in further research, we would have to take into account new technology and adapt the program to other platforms. However, the present intervention can be distinguished from typical commercial programs and applications in its theoretical basis, in the tailored, personally

provided feedback and the fact that it is introduced and delivered within a familiar health setting. These are all intervention components that in our opinion are of paramount importance for use and effect and should remain as a foundation if Young & Active is to undergo further development and evaluation.

7 Conclusion

This thesis is to our knowledge the first to report on results from the development and evaluation of a secondary preventive Internet intervention for overweight and obese adolescents in a school health setting. The intervention was generally well accepted by the participants, and the short-term effects on CRF, HRQoL and BMI seem promising. Hence, the results of the study add to the expanding evidence of the efficacy of theoretically informed, individualized, computerized interventions for health behavior change. However, a definitive evaluation of intervention effects requires a larger study sample and a more solid design. This thesis also provides increased knowledge of the relationship between CRF and HRQoL. Supported by our findings, it seems particularly important that overweight prevention interventions should focus on PA for enhanced fitness and psychosocial well-being, not only for increased metabolism. We claim that a tailored intervention like Young & Active has a unique potential to empower adolescents to make self-determined choices about their own health behavior. However, there are several ethical issues related to targeting an intervention to adolescents based on their BMI. Further research on ethical, practical as well as financial feasibility of implementation in clinical practice is needed.

“I think that the reason why exercising has become a habit for me, is that you just have to get through the first work-out sessions, and when you have done that, you just feel that your fitness increases, and you want to try something new and more challenging, perhaps harder exercise or other activities. At least that’s what made me more motivated (when you master things, most exercise is fun) ☺.”

-Participant Young & Active, 2013

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Paper I

Original Paper

Development and Usability Testing of an Internet Intervention to Increase Physical Activity in Overweight Adolescents

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Abstract

Background: Internet interventions may provide opportunities for low threshold counseling using feedback to guide and support health behavior, including increased physical activity. Research shows that overweight and obese adolescents are less physically active than their peers of normal weight. There are good reasons to believe that Internet-based interventions may be particularly suitable for motivating adolescents to increase physical activity, but we need to gain further knowledge of what features are effective and how to design such interventions.

Objective: To describe the process of development and evaluation of usability of a Web-based program for increasing physical activity in overweight adolescents.

Methods: Informed by the self-determination theory, motivational interviewing, and perspectives on self-regulation, this intervention was developed in a stepwise process by an interdisciplinary team of researchers, designers, developers, and representatives from the target group. An iterative qualitative usability testing approach (observation, survey, and interview) was applied in 2 sequences, first in the lab and second in the field, to assess how adolescents (aged 12-16 years) used and experienced the program and to make adjustments to the program based on evaluation of their response.

Results: The following components were included in the program: self-monitoring through planning and registration of physical activity and graphical response on progress, autonomy supportive individual Web-based counseling, forum for social support, and relevant age-adjusted information about physical activity. The first usability test resulted in adjustments related mainly to making the content and aim of the different features more visible and explicit. The second test evaluated the program with adjustments from the first test, revealing that the program was well accepted by the participants and only small aesthetic adjustments had to be made to complete the final version of the Internet program, Young & Active.

Conclusions: Thorough preparation, with clear theory foundation and close monitoring in the developmental phase, as well as contribution and iterative evaluation from the target group, is essential to create a user-friendly and engaging program. The efficacy of the program will be evaluated in a controlled trial.

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KEYWORDS

Internet; intervention; development; usability testing; adolescents; physical activity; overweight

Introduction

Background

Investigations point to a decrease in physical activity (PA) from childhood to adolescence [1]. Adolescents who are overweight with obesity are even less active compared to peers of normal weight [2]. Research also shows impairment in health-related quality of life among overweight and obese children and adolescents [3]. Aerobic fitness is positively associated with physical and mental health independent of body mass index, and a substantial weight reduction and maintenance over time may be unachievable for many overweight individuals [4,5]. Thus, there are good arguments for interventions to emphasize increased habitual physical activity more than individual weight regulation. It is also essential to focus on interventions to increase and maintain PA in adolescence because of the relations between activity patterns in adolescence and adulthood [6,7].

Recent research suggests that Internet technology is a promising way to change a person's health behavior and therefore provide opportunities for low threshold counseling using feedback to guide and support health behavior [8]. It might seem paradoxical to use an inactive device to promote activity among adolescents. However there are good reasons to believe that Internet interventions for promoting PA may be particularly suitable for this age group. Digital media is an area in which adolescents are experts and technology is the means of their empowerment [9]. Instead of thinking of digital media solely as the cause of physical inactivity, becoming overweight, and obesity, we can choose to use adolescents' competence as a valuable basis for raising the efficiency of communication in health promotion efforts. Despite promising results of Web-based interventions to promote PA in children and adolescents, well designed research is needed to further enhance our understanding of intervention characteristics that best promote behavior change [10-12].

An Internet program called Young & Active was developed aimed at motivating overweight adolescents (aged 13-14) to increase and maintain PA and thereby enhance their fitness and health-related quality of life. The intervention study is built upon the framework for researching complex interventions given by the Medical Research Council [13]. This framework is developed for the purpose of evaluating interventions in natural or everyday practice. The development and evaluation process is divided in 4 phases: (1) development—identifying and developing the evidence base, theory, modeling processes, and outcomes, (2) feasibility and piloting—testing procedures, estimating recruitment and retention, and determining sample size, (3) evaluation—assessing effectiveness, understanding change process, and assessing cost effectiveness, and (4) implementation—dissemination, surveillance and monitoring, and long term follow-up. This article describes the process and result of the development and how theory informed Young & Active with a particular focus on how the end users, the adolescents, through development and usability testing,

contributed to the final version of the program (Phase 1). The development and usability testing will be followed by a 12 week controlled trial (Pilot-Phase 2), and finally by a full scale RCT (Phase 3).

Theoretical Basis and Content of Young & Active

Extensive use of theory and inclusion of behavior change techniques is important in Internet interventions to increase effectiveness [8]. The present intervention aimed to stimulate adolescents to engage in self-chosen activities that they find fun, meaningful, and want to do. Research shows that individuals who have more autonomous reasons for exercising are more positive toward PA [14] and more likely to initiate and maintain PA [15]. Fun, enjoyment, social support, and to a lesser extent health benefits, are reported as predictors of participation in PA. Especially for girls, the activity must be on their own terms [16]. Self-determination theory (SDT) has proven useful in understanding motivational, cognitive, and affective processes of physical activity [15-17]. Therefore, it was chosen as the theoretical framework for this intervention, supplemented by aspects of self-regulation theory [18,19]. Central to SDT is the question of how people internalize and integrate extrinsic motivations and come to self-regulate their behaviors in order to engage autonomously in their daily life [20]. According to this theory, developing a sense of autonomy and competence as well as relatedness is essential to make a person more self-regulated and able to sustain the behavior [21,22]. Autonomy reflects the need to engage in activities with a sense of choice, competence represents the feeling that one can accomplish tasks and reach goals, and relatedness refers to the sense of being understood and respected by significant others [21,23]. SDT supplemented by perspectives on self-regulation of behavior change gives suggestions on how an autonomy-supportive counseling style can motivate people to change health behavior, in this case, to increase physical activity [24]. Autonomy support, structure, and intrapersonal involvement are the 3 dimensions of the social environment that can support the need for autonomy, competence, and relatedness. If these factors are presented in an autonomy supportive manner [25], they can facilitate physical activity adoption and maintenance [26]. By giving the adolescents opportunity to form goals for PA, make a plan for how to reach these goals and monitor them, the program might facilitate autonomy. Individualized autonomy supportive feedback from a counselor based on the adolescents' registrations in the program is believed to provide users with a sense of autonomy, competence, and relatedness. It is also shown that SDT can offer a theoretical rationale for understanding the efficacy of motivational interviewing (MI), a client centered counseling method to promote behavior change [27]. MI involves avoiding controlling behaviors and direct persuasion. By expressing empathy, making the participant more aware of discrepancies between goals and actions, encouraging personal reasons for change, and supporting self-efficacy, the MI approach seeks to empower the participants' own reasons for change [27]. Thus, theoretical inputs from SDT and principles from MI are used

in the counseling of the adolescents to promote behavior change in this intervention. [Table 1](#) presents this in a schematic form. We aimed to develop a need-supportive program which

hopefully will make the adolescents experience support in a way that enhances their self-regulation and autonomous motivation to increase and maintain PA.

Table 1. Relations between motivational styles from SDT and MI—how strategies can be applied to facilitate autonomous motivation to increase and maintain physical activity.^a

Principles from autonomy supportive counselling:	Principles from MI:	Examples of practical use:
Support autonomy	Avoid coercion and pressure	Do not pressure or argue the case for change (eg, “you have to be more active and exercise more”).
	Explore the adolescent’s own reasons for change	Let the adolescent explore his/her own reasons for being active and exercising.
	Encourage change talk	Affirm and reinforce expressions of problem recognition, exercise, desire, and intention to change.
	Explore options	Let the adolescent choose his or her preferred courses of action (ie, how and when to exercise).
Provide structure	Develop goals	Help to set goals for PA and exercise. Make sure the goals are appropriate, realistic, and achievable.
	Give clear information	Give information about what to expect from exercising and what it takes to achieve self-determined goals. Make sure the information is neutral, clear (understandable), sufficient, and repeated.
	Offer advice	Offer advice when appropriate, but avoid imperatives (eg, “you must exercise regularly”).
	Provide feedback	Follow up goals and plans with regular feedback. Ensure that the feedback is received and understandable.
	Support self-efficacy	Make sure to affirm effort, success, and progress.
Be involved	Express empathy	Display interest in the adolescent and his/her well-being.
	Explore concerns	Reassure the adolescent that their concerns are natural. Acknowledge and explore worries.
	Demonstrate understanding	Try to see the adolescents’ point of view.
	Avoid judgement	Do not blame or criticise the adolescent (eg, “you have failed in following your plan this week”).

^a adapted from [27,28]

Considering the age of the target group, we wanted to develop a program with self-explanatory and time-efficient functions [29]. This included a system that could, based on online registrations by the participants, calculate the accurate amount of self-reported low-, moderate-, and high-intensity activities related to time spent, and to make graphic presentations showing progress. Activities relevant for Norwegian adolescents were adapted from the Compendium of Energy Expenditure for Youth [30]. The compendium provides a classification system that standardizes the metabolic equivalent of task (MET) intensities of physical activities used in research. Based on categorization as light (< 3 METs), moderate (3-6 METs) or vigorous (> 6 METs) intensity activities [31,32], we coded activities as green, blue, or red, respectively. Thus, total amount of activity of different intensities would be easily identified in a graphic presentation of bar charts. Self-monitoring is central to the process of self-regulation [18,19], and is shown to increase effectiveness in interventions designed to promote healthy eating and physical activity [33]. It was expected that monitoring of progress and getting autonomy-supportive feedback emphasizing progress will enhance the Young & Active participants’

perception of competence and make them more conscious about how active they are and how increasing all kinds of PA throughout the day can contribute to a total enhancement of activity. Supplied with the narratives, such registrations will provide the counselor with broad information on the participants’ process.

The intervention includes daily registration and narratives on PA by the adolescents along with weekly individual Web counseling from trained health counselors. The initial components of Young & Active and their main content are outlined in [Table 2](#). Except for one initial face-to-face meeting with a counselor to map PA, to be introduced to the program and be assisted in the making of the first PA goals and plan, all contact between participant and counselor will be online. The choices of components for the intervention were supported in a systematic review of Internet-delivered health interventions [34]. The review points to peer support, counselor support, email/phone contact, and updates of the website as intervention characteristics related to better exposure. Internet interventions aimed at adolescents or young adults seem to be most effective when they include combinations of several strategies [35].

Table 2. Overview of planned content of Young & Active.

Mapping of physical activity
Face-to-face interview between counselor and participant based on principles of MI and autonomy supportive counseling (ASC) from SDT, to help the participant reflect on PA, map current level of PA, and outline the possibilities for change.
Goals and plan for physical activity
Instruction on how to fill in (preliminary) goals and a plan for PA during the day and week. Focus on the value of self-determined goals and activities.
Registration of daily physical activity
Registration of activities during the day (time of day, type of activity, time spent, and alone/together with someone else).
Narratives of PA experiences during the day
Free text comments on experiences, feelings, and thoughts on physical activity and exercise and on life in general.
Automatic feedback on progress
Graphic feedback displaying planned and registered activity for present week and past weeks participating in the program.
Tailored feedback from counselor
Weekly individual written response from the counselor based on the participant's goals, plan, logs, and diary notes. Feedback based on principles from ASC and MI.
Evaluation and adjustments of goals and plan
Encouragement via tailored feedback to regularly evaluate and adjust goals and plan in accordance with progress.
Forum
User-driven forum for support and the sharing of physical activity related experiences and tips.
Information on physical activity
Relevant information on PA and sports activities. Regularly updated and edited.

Usability Testing

Young & Active focuses on how adolescents can find their own source of motivation for increasing and maintaining PA. It is proven that the intervention in itself is motivating to use in the sense that the end users choose to visit, use, and revisit it [29]. We aimed for the intervention to be appealing, to include intuitive functions, to be easy to navigate, and provide understandable and meaningful information. Testing by the end users—the adolescents—is necessary to ensure that these components are met. Usability testing refers to evaluation through the analysis of typical end users interacting with the program, allowing for iterative modifications [36]. Qualitative feedback through testing with representatives from the target group can give valuable information on user experience and help developers determine if a program will turn out to be effective and achieve its purpose [37,38]. The vast amount of usability problems and issues can be identified with only a small number of test subjects, as few as 8 to 10 participants [36]. A cycle of design-evaluation-redesign has the potential of major reduction in usability problems [39], which makes usability testing a powerful method for evaluation before inclusion in a trial.

Method

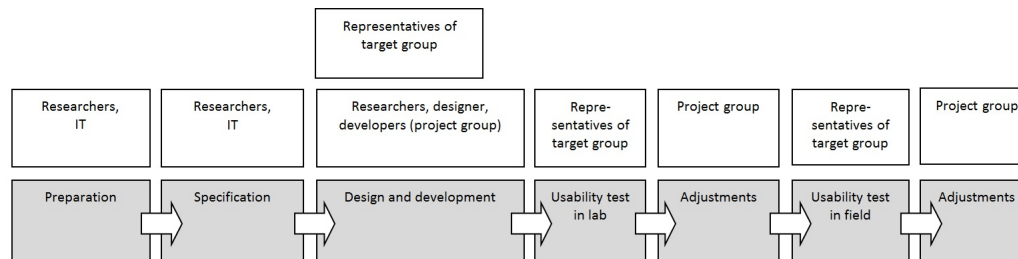
Development of the Program

The process of development of Young & Active covered the following steps, including preparation, specification,

development, usability testing in 2 different settings, evaluation, and adjustments (Figure 1).

The preparation step included choice of theoretical framework and mapping of user needs related to physical activity and use of Internet. Risk analyses were made with assistance from the Department of Information Technology at Oslo and Akershus University College of Applied Sciences to assure that potential threats to the anonymity of the adolescents were accounted for. A detailed specification of requirements for the program was developed. An interdisciplinary team of health and education researchers, graphical designers, and application developers formed the project group.

Based on risk analyses and specification of requirements, the outlined content was transformed into wireframes (a visual guide that represents the skeletal framework of a website) to visualize and illustrate the link between text and graphics and interactive features. Development started with ideas being picked from well-established websites for adolescents with functions such as forums, ask-the-expert, and information on sexuality, health, and adolescence in general for instance. Design, language, use of symbols, and site architecture were studied. Representatives from the target group of adolescents (n=4), strategically sampled from an ongoing project for obese youth, participated in a workshop to help decide on design, content, and functionalities. The workshop was an informal setting with open discussions on the presented wireframes. Comments and suggestions from the adolescents were noted and included in the ongoing developmental process when found relevant.

Figure 1. Development process of Young & Active.

Testing Usability in Lab and in Field

An iterative qualitative usability testing approach with observation, a questionnaire, and focus group interview was used to assess how the participants use and experience the intervention. Usability tests were carried out in 2 sequences, first in a lab setting and second in the field, over a period of 2 weeks. The Honeycomb model [40] served as a guideline for the tests. According to this model, the quality of experience of a program is dependent on whether the users find the program valuable, useful, usable, desirable, accessible, findable, and credible. The tasks and questions for the questionnaire and interviews were grounded in these facets to ensure that they were all focused in the different components of the program. The questionnaire included questions that were answered Yes/No/I don't know, and also the participants were encouraged to write suggestions for changing and improving the program. The focus group interviews allowed the adolescents to speak more freely about their impression of Young & Active.

As mentioned, the aim of the tests in lab and in field was to assess how adolescents in the target group used and experienced the prepared intervention. For this reason, strategic sampling was conducted among adolescents who were expected to give valuable information. The number of participants was decided upon according to an appraisal of achieved saturation of qualitative information about usability [41]. In order to strengthen the trustworthiness of the information, different types of qualitative material were gathered in the field through triangulation by using several research methods [42].

The first test (lab) was carried out in 2 groups of a total of 7 adolescents (aged 12-13 years), recruited from a school and a project for obese adolescents respectively, and took about 90 minutes per group. At this point, the program contained all the main functions except to the forum and feedback page. The participants initially received brief information about Young & Active. Listed tasks then guided them through the different parts of the program. Each participant was observed by one of the members of the project group. Following the practical tasks, the adolescents filled in the questionnaires. Finally, focus group interviews were conducted in both groups.

To perform technical evaluation, to assess how the users respond to using the program over time, and to get a more thorough evaluation after adjustments based on the first usability test, the

Young & Active program was tested over a period of 2 weeks. From an exercise group for overweight and obese youths, 8 adolescents (aged 14-16 years) were recruited. Informed consent to participate was given by the adolescents and their parents. The participants first met with the researchers for an informal conversation focusing on feelings, thoughts, and experiences with different forms of PA. The conversation was informed by the MI approach [27] and was aimed at making the adolescents reflect on goals to increase and maintain PA. The participants received a personal user identifier and a password, and were given a brief introduction to the different functions of the program. If desired, they received help to form goals for PA and to set up an activity plan to reach these goals. The adolescents started registrations the following week after getting a reminder via SMS. The counselors gave individual feedback twice during the test period. Bugs and minor errors were reported by a message in the program or via the forum, and consecutively handled by the programmer. The researchers moderated the forum and message system. An extended version of the user experience from the first test and focus group interview followed the week 2 test. Registration of use (frequent registrations, diary notes, and posts in forum), were summarized.

Data Analysis

The combination of questionnaires, observations, and focus group interviews was used to triangulate data to control and support the different findings, as the discussions in the focus groups were used to broaden and support the outcomes of observation and questionnaires. After each of the 2 tests, data from the questionnaires were summarized. Answers from the open-ended questions from the questionnaire and notes from observations and interviews were analyzed as text, using simple content analysis [43]. These data were sorted to correspond with each of the different pages of the program (My page, activity plan, diary, feedback, forum, and info page). General categories like user performance, visual design, content, functionality, and motivation for use were identified.

Results

Results From the Process of Development

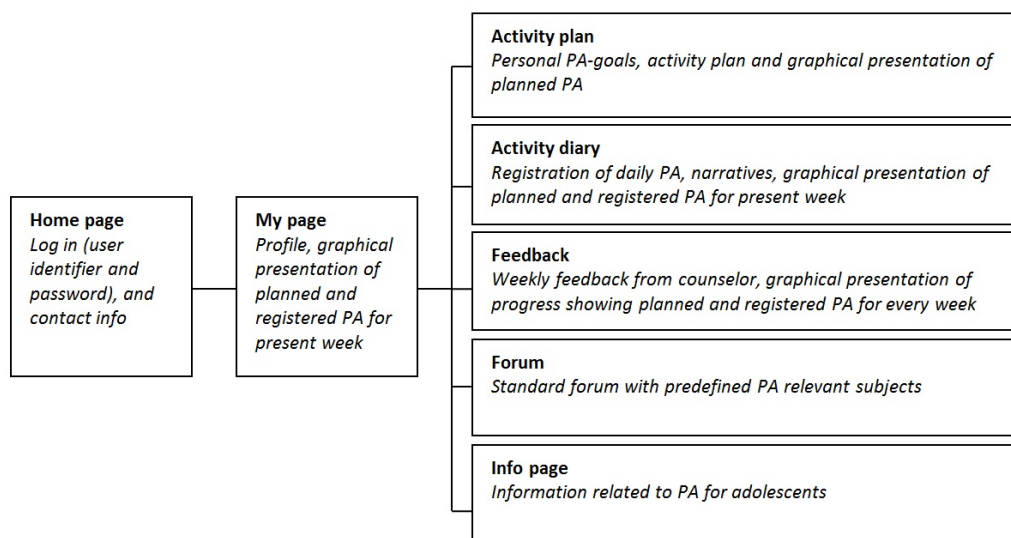
The first part of the development process resulted in a draft with suggestions on name of the program, logo, color scheme, and page layout, including the content and placement of different

functions distributed. A flow diagram of the Young & Active program as it was initially planned, showing the main content, interactive features and the links between the different pages, is provided in Figure 2.

No changes were made to this structure during development, and the pages described in Figure 2 are all represented in the final version of Young & Active. In addition, we designed a simple password-protected page for counselors. On this page,

counselors can view a summary of each participant's registrations and diary notes, write and send weekly feedback, and monitor the forum. Young & Active was developed in eZpublish (version 4.4.0), based on Open Source technology and designed to support PCs, Macs, and newer versions of all browsers. Usability was not tested for mobile devices, but the program shows acceptable readability for smartphones and tablets.

Figure 2. Main content and interactive features of Young & Active.



Response From Workshop

The workshop participants liked the suggested name of the program. Colors and graphics, especially the smiley logo, met with approval. The participants focused on the advantages of using smileys in the communication as a way of making it easier to express feelings and the communication more effective. The benefits of written self-determined goals and detailed plans for activity were emphasized, but the adolescents did not immediately understand what kind of information the PA-registration page required. It was obvious that thorough explanation and specific examples were necessary to get a quick understanding of the different functions. The participants saw the advantages of bonding with other adolescents in the program to exchange experiences and opinions and to ask questions. On the info page, the adolescents indicated they would prefer to read about activity alternatives and how to make healthy food. Feedback on the wireframes was mainly positive. Suggestions on changes and supplements to graphics, features, content, and functionality from the workshop were incorporated in further development of the program.

Results From Usability Tests in Lab and in Field

The participants of both lab and field tests had a computer at home and regarded themselves as competent computer users. All of the participants in the field test used Young & Active at

home in one way or another during the test period, meaning that they made at least 1 registration in the diary, posted in the forum, or sent a message to the counselors via the message system. Most of the participants (5/8, 63%) made regular, frequent registrations and used the diary, while 1 participant got ill, 1 had an ankle injury and 1 responded "this program is not for me, but I am sure others will find it useful". This last participant joined in on the survey and interview, while the other 2 infrequent users did not.

User Performance

The participants in the lab test had no problems logging in or navigating among pages. They tended to ask for help rather than using help buttons with explanatory text. All participants found relevant leisure sports activities, but did not intuitively choose activities for the entire day and week (to and from school, at school and so on). This occurred both when planning and making registrations in the diary. In the plan, the adolescents found it inconvenient to have to select days one by one for activities performed every weekday, such as walking to school. Searching through lists of activities in the plan and the diary were shown to be time consuming.

The most important adjustments after the first usability test concerned making the content and the aim of the different features more visible to the users. This included choosing bold

headings, making short introduction texts for every task and creating more visible help-buttons with pop-up texts for specific explanations and tips.

Observation during introduction of the program and the 2-week test period revealed that the participants in the second usability test very quickly grasped the different functions of the program. Due to the short test period, none of the adolescents made changes in their activity plan, but 2 participants supplemented their goals for activity. The 5 active users made registrations according to their activity plan and added other less regular activities if relevant. They estimated registration to take less than 5 minutes. All active users wrote in the diary, some almost every day and others less frequently. Except for minor bugs, no technical problems occurred that compromised use of the program in the field.

Visual Design

Visual design refers to the informants' impressions of how the program looks and how they find the colors, fonts, illustrations, and layout. Both groups in the lab test approved of the color scheme, the program smiley logo that has not been seen by some participants before, the design in general, and found it appropriate for both boys and girls. Participants in the second usability test also approved of the design and graphics and the smileys in particular. However, they had complaints on both visual and functional design of the forum. It did not appeal to them aesthetically, as the text fields were too spacious and the profile smileys too large.

Content

All in all, the participants in the lab test commented positively on the content of the program. They appreciated the opportunity to plan and log activity, but were mainly concerned with goals, plans and registration of sports activities and exercise, not PA in general. Some suggested pop-up text with tips on what to write about in the diary. The adolescents easily made goals for PA, although some were unsure about how specific the goals had to be and thus asked for help. The participants reported liking the info page, noting that it was understandable and the issues were relevant, but several of the informants asked for more facts about effects of exercise and more pictures and videos to illustrate the information.

No significant changes had to be made to the content after the lab test, other than adding pop-up boxes with tips, more pictures, and more fact-oriented information on the info page. Some requests were rejected due to security demands (personal profile) and time and budgetary constraints (exercise videos).

The adolescents participating in the usability test in field had no problems making goals, plans, and registering in the diary, but asked for more options for activities during school time (eg, field trips). They appreciated the opportunity to reflect on their daily activities and the day in general, but requested a less structured diary with fewer leading questions and 1 single text field with an open question ("How was your day?") instead of 3 fields with more specific questions. The info pages, both text and illustrations, were reported to be fine. Feedback from counselors was valued ("It motivated me!"), but could be given

more often. All in all, the informants found the content of the program interesting and uncomplicated.

Functionality

Functionality refers to the interactive and adaptive features of the program. The participants appreciated the possibility of making a profile. Graphs and the fact that they interactively responded to changes in registrations got positive remarks. After the lab test, the project group decided on an additional feature to give the participant and counselor an opportunity to exchange short messages independently of the diary/feedback if necessary, and included a mailing system with a message box present on every page. This was mainly for security and practical reasons.

The adolescents in the second test found it easy and fun to keep track of amount and type of activities by observing the bar charts over time. However, 2 informants reported that the bars showed variable stability depending on the browser. The forum got the most negative feedback as the adolescents experienced it as "not user friendly" and indicated that it was "hard to get an overview". Response to this was given both as messages in the forum during the test period and in the interviews that followed. The interviews revealed that not all of the adolescents had noticed that they had received feedback from the counselor and that this had to be more explicitly announced on My page.

Motivation for Use

All of the participants in the lab test focused on the importance of making goals and a plan to increase PA, commenting that, "it is easier to hold on to goals that I have written". However, they were not convinced that they would make an effort to register and write in the diary every day, and they requested the possibility to backdate. Most participants (6/7, 86%) reported that Young & Active might contribute to making them more active. Based on this response we made the operations for registering activities more intuitive and time efficient, and made it possible to backdate within the same week so registrations did not have to be made every day.

In the field test, the youngest adolescents (age 14) were most positive regarding how useful and interesting the program was, giving comments like, "it made me more conscious about PA", "the program proves that I am more active than I think I am", "I liked the program, registrations are fun, I would like to continue to use it". The older adolescents (age 16) were more uncertain, commenting that, "it takes some time and it is hard to remember to register, so I am not sure if I would have liked to use the program over time".

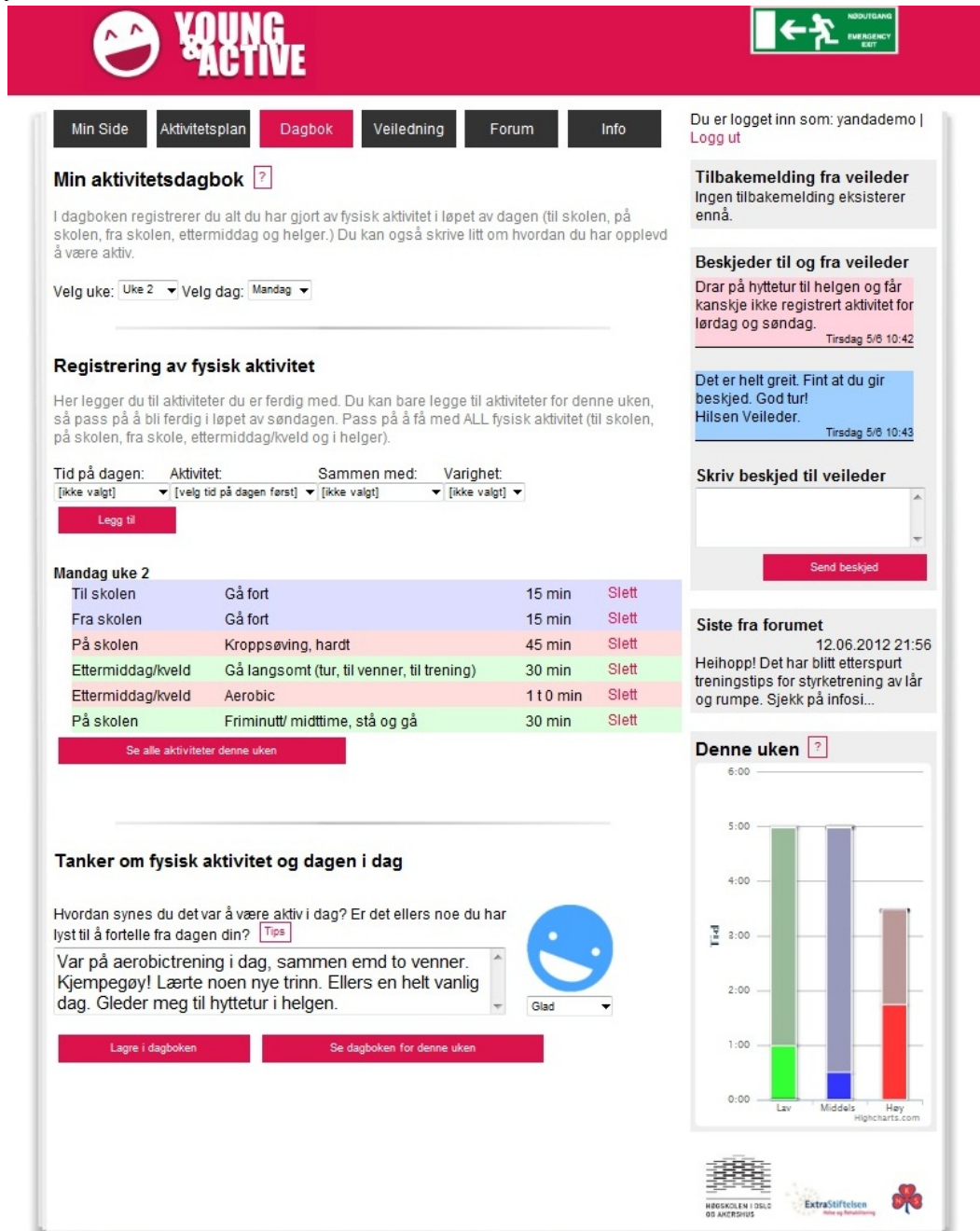
Results of Usability Test in the Field, the Finalized Young & Active Program

Only minor adjustments were made after the usability test in the field. These included better marking of feedback from the counselor, less spacious commentary fields in the forum, and 1 instead of 3 text fields and questions in the diary. Procedures for feedback once a week remained, but an initial personalized message by the message system was included in the intervention procedures. We also picked up responses from the preliminary workshop and positive feedback in the tests regarding the smileys, and added a function for choosing a smiley to

supplement the narratives in the diary for expressing the “mood of the day”. Technical adjustments and subsequent tests were made to reassure stability independent of browser.

The end result of the development and usability testing was a program that included the components as described, but with cleaner design, clearer instructions, and more intuitive and time-efficient functions. See Figure 3 for an example of one of the program pages.

Figure 3. A screenshot of the page for daily registration and diary notes on physical activity. The right panel has links to the last feedback from counselor, short messages to and from counsellor, the last comment on the forum, and a graphic presentation of the planned and registered activity for the present week.



Discussion

This article describes the development and results of usability testing of Young & Active, an Internet intervention specifically designed to increase PA in overweight adolescents. A sample of representatives from the target group participated in the development and usability testing, and gave valuable suggestions regarding design, content, and functionality. Accessing the intervention website and actually using it is essential for an Internet intervention to succeed, that is, to induce behavior change [35]. To choose to stay online, engage in the intervention, and to revisit it to follow up and complete the different tasks is definitive to whether the intervention works or not. Only the adolescents themselves can express their preferences for a program like this, thus, they are valuable creative partners in the developmental process. Inclusion of end users in the making and formative evaluation of the program is also in accordance with the chosen theoretical framework in that the adolescents' perspective and competence is acknowledged [22].

Adolescents are considered familiar with many online programs and are well aware of their preferences regarding layout, graphic appearance, colors, illustrations, fonts, and so on. Feedback from the workshop and usability tests reassured us that the adolescents liked the design, and particularly the use of specially designed smileys, which originated from well-known emoticons (emotion icons), in the logo and profile. Such emoticons can be regarded as non-verbal cues and are considered a creative and salient way to add expression to strict text [44,45]. Although they were not included in the program by the time of the usability tests, we assumed that supplementing the diary with optional smileys might help the adolescents communicate about feelings toward PA, exercise and their day in general.

The workshop indicated that explicit descriptions, clear intentions, and logic procedures of the different functions of the program are most important. In spite of this being focused in the following development, the first usability test still uncovered challenges with the understanding of the function of the different tasks (ie, making plan and registrations). Literature on how to write for Web emphasizes the importance of making short, concise texts with meaningful sub-headings and one idea per paragraph [46]. Use of pop-up boxes with supplemental text made it possible to reduce static text on the page. Face-to-face introductory instructions and a short session of training prior to getting started assured that the participants in the field test understood the program, its tasks, and its functions.

In addition to appreciation and understanding of the practical use of the program, it is essential that the adolescents find the program useful and that they acknowledge and value the aim of the intervention [40], which is to increase and maintain self-chosen PA that they find meaningful and want to do. The workshop and the first usability test revealed that the adolescents tended to equate PA with exercise and sports. This is unfortunate for at least 2 reasons. First, there is some evidence that, compared with those of normal weight, overweight adolescents participate less in sports and have less positive feelings towards PA [47]. The Young & Active program introduces the

adolescents to a broader meaning of PA, comprising, for example, playing with the dog, biking to school, walking about with friends, and playing soccer in the yard. This might make it easier to find and take part in feasible activities without prior negative associations. Second, meeting the recommendations of a total of 60 minutes of daily activity of at least moderate intensity (3 MET or more) [48] is unrealistic for most adolescents when solely including exercise or organized sports. Our intervention thus focuses strongly on the profits of engagement in all kinds of PA (in-school and leisure-time), not just planned and structured exercise, but also shorter bouts of PA. In the final version of Young & Active this message is included in the preliminary mapping interview (verbally), in the written instructional texts, and in the weekly feedback. In addition, the system for registration supports this by summarizing and visualizing the amount of all kinds of PA produced. Participants in the field test reported being motivated by the potential of increasing daily activity. The fact that they found changes in the bar charts rewarding gives hope to our goal of making adolescents more conscious and positive about daily PA when making specific goals, plans, registering, and monitoring the activity [19].

Computer-based interventions have several advantages. These include the benefits of standardization, tailoring, data collection, testing of theory, and practical use [23]. Standardization of the intervention ensures that the content is delivered equally to all participants. Young & Active also provides the flexibility of tailored automated feedback and need-supportive counseling based on registrations by the participants. As discussed, opportunity for daily PA recordings has potential benefits for the adolescents. Additionally, such recordings provide rich quantitative and qualitative data for the investigators. Another important benefit is the potential for reaching out to adolescents who might find it difficult to disclose sensitive information regarding their own health practices face-to-face with an adult. Computerized interventions also have the potential for increased cost-effectiveness compared to more time-consuming direct interventions.

More extensive use of theory has been associated with larger effect sizes [8], however, so far there is a lack of theory-driven interventions with the potential of explaining mechanisms of physical activity behavior change [23]. Young & Active represents an attempt to develop a such a theory-based program for the promotion and maintenance of PA in overweight adolescents. The ongoing study will assess the extent to which use of SDT as framework and the chosen modes of delivery might impact the efficacy of the intervention in the way that the participants increase their fitness and health-related quality of life.

The potentially biggest disadvantage for an Internet intervention such as Young & Active is its limited lifetime. The speed of development of Internet-based programs is vast and there is reason to believe that adolescent users are not particularly faithful in that their preferences shift rapidly. Considering the time-consuming process of development and testing in a research setting, it is a challenge to create a program that has not outlived itself before meeting its audience. Through development and usability testing of the program, we have taken

into account the preferences of the target group and hope that this ensured a program that is relevant for the time being. Technology is constantly developing, and new innovative applications appear, which in time will threaten to outdate the design and functions of Young & Active. Nevertheless, the ongoing study will add to the testing of our theoretically informed, individualized, computerized intervention and if the chosen characteristics are suited to promote behavior change.

This study highlights the importance of thorough preparation with explicit theory foundation in the developmental phase and

iterative usability testing throughout program development. Most important is the engagement from a sample population for ensuring that the users like, understand, and value the program. Integrating such feedback from the target group is highly valuable in the developmental process and increases the chances of making a potentially effective program. The final usability test showed that the program was well accepted by the participants and can be considered ready for further evaluation in a controlled trial.

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KR, KL, TS, and SH were involved in the development of the Web program. They designed the study and performed the testing. KR had primary responsibility for analyzing the data, interpreting the results, and writing the paper. KR, KL, YO, and SH participated in drafting and revising the article. All authors approved the final version to be published. This project was supported by the Norwegian ExtraFoundation for Health and Rehabilitation through Norwegian Women's Health Association and Oslo and Akershus University College of Applied Sciences. We thank our young participants, without whom this study would not have been possible.

Conflicts of Interest

None declared.

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Abbreviations

ASC: autonomy supportive counseling

MET: metabolic equivalent of task

MI: motivational interviewing

PA: physical activity

SDT: self-determination theory

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Paper IV

The outcomes of a 12-week Internet intervention aimed at improving fitness and health-related quality of life in overweight adolescents: The Young & Active controlled trial.

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Abstract

Background: Overweight and obesity among adolescents may have consequences, with potentially lasting effects on health and health-related quality of life (HRQoL). Excess weight is also associated with decreases in physical activity and cardiorespiratory fitness. The aim of the current study was to investigate the short-term effects of a 12-week Internet intervention in a primary care setting intended to increase cardiorespiratory fitness and HRQoL among overweight and obese adolescents.

Methods: In this controlled trial, participants (13-15 years) were non-randomly allocated to an intervention- or a control group. The intervention group received 12-weeks access to an online program providing tailored physical activity counseling based on principles from Self-determination Theory and Motivational Interviewing. The control group received standard follow-up by the school nurses. The primary outcome measure of cardiorespiratory fitness was determined using a shuttle run test. The secondary outcomes: HRQoL, leisure time exercise, body image and self-determined motivation for physical activity and exercise, were assessed by self-report measures. Age- and gender-adjusted body mass index (BMI) was calculated based on measurements of height and weight. To compare pre-to post intervention differences within groups, a paired samples t-test was used while crude differences between groups were analyzed with an independent samples t-test.

Results: Of the 120 participants, 108 completed the study, 75 in the intervention group and 33 in the control group. Exposure to the intervention had a small effect on cardiorespiratory fitness (0.14; 95% CI [0.01;0.28]; $P=0.04$), and a moderate effect on HRQoL (5.22; 95% CI [0.90; 9.53]; $P=0.02$). Moreover, the control group increased significantly in BMI, yielding a moderate preventive effect on BMI (-0.39; 95% CI [-0.74;-0.03]; $P=0.03$) for the intervention group.

Conclusion: The results suggest that the Internet intervention with tailored physical activity counseling can have beneficial short-term effect on cardiorespiratory fitness, HRQoL and BMI among adolescents with overweight and obesity.

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<https://clinicaltrials.gov/ct2/show/NCT01700309?term=01700309&rank=1>

Background

Overweight and obesity in children and adolescents is seen as a significant public health problem worldwide [1]. Excess weight is not merely a physical health matter. Overweight and obesity may have considerable psychosocial consequences with potentially lasting effects on well-being [2,3] . The stigma associated with being overweight can be pervasive and may mediate emotional and social problems [4]. Studies have documented that overweight and obesity in adolescence are related to lower self-esteem and depressive symptoms, which affect health-related quality of life (HRQoL) [3,5,6]. Being overweight have also been found to be associated with a decrease in physical activity (PA) and fitness indicating that being overweight might lead to inactivity just as much as inactivity leads to being overweight [7,8]. PA is considered a key component in prevention and treatment of overweight and obesity. The adverse effects of fatness on cardiovascular risk are found to be counteracted by higher levels of cardiorespiratory fitness (CRF) among adolescents [9,10]. Moreover, it is equally important that PA and fitness are associated with well-being and HRQoL [11]. So far, few studies have reported on associations between HRQoL and PA levels among overweight adolescents. However there are indications of such a relationship, showing that physically active overweight children demonstrate higher HRQoL compared to those who are less active [12]. CRF is also documented to be related to HRQoL among overweight and obese children and adolescents suggesting that improving fitness could be a strategy for increasing HRQoL [13,14]. These findings underline the importance of developing and making available targeted interventions that promote PA and fitness and potentially contribute to increase HRQoL in addition to preventing further weight gain among overweight adolescents.

Physical activity and web-based interventions

Although it seems that the field of primary preventive interventions is moving forward, and beneficial effects of programs on BMI have been found [15], very few secondary preventive studies targeting

those already overweight have been conducted in primary care [16]. In the search for new effective and efficient strategies to change and maintain health behavior, web-based interventions are becoming increasingly popular. Web-delivered interventions give professionals the opportunity to offer interactive feedback to large numbers of people, while also making the messages relevant to each user by individualizing them [17-19]. Internet interventions for prevention and management of overweight and obesity in children and adolescents have shown promise in terms of either dietary and/or PA behavior [20,21]. Reviews of internet-delivered interventions focusing exclusively on increasing PA among children and adolescents have also documented that such interventions could be feasible [22,23]. However, the quality of studies of web-based PA and overweight interventions has been limited, and they have problems with achieving clinically meaningful long-term results [20]. In addition, the attrition rate is often reported to be high [18]. Given that there is a dose-response relationship between use and effectiveness, it is decisive to develop the interventions in ways that increase adherence [19]. In order to do so, it has been repeatedly stressed that interventions should consider individual tailoring, increased frequency of personal contact and extensive use of theoretical frameworks [17,20,22,23].

Theoretical basis

Self-determination Theory (SDT) has shown to be useful in understanding motivational, cognitive and affective processes of PA [24]. According to the theory, developing a sense of autonomy, competence and relatedness, is essential to make a person more self-regulated and able to sustain behavior [25]. Autonomy reflects the need to engage in activities with a sense of choice, competence represents the feeling that one can accomplish tasks and reach goals, while relatedness refers to the sense of being understood and respected by significant others [26]. Autonomy support, structure and interpersonal involvement can support the basic psychological needs of autonomy, competence and relatedness, and thus facilitate adoption and maintenance of physical activity [27]. SDT proposes that people can be intrinsically as well as extrinsically motivated in their regulation of behavior [25]. Different forms of motivation can be conceptualized along a continuum from non-autonomous

controlled forms of behavior to completely autonomous forms [28]. Autonomous regulation of behavior is held to be more stable and enduring in addition to having more positive effects on human well-being than controlled regulation [25]. The social-environmental factors considered by SDT to facilitate self-determined function, such as autonomy support, have been shown to be closely related to the practice of motivational interviewing (MI) [29]. MI is a collaborative, person-centered form of guiding to elicit and strengthen motivation for change [30]. The MI-approach seeks to empower the participants' own reasons for change by expressing empathy, increasing awareness of discrepancies between goals and actions and supporting self-efficacy [29]. Development of the present intervention was informed by SDT and supplementary perspectives on self-regulation [31]. Inputs from SDT focusing on autonomy support, coupled with principles from MI, were used to promote behavior change in the tailored counseling (Table S1).

Aim

The aim of the current study was to investigate the short-term effects of a 12-week Internet intervention in a primary care setting intended to increase cardiorespiratory fitness and HRQoL among overweight and obese adolescents. We hypothesized that focusing on self-determined PA through an Internet intervention would have positive effects on the adolescents' cardiorespiratory fitness and HRQoL. Moreover, we hypothesized that compared to the control group, the intervention group would show increased self-determined motivation for PA and exercise, increased moderate to vigorous PA during leisure time, improved body image and stabilized or reduced BMI after the intervention.

Methods

Study design, recruitment and sample

The protocol for this trial and supporting TREND checklist are available as supporting information; see Protocol S1 and Checklist S1. This study was designed as a controlled trial without randomization. The initial randomization protocol was abandoned after responses from school nurses in the early stages of the study. They found it difficult to approach a sensitive topic like overweight by

introducing the adolescents to an intervention they assigned for and hoped to receive, but perhaps ended up *not* receiving. Both their weight and their young age, make these adolescents especially vulnerable [32]. When designing the study as a control group study, the amount of information was reduced and adjusted specifically to the two different groups. In addition, the adolescents would immediately know for which group they were offered participation. Participants were allocated to intervention- and control groups sequentially. Recruitment of the intervention group was completed first, in February and March 2012 and between November 2012 and March 2013, and the control group between November and March the following school year. All participants filled in questionnaires three times: at baseline (T0), immediately after the intervention at 12 weeks (T1) and one year after baseline (T2). The current findings are based on the T0-T1 data. Adolescents identified as overweight or obese after standardized screening of weight and height in the eighth grade or follow-up measurements in the ninth grade [33,34] and who were not engaged in other programs, were eligible for the study. We requested permission from primary health care head nurses of municipalities in three counties in eastern Norway to engage their school nurses in the recruitment of participants. Despite the fact that a great majority of the head nurses gave their permission, most school nurses declined our request, giving reasons such as lack of resources, no priority given to weight screening, or reluctance to discuss the topic of overweight with adolescents and their parents. Twenty-five nurses volunteered to recruit, and became responsible for issuing information and obtaining informed consent from participants and their guardians. We intended to match the participants in the intervention group with controls from the same schools; however difficulties in recruiting sufficient controls, made it necessary to extend the number of schools. At post-test (T1), reminders were given to the participants in advance, both by SMS and directly by the school nurse. A second appointment for T1-test was made whenever participants did not show up. The sample size of the original protocol was estimated to 96 in each group based on an effect size of 0.5, a power of 0.80, a level of significance 0.01 and the use of a two-sided t-test for statistical analysis. A 5 % significance level reduced the sample size to 64 per group.

Outcome measures

Primary outcome

Cardiorespiratory fitness was measured with the 20-meter shuttle run test (20mSRT). This reliable and valid test is widely used to assess cardiorespiratory fitness in children and adolescents [35]. The participant is required to run 20 m shuttles back and forth at an audible signal with a starting speed of $8.5 \text{ km} \cdot \text{h}^{-1}$. The pace continues to increase by $0.5 \text{ km} \cdot \text{h}^{-1}$ every minute thereafter with each new pace representing a higher level. The test ends when the participant has to stop because of fatigue, or fails to maintain the pace for two consecutive shuttles. In accordance with the literature, performance was calculated and presented as total shuttle count and end running speed [36,37], of which the latter was included in the analyses.

Secondary outcomes

Health-related quality of life was assessed using the Norwegian version of KIDSCREEN, a generic instrument focusing on physical, mental and social dimensions of well-being measured from the adolescents' perspective [38]. For the present study, a global HRQoL score was constructed based on an index from the 10-item version as described in the KIDSCREEN manual [38]. The timeframe of the questionnaire refers to the last week prior to assessment and consists of the following items: (1) felt fit and well, (2) felt full of energy, (3) felt sad, (4) felt lonely, (5) had enough time for yourself, (6) have been able to do the things that you want in your free time, (7) parent(s) treated you fairly, (8) had fun with your friends, (9) got on well at school and (10) have been able to pay attention. All items were rated on a five-point Likert scale ranging from never to always or not at all to extremely. The scales for negatively worded items were reversed. The raw scores were transformed linearly to a 0–100-point scale, with 100 indicating the best quality of life and 0 the worst [38]. The Norwegian version of KIDSCREEN-10 has previously shown satisfactory validity and reliability [39]. Cronbach's alpha of 0.79 at T0 indicated satisfactory internal consistency for the instrument in this study.

Physical activity was self-reported and measured with a single item adapted from World Health Organization Health Behaviour in School-Aged Children (HBSC) surveys [40], validated in the Young-HUNT study [41]. The question was “Apart from the average school day, how often do you play sports or exercise to the point where you breathe heavily and/or sweat?”. The seven response alternatives ranging from “every day” to “never” were recoded into three categories so that “low activity” represented “one day a week or less”, “moderate activity” represented “2-3 days a week” and “high activity” represented “four days a week or more” [41].

Self-determined motivation towards physical activity and exercise was assessed using the Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2). The scale consists of 19 items relating to the five types of motivation identified by self-determination theory (from least to most self-determined: amotivated, extrinsic, introjected, identified and intrinsic regulation). A relative autonomy composite score representing self-determined motivation was calculated consistent with past work [42]. The score ranges from -24 to +20 with more autonomous motivation being indicated by higher positive scores. A confirmatory factor analysis has been performed on the baseline results showing adequate factorial validity of the questionnaire [14]. Acceptable alpha coefficients were found for all subscales (0.71 - 0.86).

Body image was assessed using a Norwegian body image scale [43] consisting of four items; (1) I would like to change a good deal about my body, (2) by and large, I am satisfied with my looks, (3) I would like to change a good deal about my looks, and (4) by and large, I am satisfied with my body. The adolescents responded to one of the following categories: does not apply at all; does not apply well; applies somewhat; applies fairly well; applies well and applies exactly. The two negatively formulated items were recoded so that higher scores indicated a more positive body image. All four items were summed to construct a body image score ranging from zero to 20 with higher scores indicating a more positive body image. Previous research has found that the scale has acceptable

reliability [44]. In this study, Cronbach's alpha for the scale was 0.87, showing good internal consistency.

Body mass index was calculated based on weight and height measurements. Body weight was measured to the nearest 0.1 kg with a portable digital weight. The adolescents wore no shoes and only light clothing. Weight was corrected (-0.5 kg) for clothes. Height was measured to the nearest 0.1 cm with a stadiometer. Age- and gender-specific BMI cut-off values proposed by the International Obesity Task Force were used to categorize the adolescents as overweight or obese [45].

Procedures

The intervention group received the 12 week-intervention described below, while the participants in the control group were given follow-up as usual by the school health service. Such follow-up consisted of opportunities to meet with the nurse on the adolescent's request and in some cases participation in weekly exercise groups run by the school health service. These groups were offered as an alternative to organized sports. However, the groups did not include more than merely organized exercise comparable to any other typical leisure time sports activity.

Participants in both groups completed self-report measures, measurements of height and weight and a standardized fitness-test at baseline (T0) and after 12 weeks (T1). All measurements took place during school hours. The researchers were responsible for the assessment. The school nurse and the researchers were available to clarify the items in the questionnaires if necessary. The fitness-test was performed in the school's gym, with only one of the researchers present. Standardized information about how to perform the test was given individually. The participants wore running shoes and light clothing.

The intervention: Young & Active

Young & Active was developed with the aim of motivating overweight adolescents to increase and maintain PA and thereby enhance their fitness and HRQoL. The intervention focused on physical activity, how active the adolescents aimed to be, and how they could make self-determined choices

to increase activity throughout the day. Weight reduction was not emphasized. The development and the content of the Internet program, as well as an evaluation of its usability, have been thoroughly described elsewhere [46]. In brief, the program offered the participant opportunities to establish personal goals and a plan for physical activity, to register physical activity, to keep a physical activity diary and to get support from a forum. It provided continuous graphical response on progress, frequently updated information on physical activity and, most importantly, weekly individualized feedback and counseling from a health professional. Additionally, the program contained a mailing system with a message box present on every page making it possible for the participant and counselor to exchange short messages independently of the diary and weekly feedback if necessary. A summary of the main content and the interactive features of the program are shown in Figure S1. A simple password-protected page for the counselor was also designed. On this page, the counselor could view a summary of each participant's registration and diary notes, and write and send weekly feedback and monitor the forum.

The intervention started with an individual meeting with one of the researchers. Embedded in the principles of MI, the informal conversation focused on feelings, thoughts and experiences with different forms of sports and physical activities. Additionally, the participant was given access to the program with a brief introduction to it. The following Monday, the participant received a reminder via SMS to start registrations. Except for the first face-to-face introductory meeting, all communication between the participant and the counselor took place online. One of the researchers (a physiotherapist trained in MI) provided the written counseling to every participant every Monday for 12 weeks. The key principles from the application of autonomy support with examples from MI-principles and the counselors' feedback are given in Table S1. The participant was encouraged to make daily registrations and write narratives on PA and exercise. However, the program allowed for backdating within the same week, so that registrations did not have to be made every day. Daily registrations and writing in the diary took an estimated 5-10 minutes. If registrations were missing

for the entire week, the participant received a standardized reminder via SMS and a standardized message in the program.

Ethical aspects

The study was reviewed and approved by the Regional Committees for Medical and Health Research Ethics in Norway. We emphasized that our informants were given sufficient and understandable information about the study, the purpose, the right to withdraw, potential harms and benefits. All participants gave written assent to participation by signing a form, and at least one of their guardians signed an informed consent. Based on a rigorous risk analysis, appropriate steps were taken to ensure program security and thus security and anonymity of the participants. During the development and preliminary implementation of the study, several ethical issues became apparent. For this reason, a thorough ethical evaluation of the entire intervention was carried out and published [32]. It seems evident that the ethical aspects of the present intervention were mainly concerned with the vulnerability of adolescents being identified as overweight. However, we argue that the individually tailored feedback as provided in this intervention had a unique potential to empower the participant to make decisions about his or her own health behaviour. The present study is registered at ClinicalTrial.gov (NCT01700309).

Statistical analyses

Due to a limited number of cases and a relatively small amount of missing values, no imputation of missing values was considered necessary. No sum scores were computed if one or more items were missing. All participants were analyzed in the group to which they were allocated. Distributions of all continuous variables were visually inspected. Data were generally skewed, thus data are described with median, minimum and maximum values, and the groups compared with non-parametric methods (Chi-square test and Mann-Whitney Wilcoxon test). The small sample size did not allow for multivariate analysis. To compare pre-to post intervention differences within groups, a paired samples t-test was used as the mean differences followed normal distribution. Crude differences

between groups were analyzed with an independent samples t-test. The differences between change in the intervention group versus the control group are expressed as effect sizes calculated with Cohen's d and categorized as <0.5 = small effect, $0.5-0.8$ = medium effect and >0.8 = large effect [47]. In addition, we investigated if frequency of use affected the outcomes. We chose a cut-off at seven weeks and performed analyses comparing those who made registrations for more than seven of 12 weeks ("frequent intervention users") and the control group. Finally, logistic regression was performed to assess the impact of factors on the likelihood of being a frequent user versus an infrequent user of the intervention. The results are expressed as odds ratio (OR) with 95% confidence interval (CI). P-values ≤ 0.05 were considered statistically significant and all tests were two-sided. The analyses were performed using SPSS© 21.0.

Results

Participants

In total, 84 and 36 adolescents agreed to participate in the intervention and control groups respectively (Figure S2). Only eight of 84 adolescents withdrew from the intervention group during the intervention period leading to an attrition rate of 9.5 %. The most common reason for resigning was that participation was felt to be too stressful or time-consuming. In addition to those who actively resigned, one participant in the intervention group never appeared for retest, for reasons unknown. Among the control participants, three discontinued participation. Eight of the 12 who discontinued participation were boys. There were no statistically significant differences between the discontinuers and the continuers on any of the study variables.

Participant characteristics at baseline (T0) and post-intervention (T1) are presented in Table S2. More intervention participants (6) than control group participants (1) became normal weight (age- and gender adjusted BMI < 25) during the intervention. In addition, four intervention group participants went from being obese to overweight, while two participants from each of the two groups went from overweight to obese during the intervention period. About one third, 36% of the participants in the control group and 31% in the intervention group reported an increased PA level (from low to

moderate, low to high or moderate to high) at T1. Table S3 displays median and minimum and maximum values for assessments of all study variables at both assessment points. At baseline, there were no statistically significant differences between the intervention- and control groups, except for self-determined motivation for PA and exercise as indicated by the relative autonomy index (BREQ2), which was significantly higher in the control group ($P=0.04$).

Within-group analysis

A paired samples t-test was conducted to evaluate changes on the outcome variables within groups. The results are presented in Table S4. Intention-to-treat analysis showed a small, however statistically significant increase in cardiorespiratory fitness for the intervention group ($P=0.01$). In addition, as opposed to the control group, HRQoL as measured by KIDSCREEN-10 increased significantly in the intervention group ($P<0.01$), as did body image ($P<0.01$). Conversely, there was a statistically significant increase in BMI in the control group during the test period ($P=0.02$), while no change was seen on BMI in the intervention group. Self-determined motivation measured by relative autonomy index did not change in any of the groups.

Between-group analysis

Differences in between-group changes are presented as effect sizes in Table S5. A small effect (0.14; 95% CI [0.01;0.28]; $P=0.04$) was found between the groups on CRF after the intervention and a moderate effect (5.22; 95% CI [0.90;9.53]; $P=0.02$) was found on HRQoL. Moreover, a moderate effect was found on BMI (-0.39; 95% CI [-0.74;-0.05]; $P=0.03$). The remaining differences were not statistically significant and the effect sizes small and non-existent. Analysis including controls ($n=33$) and frequent users ($n=35$) of the intervention revealed moderate effect sizes on CRF ($P=0.04$), body image ($P=0.04$) and BMI ($P=0.01$). However, the effect size on HRQoL was smaller (4.21; 95% CI [-0.74;9.15]; $P=0.09$) when comparing frequent users to controls, than in the analysis including the complete intervention group.

Frequent- or infrequent use of the program

Logistic regression was performed to assess the impact of selected variables on the likelihood of being a frequent (n=35) or an infrequent user (n=41) of the intervention. Each study variable was tested individually against frequent/infrequent use. Variables that were statistically significant in univariate analyses were entered into a multiple regression model. In this model containing HRQoL, BMI and self-determined motivation, HRQoL and BMI remained independent predictors of frequent use. For each extra unit on KIDSCREEN-10, the participants were 9% more likely to use the intervention frequently ($P<0.01$; OR=1.09; 95% CI [1.03;1.16]), while for each unit increase in BMI, they were about 20 % less likely to use the program frequently ($P=0.03$; OR=0.81; 95% CI [0.68;0.97]). CRF was not included in the model as we expected this variable to be heavily confounded by BMI. Gender was not associated with frequency of use.

Discussion

To our knowledge, this is the first study to investigate the effects of an individually tailored Internet intervention using principles from SDT and MI to increase CRF and HRQoL among young people with overweight and obesity. The results indicate that we were successful in reaching the group approached. Our findings support that during the 12-week intervention, we managed to influence the intervention group participants' CRF, HRQoL and BMI in a positive direction. The short-term effect on the primary outcome CRF was significant, but modest; however some factors should be considered which might lend more weight to the result. First, the present intervention emphasized self-determined physical activities and exercise in general, not just endurance activities. Enhancement of CRF demands systematically increased efforts in aerobic activities over time. Thus, increased CRF in this study depended on the participant understanding the information provided by the intervention, engaging in aerobic activities and possessing or acquiring self-regulatory skills to execute planned PA with sufficient intensity [31]. We have to take into account that for different reasons, some intervention group participants perhaps chose less intensive activities and thus did not contribute to increasing the total CRF. Secondly, our sample had notably low initial CRF.

Compared to centile curves from a general sample in an English study [37], both girls and boys in the present study scored below the 25th percentile [14]. Despite substantial evidence demonstrating that CRF is a powerful marker of health [9], there are no agreed definition or cut-offs for low CRF in youth. However, studies on adults indicate that individuals gain the largest benefits to health by moving out of the lowest quartile or quintiles for CRF [48]. Hence, we argue that any improvement in a positive direction is of value to the group of overweight and obese adolescents and might be the beginning of a positive development towards higher levels of CRF. Excess weight was most certainly a strong contributor to the low CRF of the present sample. The inverse relationship between BMI and CRF is well documented [8]. However, since there were only minor changes in mean BMI in the intervention group and minor changes in CRF in the control group, it seems unlikely that BMI can explain the entire between-group difference in CRF post intervention.

We were unable to detect changes in the amounts of leisure time PA in favor of the intervention group by means of the single item measuring PA frequency. Hence, there are reasons to assume that increased CRF within this group was caused by an increase in PA intensity and possibly duration. This relates well to the intervention's content, features and counseling, which explicitly emphasized the importance of increasing intensity in endurance activities to enhance aerobic capacity (Table S1). It is important to notice that since we included only assessment of cardiorespiratory fitness, we were not able to document potential improvement on, e.g. musculoskeletal or motor fitness.

We also observed effects of the intervention on well-being, conceptualized as HRQoL. A large body of research has found that overweight and obese youth report lower health-related quality of life than do adolescents with normal weight, and the physical dimension seems to be one of the most affected [3,49]. Compared to a representative Norwegian sample of adolescents, the participants in the present study reported a lower baseline HRQoL [39]. KIDSCREEN-10 does not allow for analyses of dimensions of HRQoL. Even so, the fact that a generic short form instrument captured

improvement in overall HRQoL following an intervention focusing on PA, may emphasize the importance of physical performance and participation on well-being for this group.

Additionally, the intervention had a beneficial effect on BMI, mainly reflecting a BMI gain prevention among the intervention participants. While the intervention group had a small non-significant reduction in BMI, the control group increased significantly. Findings from studies indicate that adiposity continues to increase in obese children who do not receive treatment [50,51]. Thus, a stagnation following an intervention must be considered a goal in secondary preventive interventions. When comparing frequent users of Young & Active to the controls, we found an even larger effect size, pointing to a relationship between adherence and the outcome and an additional effect on BMI reduction for intervention users. The intervention did not emphasize weight reduction or eating behavior. However, previous studies on adults have documented that interventions targeting one specific health behavior, can have motivational impact on other health behaviors [52]. Even though the intervention focused on PA and exercise, the participants may have been influenced to reduce their sedentary behavior, and change diet and eating patterns as well.

We also hypothesized that the intervention would improve body image. When all participants were included in the analysis, the effect size on body image was insignificant and small. However, we found a moderate per protocol between-group effect when including only those who used the intervention frequently. This may indicate that the intervention, depending on the use, managed to facilitate body satisfaction, however, the difference is too small to be of particular clinical importance.

Even though the intervention aimed to influence self-determined motivation specifically, within-group analyses revealed no statistically significant increase in the intervention group on regulation of motivation, and no between-group effect was found post intervention. Both groups voluntarily signed up for an intervention study with an explicit focus on PA. Thus, it is likely that they were all more self-determined in their self-regulation of motivation for PA and exercise than the general

population of overweight and obese adolescents, an assumption supported by their relatively high positive baseline relative autonomy index-scores. Another explanation is that even though we emphasized autonomy by including need-supportive features in the intervention, the young participants may have perceived their motives for taking part as somewhat controlling. As a result, some may have felt the pressure to become more physically active, which contributed to increasing controlled forms of regulation and evened out a potential increase in autonomous regulation. This study does not present data on the different forms of regulation, however previous studies have found introjected regulation to relate positively to autonomous forms of motivation [53,54].

Finally, this study adds some information about the probability of using the intervention by showing that higher initial BMI reduced, while higher initial HRQoL increased, the likelihood. Even though most of the withdrawers were boys, gender did not seem to be a significant factor for intervention use. These findings will be supplemented with an upcoming detailed process evaluation.

Strengths and limitations

Strengths and limitations of the intervention

We systematically developed the Young & Active based on theory and in cooperation with representatives from the target group, which is likely to have influenced use and satisfaction [46]. Among the many advantages of Internet interventions is accessibility, anonymity and flexibility for the users. In addition, the health promoters are given improved opportunities for maintenance and updating of the intervention. The present intervention included multiple active ingredients with automated feedback and individually tailored need-supportive counseling, all of which are factors shown to improve exposure [18,55]. However, we have to take into consideration that for some, the intervention might have been too extensive.

A great disadvantage for an Internet intervention such as ours is its limited lifetime. From the time Young & Active was planned, technology and new innovative applications have developed at a

furious pace. Although the program's design and functions already may seem outdated, the content and characteristics will make a valuable basis for further development and improvement.

Strengths and limitations of the study

Application of pretests and a control group design is among the appreciable strengths of this study. The small pretest differences between the groups decreased the likelihood of initial selection biases. As shown, with only one exception, there were no significant differences between the groups on any of the baseline variables and thus no need to adjust for possible confounders in multiple analyses. One of the most substantial problems in web-based prevention is high attrition rate and low use of the interventions. In the current study, the actual attrition rate was low, and even though half of the intervention group made only infrequent registrations, these participants may have been exposed to intervention content despite not using the diary. Lastly, we chose a clinically realistic way of recruiting the sample. This provided valuable information about pitfalls and possibilities for future potential large-scale assessments and implementation.

Randomized controlled trials are generally more reliable than quasi-experimental trials. Hence, a major disadvantage of the current study is its lack of randomization. The vulnerability of the target group and the clinical setting, made it unethical to assign participants randomly. The individuals were included sequentially and based on convenience, with the consequence of potential between-group baseline differences in unmeasured variables. Recruitment of participants can be a significant obstacle in research, as it proved to be in the present study. In this case, the greatest hinder turned out to be that the majority of the school nurses, on whom we relied to engage participants, declined our requests for assistance. The consequence was an extensive recruitment process, which due to time limitations had to be terminated before we had two equally large groups containing the number of participants suggested by the power analysis. The small sample size did not provide sufficient power to analyze subgroups like gender. In addition, the generalizability of the study was heavily reduced, both because of the quasi-experimental design, and because of the lack of information

about participants who were invited, but declined participation. Although the two groups were included and assessed during the same months, they participated during two following school years. Potential seasonal variations between the two years may have affected the PA level between the groups. As in all research, there are validity issues associated with the use of self-report measures. An objective measure of PA would have increased the validity and added valuable information to the analyses. Another disputed assessment undertaken in this study, is BMI, which does not take full account of maturation status. In addition, the reliability and appropriateness of the 20mSRT have been discussed in the past, with motivation, competency and perceived worth being mentioned as variables that influence performance. However, in a recent systematic review, the authors concluded that the test was valid and reliable for estimating CRF in children and adolescents [56]. We used a sum score from the 10-item version of the KIDSCREEN questionnaire. The results might have been different if we had used the extended versions (27- and 53-items) which include different sub-dimensions. Finally, this study does not generate evidence for long-term effects, which is an important limitation. One-year-follow-up data are being obtained, and will be analyzed and presented in the near future.

Conclusion

Our results give preliminary support to the efficacy of an Internet intervention for increasing CRF and HRQoL in adolescents with overweight and obesity. We also found beneficial effect on BMI. Despite national guidelines for measurement and follow-up of overweight and obesity, our impression is that face-to-face health-behavior counseling of overweight and obese adolescents in primary health care is limited or non-existent. The integration of Internet technology into primary care practice offers new possibilities for interaction with the target group with several advantages for the users as well as for the health promoters. The findings of the present study give promise to future interventions applying newer technology in a primary health care setting.

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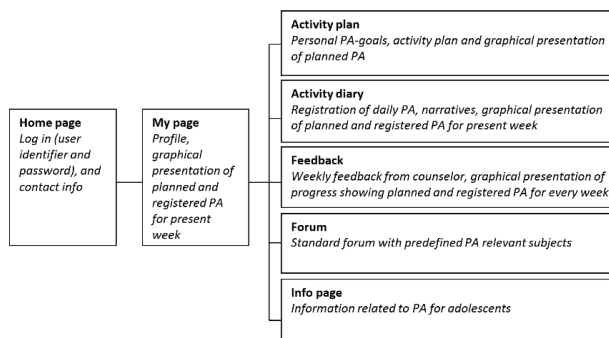


Figure S1 Main content and interactive features of Young & Active [46]

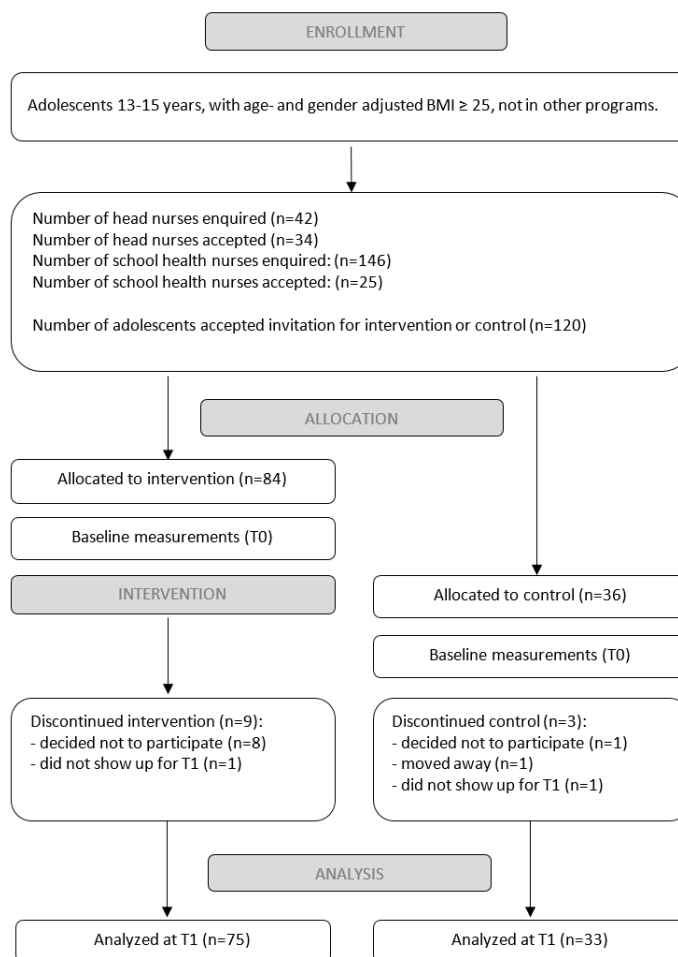


Figure S2 Participant flow and study design

Table S1 Examples of autonomy supportive counselling and MI elements in the feedback

Principles from autonomy supportive counseling:	Examples of principles from MI:	Examples of practical use:	Examples of feedback provided in Young & Active:
Support autonomy	Explore the adolescent's own reasons for change	Let the adolescent explore his/her own reasons for being physically active and exercising.	I am happy to read that you are satisfied with your training on Wednesday. You managed to do both running and weight exercises! Your goal is to complete what you plan for, and on Wednesday, you really did! Why? What made you do so? It is smart to think all this through; "What does it take for me to be as physically active as planned?"
Provide structure	Develop goals	Help set goals for PA and exercise. Make sure the goals are appropriate, realistic, and achievable.	To increase your aerobic fitness, which is one of your goals, you have to improve your lung capacity. This requires that you choose vigorous activities that increase your heart rate. Dancing is great exercise, but often contains frequent pausing, while cycling, running or swimming require that you keep your pace up over time. I challenge you to give it your best whenever you can, i.e. in the PE-class. Having said that, all the exercise and activity that you have planned, including dancing, is good for your fitness, with respect to strength, balance and flexibility.
Be involved	Express empathy	Display interest in the adolescent and his/her well-being.	I hope you are feeling better. I see from your registrations that some of your planned activities were cancelled because you were ill. It is important not to exert yourself too much when you have an infection. When you feel up to it, you can slowly increase the exercise intensity. Start carefully, do not overdo it.

Table S2 Participants' characteristics

Characteristics	T0		T1	
	Intervention n=84	Control n=36	Intervention n=75	Control n=33
Age, median (min/max)	13.70 12.9/15.1)	13.78 (12.8/15.0)		
Girls	50 (60%)	23 (64%)	47 (63%)	22 (67%)
Born in Norway	72 (86%)	29 (81%)	63 (84%)	26 (79%)
Overweight	57 (68%)	23 (64%)	46 (61%)	19 (58%)
Obese	27 (32%)	13 (36%)	23 (31%)	13 (39%)
Normal weight			6 (8%)	1 (3%)
Low activity	25 (30%)	8 (22%)	13 (17%)	6 (18%)
Moderate activity	41 (49%)	21 (58%)	37 (50%)	13 (40%)
High activity	18 (21%)	7 (19%)	25 (33%)	14 (42%)

Table S3 Median and minimum/maximum values for primary and secondary outcome measures at baseline (T0) and post intervention (T1)

Assessments	T0		T1	
	Intervention n=84	Control n=36	Intervention n=75	Control n=33
20mSRT (km/h)	9.50 (8.5/12.0)	9.50 (8.5/11.0)	10.00 (8.5/12.0)	9.50 (8.5/11.5)
missing	n=0	n=0	n=8	n=1
Shuttles	23.0 (7.0/64.0)	20.0 (6.0/51.0)	25.0 (7.0/72.0)	17.5 (6.0/55.0)
missing	n=0	n=0	n=8	n=1
KIDSCREEN-10 (0-100)	67.50 (17.50/100.00)	68.75 (30.00/92.50)	68.75 (25.00/97.50)	70.00 (40.00/92.50)
missing	n=9	n=6	n=7	n=1
Body image (0-20)	7 (0/17)	8 (1/19)	10 (0/20)	8 (0/19)
missing	n=3	n=3	n=4	n=2
Relative autonomy index (-24-20)	7.92 (-11.00/19.33)	10.83 (-2.50/17.83)	8.75 (-9.00/18.67)	10.25 (-3.33/17.83)
missing	n=2	n=2	n=6	n=0
Body mass index (kg/m ²)	26.62 (22.09/37.79)	27.45 (22.37/36.36)	26.40 (21.59/40.04)	27.45 (22.33/36.37)
missing	n=0	n=0	n=0	n=0

Table S4 Mean differences for the primary outcome measure and secondary outcome measures within groups, confidence intervals (CI) and P-values.

Outcome measure	N	Mean diff. T0 to T1	95% CI	P-value ^a
20mSRT^b				
Intervention	67	0.14	0.03;0.25	0.01
Control	32	0.00	-0.08;0.08	1.00
KIDSCREEN-10				
Intervention	61	4.59	2.08;7.10	<0.01
Control	28	-0.63	-4.05;2.80	0.71
Body image				
Intervention	68	1.57	0.66;2.49	<0.01
Control	28	0.29	-0.68;1.25	0.55
Relative autonomy index				
Intervention	67	0.03	-1.24;1.30	0.97
Control	31	-0.21	-1.85;1.44	0.80
Body mass index				
Intervention	75	-0.10	-0.31;0.10	0.32
Control	33	0.29	0.06;0.53	0.02

^a P values for paired samples t-tests

Table S5 Between-group differences and effect sizes after the intervention (T1)

Outcome measure	Intervention versus control				Frequent users versus controls			
	Mean diff	95% CI	P-value ^a	ES ^b	Mean diff	95% CI	P-value ^a	ES ^b
<i>Primary</i>								
20mSRT	0.14	0.01;0.28	0.04	0.39	0.21	0.01;0.41	0.04	0.55
<i>Secondary</i>								
KIDSCREEN-10	5.22	0.90;9.53	0.02	0.56	4.21	-0.74;9.15	0.09	0.45
Body image	1.29	-0.26;2.83	0.10	0.40	1.68	0.10;3.26	0.04	0.56
Relative aut.index	0.23	-1.92;2.39	0.83	0.05	0.51	-1.86;2.88	0.67	0.11
BMI	-0.39	-0.74; -0.05	0.03	-0.50	-0.52	-0.89; -0.16	0.01	-0.70

^aP-values for independent samples t-tests

^bCohen's d

Appendixes 1–5

APPENDIX 1: Information brochure

APPENDIX 2: Informed consent

APPENDIX 3: Guides and questionnaire for usability tests

APPENDIX 4: Questionnaires

APPENDIX 5: Screenshots from the program



Fysisk aktivitet gir deg

glede!
bedre helse!
overskudd!
økt forbreining!



2012



Et forskningsprosjekt i regi av
Høgskolen i Oslo og Akershus

Forskningsprosjektet Young & Active trenger deltakere!

Vi ønsker deltakere til et forskningsprosjekt som tester effekten av å bruke en nettbasert aktivitets- og treningsdagbok som heter Young & Active.

Høres det spennende ut?



Hvem kan være med?

Vi vil gjerne komme i kontakt med ungdommer på 8. trinn i forbindelse med rutinemessig veiing og måling hos helsesøster. Dersom det viser seg at din vekt* ligger over det som er anbefalt, er du velkommen til å være med i studien vår.

*BMI for barn og unge beregnes og leses ut fra en spesiell tabell. Helsesøster kan finne denne verdien for deg.

Om prosjektet

I dette prosjektet ønsker vi å finne ut om det å skrive aktivitetsdagbok og få internettbasert aktivitets- og treningsveiledning gjennom Young & Active gjør at du blir mer fysisk aktiv og kommer i bedre form.

Hvis du vil delta i studien, får du være med å teste ut Young & Active i tolv uker. Før du starter skal du fylle ut et spørreskjema og gjøre en enkel løpetest. Forskere gir deg opplæring i programmet og hjelper deg med å finne mål for aktivitet og å lage en aktivitetsplan. Etter tolv uker fyller du ut spørreskjemaet på nytt og gjentar testen.



Young & Active

Young & Active er et internettprogram som gir deg mulighet til å skrive mål og lage plan for fysisk aktivitet og trening. Du kan registrere daglig hvor aktiv du er og skrive i en dagbok om hvordan du synes det går. Ulike grafer vil vise hvordan du ligger an i forhold til planen din. Hver uke får du en tilbakemelding og råd fra en veileder. Du kan også kommunisere med andre i et forum og lese om fysisk aktivitet og trening på en informasjonsside.

*«Jeg mener at Young & Active hjelper meg med å komme meg i form fordi det pusher meg til å tenke at nå skal jeg slå antall timer i aktivitet fra forrige uke. Jeg kjenner jeg blir litt glad når jeg kan skrive inn i aktivitetsdagboken at jeg har vært aktiv. Young & Active er til stor hjelp for meg! :D»
-Deltaker vår 2012*

Interessert?

Snakk med helsesøster på skolen eller ta kontakt: yaa@hioa.no

APPENDIX 1



Et forskningsprosjekt i regi av
Høgskolen i Oslo og Akershus



2012/2013



Forskningsprosjektet Young & Active trenger deltakere til en kontrollgruppe!

Vi ønsker ungdommer til et forskningsprosjekt som fokuserer på fysisk aktivitet og livskvalitet. Vi trenger deltakere til en **kontrollgruppe**. Kunne du tenke deg å være med? Det innebærer at du tre ganger i løpet av et år fyller ut et spørreskjema, veies/måles og gjennomfører en enkel fysisk test. Dette tar ca 30 minutter hver gang og skjer i tilknytning til skoledagen. (Testen foregår *ikke* i gruppe, du møter en av oss alene). Helsesøster på skolen hjelper oss å komme i kontakt med deg.

Hva betyr «kontrollgruppe»?

Når forskere skal teste ut om et nytt tiltak virker, må noen som prøver tiltaket (intervensjonsgruppe) sammenliknes med noen som ikke prøver det (kontrollgruppe). Begge gruppene er like viktige for prosjektet!



Hvem kan være med?

Vi vil gjerne komme i kontakt med ungdommer på 8. trinn i forbindelse med rutinemessig veing og måling hos helsesøster. Dersom din vekt* ligger over det som er anbefalt, er du velkommen til å være med i studien vår

*KMI for barn og unge beregnes og leses ut fra en spesiell tabell. Helsesøster kan finne denne verdien for deg.



Interessert?

Snakk med helsesøster på skolen eller ta kontakt: yaa@hioa.no

Hilsen forskere ved Høgskolen i Oslo og Akershus

Forespørsel om deltakelse i forskningsprosjektet Informasjon til ungdom

Vil du være med i et forskningsprosjekt?

Dette er et spørsmål til deg om å delta i en forskningsstudie. Studien ønsker å undersøke om det å holde på med selvvalgt fysisk aktivitet og trening gjør at du blir i bedre form og føler at du har det bedre med deg selv og kroppen din. Som helsearbeidere ser vi at mange barn og unge med overvekt ikke alltid trives så godt med treningsaktiviteter og velger derfor mer stillesittende aktiviteter. Kroppen trenger bevegelse, og helst skal vi være så aktive at vi blir litt svette og andpustne hver dag. Det at du veier mer enn gjennomsnittet, betyr ikke så mye så lenge du synes du har en kropp som fungerer, du driver med regelmessig og variert fysisk aktivitet og at du synes dette er morsomt og meningsfylt.

Vi er en gruppe forskere ved Høgskolen i Oslo og Akershus og Norges Idrettshøgskole som har utviklet et internettbasert program som heter Young & Active. Det er dette programmet studien vår ønsker å teste ut. Gjennom registreringer og dagbok snakker du som deltager med fagpersoner som gir deg veiledning, tips og råd for hvordan du kan bli mer aktiv i hverdagen. Young & Active inneholder også et forum der du kan snakke med andre ungdommer som deltar i prosjektet. Du er anonym og bruker et "nick". Oppfølgingen vil vare i tre måneder.

Dette skjer:

Du møter forskerne en uke før oppstart for informasjon, spørreundersøkelse, fysisk test, veiing og måling. I tillegg gjennomfører vi en kartlegging av din fysiske aktivitet gjennom en vanlig uke. Samtalen vil bli tatt opp på bånd. Du får også informasjon om og opplæring i bruk av Young & Active. Foreldrene dine kan være med dersom du ønsker det. Med utgangspunkt i kartleggingssamtalen lager vi sammen mål for fysisk aktivitet og en plan for hvordan skal nå disse. Uken etter starter du med daglig dagbok- og registrering på nettet. Hver uke gir vi deg tilbakemelding på hvordan vi synes det går og hjelper deg til å holde fast ved planen din og nå de målene du har satt deg. I Young & Active sitt forum har du også muligheten til å snakke med andre ungdommer som deltar på samme måte som deg. Her kan dere oppmuntre hverandre og gi hverandre tips til spennende aktiviteter. Det legges også ut informasjon om trening og fysisk aktivitet på programmets informasjonsside.

I løpet av prosjektperioden vil du møte forskerne ved oppstart, etter 3 måneder og etter et år. Ved disse møtene vil vi be deg fylle ut spørreskjema, du vil bli veid og målt og det vil bli gjennomført en fysisk test. I tillegg ønsker vi å intervju noen deltakere om hvordan du har det og hvordan du synes det er å bruke et program som Young & Active. Denne samtalen vil vi ta opp med en MP3-spiller og brukes videre i forskningen.

Helsesøster på skolen hjelper oss å komme i kontakt med deg og koordinerer også tidspunktene for når du skal møte forskerne. Dette skjer i tilknytning til skoledagen.

Det å være med i studien vil ikke medføre ubehag for deg. Vi skal ta godt vare på deg og du skal få god informasjon underveis. Dersom du først takker ja til å være med i studien, men ombestemmer deg seinere, kan du når som helst og uten å fortelle hvorfor, velge å trekke deg. Du vil da få oppfølging fra skolehelsetjenesten som vanlig. I utgangspunktet er all informasjon du gir oss som forskere anonym, det vil si at det du sier blir mellom oss og kan senere ikke spores tilbake til deg. Men av og til kan det oppstå ting som det kan være viktig at dine foreldre/foresatte eller helsesøster på skolen får

APPENDIX 2

vite om. Dersom vi mener det er riktig å gi informasjon til dine foreldre/foresatte eller helsesøster skal du føle deg trygg på at det ikke gjøres uten at vi har snakket med deg først.

Vi kan forsikre deg om at alt du sier, skriver på nettet eller opplysninger du gir om deg selv i spørreskjema vil være helt anonyme. Ingen vil kunne spore noe informasjon tilbake til deg. Du vil få tildelt et nummer som identifiserer deg i prosjektet og bare forskerne i prosjektet vil kjenne navnet ditt. Koblingen mellom nummer og navn vil bare være tilgjengelig for prosjektleder.

Prosjektleder er Sølvi Helseth, tlf:

Prosjektmedarbeider/forsker er Kirsti Riiser, tlf:

Forespørsel om deltakelse i forskningsprosjektet

Informasjon til foresatte

Bakgrunn og hensikt

Dette er et spørsmål til dere som foreldre/foresatte om å la deres ungdom delta i en forskningsstudie. Studien ønsker å undersøke betydningen av økt fysisk aktivitet for livskvalitet hos en gruppe ungdom med overvekt. Bakgrunnen for studien baserer seg på forskning som viser at:

- det er sammenheng mellom fysisk aktivitet og livskvalitet
- mange barn og unge med overvekt er mindre aktive enn anbefalt og de vegrer seg oftere for å delta i aktiviteter med jevnaldrende
- fysisk aktivitet har store helsefordeler uavhengig av vektreduksjon
- fysisk aktivitet som oppleves meningsfylt, øker sjansen for å opprettholde et høyere aktivitetsnivå

I studien ønsker vi å gjennomføre en intervensjon (et tiltak) der vi prøver ut et individuelt tilpasset aktivitetsopplegg der oppfølgingen skjer via en nettside, Young & Active. Det vil si at vi sammen med ungdommen lager et program for fysisk aktivitet som tilfredsstiller noen gitte krav til mengde, intensitet og varighet. Kontakt mellom forsker og ungdom skjer via Young & Active der ungdommen skriver dagbok og rapporterer på grad av aktivitet og hvordan de opplever det å være fysisk aktive og delta i et forskningsprosjekt. Via nettsiden får ungdommen ukentlig tilbakemelding og veiledning fra forskerne i studien. De gis også mulighet til å kommunisere med jevnaldrende studiedeltagere ved å poste innlegg i et forum. Oppfølging gis i etter 12 uker. Det er økt fysisk aktivitet og livskvalitet og ikke vekt som er fokus for denne studien.

Deltakere

13åringer fra utvalgte kommuner i Norge, som ved rutineundersøkelsen på skolen viser at de ligger over grensene for overvekt, tilbys deltagelse i studien. Oppfølgingen gis av forskere med helsefaglig bakgrunn (fysioterapeut og helsesøster) via Young & Active. Alle deltagere testes før og etter intervensjonen.

Høgskolen i Oslo og Akershus, institutt for sykepleie og Norges Idrettshøgskole står ansvarlige for studien.

Hva innebærer studien?

Nedenfor vises en oversikt over tidspunkt for møter mellom ungdom, foreldre/foresatte, dersom de ønsker det, og forskere og innholdet i møtene:

	Test 1 Opplæring Uke 0	Oppstart Uke 1	Test 2 Uke 12 (intervensjonen avsluttet)	Kontrollmåling Ett år etter oppstart
Intervensjonsgruppen	Spørreundersøkelse Fysisk test Veiing/måling Informasjon Kartleggingssamtale Opplæring Young&Active <i>m. foreldre/foresatte hvis ønskelig</i>	Young & Active	Spørreundersøkelse Fysisk test Veiing/ måling	Spørreundersøkelse Fysisk test Veiing/ måling

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Ungdommen blir kalt inn til et første møte med forskningsansvarlig. Foreldre/ foresatte kan delta dersom de ønsker det. Temaet for møtet er informasjon om studien og utfylling av spørreskjema. Det blir også gjennomført en enkel fysisk test. Gjennom en samtale kartlegger vi fysisk aktivitet. Samtalen blir tatt opp på bånd. I fellesskap med forskningsansvarlig, utarbeides en aktivitetsplan basert på kartleggingssamtalen. Det gis opplæring i bruk av Young & Active. Ungdommene starter rapportering den påfølgende uken. I en delvis strukturert dagbok rapporterer de egen fysisk aktivitet og hvordan de opplever denne. Dagboken danner utgangspunkt for ukentlig veiledning. Ungdommene blir også oppfordret til å snakke med andre deltagere via programmets forum. Informasjon/ tekst som blir formidlet fram og tilbake mellom deltager og forsker, vil også være gjenstand for analyser. Noen av deltagere vil kunne bli forespurt om å delta i dybdeintervjuer der vi vil samtale om hvordan de har det og hvordan de opplever det å delta i et slikt forskningsprosjekt. Det vil gjøres lydopptak av intervjuene som senere skrives ut og analyseres av forskerne.

Mulige fordeler og ulemper

Internettbasert veiledning er en ny og foreløpig lite utprøvd måte å stimulere ungdommer med overvekt til å bli mer aktive på og på den måten bedre sin livskvalitet og på sikt kanskje forebygge en uheldig vektutvikling. Vi vet at de fleste ungdommer har stor kompetanse og interesse for digitale medier og vi ønsker å fokusere på disse ressursene i oppfølgingen av ungdommene.

Det å være med på studien, vil ikke medføre ubehag for deltagerne. De vil bli behandlet profesjonelt og bli godt ivarettatt og informert underveis. I utgangspunktet har ungdommene krav på anonymitet, men dersom vi i løpet av studien og kontakten med ungdommene blir oppmerksomme på forhold som dere som foresatte bør informeres om eller som vil trenge videre oppfølging i skolehelsetjenesten, vil vi ta kontakt med foreldre/foresatte og/eller skolens helsesøster. Eventuelle henvendelser til foreldre/foresatte/helsesøster vil ungdommene alltid få informasjon om på forhånd. All oppfølging er gratis.

Deltagere i opererer via et brukernavn som også brukes på forumet. Kun forskerne har tilgang på registreringene og dagboknotatene. Forumet er overvåket av de ansvarlige for studien for å sikre at ungdommene ikke legger ut identifiserbare opplysninger om seg selv eller upassende eller potensielt støtende tekst. Webløsningen har høye krav til sikkerhet slik at brukernes anonymitet ivaretas. Før oppstart i intervensjonsgruppen må alle deltagere gjennom en kort opplæring som fokuserer på sikkerhet og "nett-vett".

Hva skjer med informasjonen om deltagerne?

Informasjonen som registreres om ungdommene skal kun brukes slik som beskrevet i hensikten med studien. Alle opplysningene fra spørreskjema, dagbok, fysisk test og intervjuer vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennende opplysninger. En kode knytter deltageren til opplysninger om vedkommende gjennom en navneliste. Det er kun prosjektleder som har adgang til navnelisten og som kan finne tilbake til deltagerne, de ansatte på skolen eller i skolehelsetjenesten vil ikke ha tilgang til dette. Det vil ikke være mulig å identifisere ungdommene i resultatene av studien når disse publiseres.

Frivillig deltakelse

Det er frivillig å delta i studien. Foresatte og/eller ungdommene kan når som helst og uten å oppgi noen grunn trekke sitt samtykke til å delta i studien. Dette vil ikke få konsekvenser for ungdommens videre oppfølging. Dersom du ønsker at ditt barn skal delta, undertegner du samtykkeerklæringen på siste side. Om dere nå sier ja til å delta, kan dere altså senere trekke tilbake deres samtykke uten at det får noen følger. Dersom dere har spørsmål til studien eller senere ønsker å trekke dere, kan en av disse kontaktes:

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Professor Sølvi Helseth, prosjektleder: tlf
Stipendiat Kirsti Riiser, prosjektmedarbeider: tlf

Økonomi

Studien er finansiert gjennom forskningsmidler fra ExtraStiftelsen Helse & Rehabilitering og Høgskolen i Oslo og Akershus.

Informasjon om utfallet av studien

Foreldre/foresatte og ungdom som har deltatt i studien har rett til informasjon om resultatet av studien. Etter at studien er avsluttet vil resultatene gjøres tilgjengelig i ulike vitenskapelige og populærvitenskapelige publikasjoner. Lenker til disse, samt et sammendrag av de viktigste funnene vil legges på nettsiden til Young & Active (yaa.hioa.no) når prosjektet er avsluttet.

Samtykke til deltakelse i studien

Jeg bekrefter å ha fått informasjon om studien og samtykker til å delta

(Signert av ungdom, dato)

Jeg bekrefter å ha fått informasjon om studien og samtykker til at min sønn/datter deltar

(Signert av forelder, dato)

Jeg bekrefter å ha gitt informasjon om studien

(Signert av forsker, dato)

Forespørsel om deltakelse i en forskningsstudie Informasjon til ungdom

Vil du være med i en forskningsstudie?

Vi er en gruppe forskere ved Høgskolen i Oslo og Akershus og Norges Idrettshøgskole som har utviklet et internettbasert program som heter Young & Active og som skal hjelpe ungdom med overvekt å bli mer aktive og komme i bedre form. Vi nå i ferd med å teste ut programmet.

For å kunne vite om Young & Active virker, må vi sammenligne med noen som ikke bruker programmet. Skolen din er valgt ut som en som en slik sammenligningsskole. Elever på 8. trinn som har blitt veid og målt av helsesøster og som ligger over grensen for overvekt, er velkommen til å delta.

Dette innebærer deltakelse for deg

Du møter forskerne tre ganger; uke 1, uke 12 og etter ett år. Hver gang skal du fylle ut et spørreskjema, veies/måles og gjøre en enkel fysisk test. Helsesøster på skolen hjelper oss å komme i kontakt med deg og koordinerer også tidspunktene for når du skal møte oss. Hvert møte tar ca. 30 minutt og skjer i tilknytning til skoledagen.

Det å være med i forskningsstudien vil ikke medføre ubehag for deg. Vi skal ta godt vare på deg og du skal få god informasjon underveis. Dersom du først takker ja til å være med i studien, men ombestemmer deg seinere, kan du når som helst og uten å fortelle hvorfor, velge å trekke deg.

Vi kan forsikre deg om at opplysninger du gir om deg selv i spørreskjemaet vil være helt anonyme. Ingen vil kunne spore noe informasjon tilbake til deg. Du vil få tildelt et nummer som identifiserer deg i prosjektet og bare forskerne i prosjektet vil kjenne navnet ditt. Koblingen mellom nummer og navn vil bare være tilgjengelig for prosjektleder.

Prosjektleder er Sølvi Helseth, tlf: 22453773/90020278
Prosjektmedarbeider/forsker er Kirsti Riiser, tlf: 91757485

Forespørsel om deltakelse en forskningsstudie Informasjon til foresatte

Bakgrunn og hensikt og gjennomføring

Vi er en gruppe forskere ved Høgskolen i Oslo og Akershus og Norges Idrettshøgskole som har utviklet et internettbasert program som heter Young & Active og som vi håper skal hjelpe ungdom med overvekt å bli mer aktive og komme i bedre form. Bakgrunnen for studien baserer seg på forskning som viser at:

- det er sammenheng mellom fysisk aktivitet og livskvalitet
- mange barn og unge med overvekt er mindre aktive enn anbefalt og de vegrer seg oftere for å delta i aktiviteter med jevnaldrende
- fysisk aktivitet har store helsefordeler uavhengig av vektreduksjon
- fysisk aktivitet som oppleves meningsfylt, øker sjansen for å opprettholde et høyere aktivitetsnivå

For å kunne vite om Young & Active virker, må vi sammenligne resultater fra deltakere som har brukt programmet med noen som ikke bruker programmet. Skolen der ditt barn er elev er valgt ut som en slik sammenligningsskole. Elever på 8. trinn som har blitt veid og målt av helsesøster og som viser at de ligger over grensen for overvekt, er velkommen til å delta.

For ditt barn innebærer deltakelse å møte forskerne tre ganger; uke 1, uke 12 og etter ett år. Hver gang fyller eleven ut et spørreskjema, blir veid/målt og gjør en enkel fysisk test. Helsesøster på skolen hjelper oss å komme i kontakt med eleven og koordinerer også tidspunktene for møtene. Hvert møte tar ca. 30 minutt og skjer i tilknytning til skoledagen.

Det å være med på studien, vil ikke medføre ubehag for deltagerne. De vil bli behandlet profesjonelt og bli godt ivaretatt og informert underveis.

Hva skjer med informasjonen om deltagerne?

Alle opplysningene fra spørreskjema og tester vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjenner opplysninger. En kode knytter deltageren til opplysninger om vedkommende gjennom en navneliste. Det er kun prosjektleder som har adgang til navnelisten og som kan finne tilbake til deltagerne, de ansatte på skolen eller i skolehelsetjenesten vil ikke ha tilgang til dette. Det vil ikke være mulig å identifisere ungdommene i resultatene av studien når disse publiseres.

Frivillig deltakelse

Dersom du ønsker at ditt barn skal delta, undertegner du samtykkeerklæringen på siste side. Det er frivillig å delta i studien. Om dere nå sier ja til å delta, kan dere senere trekke tilbake deres samtykke uten å oppgi grunn og uten at det får noen følger for annen eventuell oppfølging. Dersom dere har spørsmål til studien eller senere ønsker å trekke dere, kan en av disse kontaktes:

Professor Sølvi Helseth, prosjektleder: tlf
Stipendiat Kirsti Riiser, prosjektmedarbeider: tlf

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Økonomi og ansvar

Studien er finansiert gjennom forskningsmidler fra ExtraStiftelsen Helse & Rehabilitering og Høgskolen i Oslo og Akershus. Høgskolen i Oslo og Akershus, institutt for sykepleie og Norges Idrettshøgskole står ansvarlige for studien.

Informasjon om utfallet av studien

Foreldre/foresatte og ungdom som har deltatt har rett til informasjon om resultatet av studien. Etter at studien er avsluttet vil resultatene gjøres tilgjengelig i ulike vitenskapelige og populærvitenskapelige publikasjoner. Lenker til disse, samt et sammendrag av de viktigste funnene vil legges på nettsiden til Young & Active (yaa.hioa.no) når prosjektet er avsluttet.

Samtykke til deltakelse i studien

Jeg bekrefter å ha fått informasjon om studien og samtykker til å delta

Elevens **navn** og **skole** med blokkbokstaver

Signatur elev, dato

Telefonnummer (mobil) elev eller foreldre

Jeg bekrefter å ha fått informasjon om studien og samtykker til at min sønn/datter deltar

Signatur forelder, dato

Jeg bekrefter å ha gitt informasjon om studien

Signatur forsker, dato

Forespørsel om deltakelse i en pilotstudie august/september 2011

Informasjon til ungdommer

Dette er et spørsmål til deg om å delta i en *pilotstudie* (en liten forstudie) til et større forskningsprosjekt.

Om forskningsprosjektet

Forskningsprosjektet ønsker å undersøke om det å holde på med selvvalgt fysisk aktivitet og trening gjør at du blir i bedre form og føler at du har det bedre med deg selv og kroppen din. For å stimulere ungdom til mer fysisk aktivitet og trening har vi, en gruppe forskere ved Høgskolen i Oslo og Norges Idrettshøgskole, utviklet et internettprogram som heter Young & Active. Programmet tilbyr veiledning til ungdom med overvekt som ønsker å bli mer aktive. Gjennom en aktivitetslogg og dagbok får ungdommer mulighet til å ha kontakt med fagpersoner som gir veiledning, tips og råd om hvordan man kan bli mer aktiv i hverdagen. Young & Active inneholder også et forum der ungdommene som deltar kan snakke med hverandre.

Om pilotstudien

Det er internettprogrammet Young & Active vi nå ønsker å teste ut en pilotstudie. En slik pilotstudie er en kortere og enklere variant av den store studien vi skal gjøre senere. I tillegg til å prøve ut internettløsningen, ønsker vi å teste de ulike spørreskjemaene og den fysiske testen som inngår i studien. Fra kartleggingssamtalen en uke før oppstart, til vi avslutter, vil det ta ca tre uker. Nedenfor vises en oversikt over og forklaring på hva deltagelse innebærer for deg. Vi prøver å organisere det slik at de to møtene med oss skjer i tilknytning til treningsgruppa på xxx ungdomsskole på tirsdager. Foreldrene dine kan bli med dersom du og de ønsker det.

En uke før oppstart Møte forskerne	Oppstart Møte forskerne	2 uker fra oppstart Registrere på nettet
Informasjon og kartleggings-samtale	Formulere mål Lage aktivitetsplan	Daglig rapportering i Young & Active via internett
Spørreundersøkelse Fysisk test	Opplæring i systemet Young & Active	Ukentlig veiledning fra forskere via internett
<i>m. foreldre dersom ønskelig</i>	<i>m. foreldre dersom ønskelig</i>	

-Informasjon og kartlegging: En samtale der vi gir informasjon om studien og spør deg om hvilke aktiviteter du liker, og hvilke tanker og følelser du har knyttet til trening og fysisk aktivitet.

-Spørreundersøkelse: Du svarer på spørsmål knyttet til livskvalitet, fysisk aktivitet, kosthold, motivasjon, mestring og kroppsbilde.

-Fysisk test: En enkel standardisert test som måler fysisk form (utholdenhet)

-Mål og aktivitetsplan: Du formulerer sammen med oss mål for aktivitet og lager en plan for å nå disse.

I etterkant av pilotstudien vil vi kalle deg inn til et gruppeintervju for å få vite litt om dine erfaringer og opplevelser knyttet til bruk av Young & Active.

Det å være med i studien vil ikke medføre ubehag for deg. Vi skal ta godt vare på deg og du skal få god informasjon underveis. Dersom du først takker ja til å være med i studien, men ombestemmer deg, kan du når som helst og uten å fortelle hvorfor, velge å trekke deg uten at det får noen konsekvenser for deg.

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Dersom du ønsker å delta, undertegner du den vedlagte samtykkeerklæringen og leverer denne til xxx eller xxx ved neste trening. Dersom du har spørsmål til studien, kan du ta kontakt med stipendiat Kirsti Riiser på denne adressen: eller på telefon:

Lederne av treningsgruppa på xxx kontakter deg i august, ved skolestart, med informasjon om når og hvor første samtale finner sted.

Oslo, mai 2011,

Vennlig hilsen

Prosjektgruppa
Høgskolen i Oslo
Norges idrettshøgskole

Samtykke til deltakelse i pilotstudien "Young & Active"

Jeg har fått informasjon om pilotstudien "Young & Active" og er villig til å delta i studien

(Signert av prosjektdeltaker, dato)

Jeg har fått informasjon om pilotstudien "Young & Active" og samtykker til at mitt barn kan delta i studien

(Signert av foresatt, dato)

Jeg bekrefter å ha gitt informasjon om studien

(Signert, rolle i studien, dato)

APPENDIX 3

Brukertest 1

Dato: _____

Kjønn: _____

OBSERVASJONSTEST

Oppgave	+/-	Kommentar
1. Logg inn og velg et personlig smilefjes		
2. Lag en aktivitetsplan for uke 1		
3. Registrer i dagboken et antall gjennomførte aktiviteter for en ukedag (f.eks i går)		
4. Skriv noe i feltene i dagboken		
5. Hent opp aktivitetsplanen din		
6. Finn og les en sak på infosiden som du synes ser spennende ut		

APPENDIX 3

Dato: _____

Kjønn: _____

PRAKTISKE OPPGAVER

1. Logg inn og velg et personlig smilefjes
2. Lag en aktivitetsplan for uke 1
3. Registrer i dagboken et antall gjennomførte aktiviteter for en ukedag (f.eks i går)
4. Skriv noe i feltene i dagboken
5. Hent opp aktivitetsplanen din
6. Finn og les en sak du synes ser spennende ut på infosiden

SPØRSMÅL (Sett ring rundt det svaret som passer best for deg)

- | | | | |
|---|-------|-----|----------|
| 1. Likte du utseendet/ designet på sidene? | Ja | Nei | Vet ikke |
| 2. Likte du at du kunne velge smilefjes i profilen? | Ja | Nei | Vet ikke |
| 3. Fant du et smilefjes du likte? | Ja | Nei | Vet ikke |
| 4. Klarte du å lage mål for fysisk aktivitet/trening? | Ja | Nei | Vet ikke |
| 5. Fant du de aktivitetene som du driver med i listene? | Ja | Nei | Vet ikke |
| 6. Klarte du å lage en aktivitetsplan? | Ja | Nei | Vet ikke |
| 7. Klarte du å se ut fra aktivitetsplanen hvilke aktiviteter du skulle gjøre denne uka? | Ja | Nei | Vet ikke |
| 8. Klarte du å registrere aktiviteter og skrive i dagboka di? | Ja | Nei | Vet ikke |
| 9. Var det greit å forstå det som står skrevet på sidene? | Ja | Nei | Vet ikke |
| 10. Likte du det som sto på informasjonssiden? | Ja | Nei | Vet ikke |
| 11. Tror du at Young & Active ville gjort at du ble mer aktiv? | Ja | Nei | Vet ikke |
| 12. Hadde du hatt lyst til å bruke et program som dette over tid? | Ja | Nei | Vet ikke |
| 13. Er det noe du synes burde vært annerledes? | _____ | | |

Gruppe: _____

INTERVJUGUIDE

1. Hvordan synes du sidene så ut? Hva synes du om fargene, grafene, planene?
2. Hva synes du om smilefjesene?
3. Hvordan synes du det var å finne mål for aktivitet/trening?
4. Hva med aktivitetene i listene, fant du de som du driver med? Var det noen aktiviteter som manglet?
5. Hva synes du om spørsmålene i dagboka?
6. Hva synes du om informasjonssiden?
7. Er Young & Active et program du kunne tenkt deg å bruke? Ville det å bruke programmet gjort at du ble mer aktiv tror du?
8. Hva ville du skulle vært annerledes?

APPENDIX 3

Brukertest 2

Jente ☐ Gutt ☐

SPØRSMÅL (Sett ring rundt det svaret som passer best for deg)

1. Likte du utseendet/ designet på sidene?	Ja	Nei	Vet ikke
2. Likte du at du kunne velge smilefjes og favorittaktiviteter i profilen?	Ja	Nei	Vet ikke
3. Fant du et smilefjes du likte?	Ja	Nei	Vet ikke
4. Klarte du å lage mål for fysisk aktivitet/trening?	Ja	Nei	Vet ikke
5. Tror du at det å bruke Young & Active kunne hjulpet deg å nå målene dine?	Ja	Nei	Vet ikke
6. Fant du de aktivitetene som du driver med i listene i plan og registrering?	Ja	Nei	Vet ikke
7. Klarte du å lage en aktivitetsplan?	Ja	Nei	Vet ikke
8. Var det nyttig å lage en slik plan for å få oversikt over alle ukens aktiviteter?	Ja	Nei	Vet ikke
9. Var det vanskelig å huske på å registrere og skrive i dagboka?	Ja	Nei	Vet ikke
10. Var grafene til hjelp for å få oversikt over planlagt og gjennomført aktivitet?	Ja	Nei	Vet ikke

APPENDIX 3

11. Var det greit å forstå det som står skrevet på sidene?	Ja	Nei	Vet ikke
12. Var hjelpetekstene (som kom fram når du trykket på spørsmålstegnet) nyttige?	Ja	Nei	Vet ikke
13. Likte du det som sto på informasjonssiden?	Ja	Nei	Vet ikke
14. Var du innom og leste i forumet?	Ja	Nei	Vet ikke
15. Skrev du et foruminnlegg?	Ja	Nei	Vet ikke
16. Var det lett å finne fram på sidene?	Ja	Nei	Vet ikke
17. Ble du motivert av tilbakemeldingene du fikk fra veileder?	Ja	Nei	Vet ikke
18. Førte Young & Active til at du ble mer opptatt av trening og fysisk aktivitet?	Ja	Nei	Vet ikke
19. Hadde du hatt lyst til å bruke et program som dette over tid (12 uker)?	Ja	Nei	Vet ikke
20. Hvorfor/ hvorfor ikke?	<hr/>		
	<hr/>		
21. Er det noe du synes burde vært annerledes?	<hr/>		
	<hr/>		
	<hr/>		

INTERVJUGUIDE

1. Hvordan synes dere sidene så ut? Hva synes dere om fargene, smileyene, grafene, planene?
2. Hvordan synes dere det var å finne mål for aktivitet/trening?
4. Hva med aktivitetene i listene, fant dere de som du driver med? Var det noen aktiviteter som manglet?
5. Hvordan var det å registrere aktiviteter? Var det lett å huske? Tok det mye tid?
6. Hva synes dere om spørsmålene i dagboka?
7. Hva med veiledningen? Leste dere denne? Var det nyttig?
8. Hva synes dere om forumet?
9. Hva synes dere om informasjonssiden? Har dere lært noe nytt?
10. Er Young & Active et program dere kunne tenkt dere å bruke over tid? Ville det å bruke programmet gjort at dere ble mer aktive tror dere?
11. Hva ville dere skulle vært annerledes?

APPENDIX 4

Om deg selv

	Jente	Gutt
Kjønn	<input type="radio"/>	<input type="radio"/>

Hvor er du og foreldrene dine født?

	Norge	Et annet land	Hvilket land?
Jeg er født i	<input type="radio"/>	<input type="radio"/>	_____
Far er født i	<input type="radio"/>	<input type="radio"/>	_____
Mor er født i	<input type="radio"/>	<input type="radio"/>	_____

(KIDSCREEN-10)

Helse

Når du tenker på den siste uka...

	Ikke i det hele tatt	Litt	Ganske	Veldig ofte	I høy grad
Har du følt deg frisk og sprek?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har du følt deg full av energi?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Humør

Når du tenker på den siste uka ...

	Aldri	sjelden	Ganske ofte	Veldig ofte	Alltid
Har du følt deg trist?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har du følt deg ensom?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

APPENDIX 4

Fritid

Når du tenker på den siste uka ...	Aldri	Sjelden	Ganske ofte	Veldig ofte	Alltid
Har du hatt nok tid for deg selv?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har du kunnet gjøre de tingene du ønsker i fritiden din?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Familie og hjemmeliv

Når du tenker på den siste uka...	Ikke i det hele tatt	Litt	Ganske	Veldig	I høy grad
Har moren/faren din behandlet deg rettferdig?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Venner

Når du tenker på den siste uka...	Aldri	Sjelden	Ganske ofte	Veldig ofte	Alltid
Har du hatt det gøy sammen med vennene dine?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Skole

Når du tenker på den siste uka...	Ikke i det hele tatt	Litt	Ganske	Veldig	I høy grad
Har du klart deg bra på skolen?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har du klart å følge med på skolen?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(Young-HUNT)

Fysisk aktivitet, idrett og trening

Utenom skoletida: Hvor mange ganger i uka driver du idrett eller mosjonerer du så mye at du blir andpusten og/eller svett? (Sett bare ett kryss)

Hver dag	<input type="radio"/>
4-6 dager i uka	<input type="radio"/>
2-3 dager i uka	<input type="radio"/>
1 dag i uka	<input type="radio"/>
Sjeldnere enn en gang i uka	<input type="radio"/>
Sjeldnere enn en gang i måneden	<input type="radio"/>
Aldri	<input type="radio"/>

(BREQ-2)

Motivasjon for fysisk aktivitet og trening

Hvorfor driver du med fysisk aktivitet og trening?
(Sett kryss for det som passer best for deg)

	Stemmer ikke	Stemmer noen ganger	Stemmer helt
1. Jeg er fysisk aktiv og trener fordi andre sier at jeg bør	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Jeg får dårlig samvittighet når jeg ikke er fysisk aktiv eller trener	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Jeg setter pris på fordelene ved å være fysisk aktiv og trene	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Jeg er fysisk aktiv og trener fordi det er gøy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Jeg ser ikke hvorfor jeg må være fysisk aktiv og trene	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Jeg deltar i fysisk aktivitet og trening fordi vennene mine/familien min sier at jeg bør	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Jeg skammer meg når jeg går glipp av en aktivitets- eller treningsøkt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Det er viktig for meg å være i fysisk aktivitet og trene regelmessig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Jeg skjønner ikke hvorfor jeg skulle gidde å være fysisk aktiv og trene	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Jeg liker aktivitets- og treningsøktene mine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Jeg driver med fysisk aktivitet og trening fordi andre ville bli misfornøyd med meg hvis jeg ikke gjør det	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Jeg ser ikke poenget med å være fysisk aktiv og trene	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

APPENDIX 4

Hvorfor driver du med fysisk aktivitet og trening? (Sett kryss for det som passer best for deg)						
		Stemmer ikke		Stemmer noen ganger		Stemmer helt
13.	Jeg føler meg mislykket når jeg ikke har vært fysisk aktiv eller trent på en stund	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.	Jeg synes det er viktig å anstrenge seg for å være fysisk aktiv og trene regelmessig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15.	Jeg forbinder fysisk aktivitet og trening med noe positivt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.	Jeg føler meg presset av vennene mine/familien min til å være fysisk aktiv og trene	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17.	Jeg blir rastløs hvis jeg ikke er fysisk aktiv og trener regelmessig	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.	Jeg blir glad og fornøyd av å delta i fysisk aktivitet og trening	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19.	Jeg synes fysisk aktivitet og trening er bortkastet tid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



APPENDIX 4

(Kroppsbilde, Alsaker 1992)

Kroppsbilde

Vil du si om deg selv at: (Sett ett kryss)

[illegible]


Min Side | Aktivitetsplan | Dagbok | Veiledning | Forum | Info

Du er logget inn som: yanda | Logg ut


Velkommen til Young and Active

Dette programmet gir deg mulighet til å planlegge og registrere fysisk aktivitet og skrive om hvordan du opplever å være fysisk aktiv. Du får tilbakemelding fra veileder hver uke. I forumet kan du snakke med andre brukere av programmet. På infosiden finner du informasjon om fysisk aktivitet og trening.

Du er nå i uke 9

Profil 

Her kan du lage en profil.

Min profil


Kjønn: Jente


[Endre profil](#)

Mine favorittaktiviteter

- Være sammen med venner
- Høre på musikk
- Volleyball

Nytt fra infosiden

Hvorfor får man hold?



Beina er gode og humøret høyt mens du jogger av sted i fin stil. Men plutselig merker du en begynnende smerte i den ene siden. Hold. Du forsøker tappert å løpe videre, men det blir verre og verre, og etter hvert stopper du opp med en forpint grimase. De fleste av oss har opplevd å få hold, men hvorfor får vi det?

Tilbakemelding fra veileder

Hei igjen! Volleyball asså-). Det er det som står på planen.

Beskjeder til og fra veileder

Velkommen til Young & Active! Så fint at du er med! Planen din har blitt veldig bra! Det blir spennende å se om du klarer å gjennomføre det du har bestemt deg for. Husk å registrere aktivitet for hver dag i dagboken. Følg med i forumet og på infosiden. Jeg sjekker innom profilen din hver dag. Du får tilbakemelding fra meg om en uke. (Send meg en beskjed her i meldingsfeltet dersom det er noe du lurer på.) LYKKE TIL! Hilsen Veileder

Mandag 23/11 10:23

Turninga tar juleferie nå, så jeg må kutte ned på planen... Det har dessuten vært iskaldt, så jeg har ikke gått så mange turer

Søndag 9/12 11:00

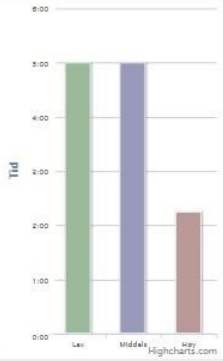
Skriv beskjed til veileder

[Send beskjed](#)




Siste fra forumet

01.06.2013 08:04



TØFFING: Her kan dere lese om en skikkelig tøffing av en 13-åring: <http://www.bt.no/spek/Tok-un-...>



Highcharts.com

-My page-

Min Side
Aktivitetsplan
Dagbok
Veiledning
Forum
Info

Du er logget inn som: yanda | Logg ut

Mine mål for fysisk aktivitet ?

Her skriver du ned dine personlige mål for fysisk aktivitet og trening (til og fra skolen, på skolen og i fritiden). Når målene er nådd, eller du ønsker å endre dem, kan du når som helst gjøre dette selv.

- 1 Få bedre kondisjon
- 2 Bli bedre i volleyball (jeg er ute av trening)
- 3

Lagre mål

Min aktivitetsplan ?

Her lager du en plan for hvordan du skal nå målene dine. Pass på å få med ALL fysisk aktivitet (til skolen, på skolen, fra skole, ettermiddag/kveld og i helger).

Dag: ☐ Hverdager ☐ Helgen | ☐ Mandag ☐ Tirsdag ☐ Onsdag ☐ Torsdag ☐ Fredag ☐ Lørdag ☐ Søndag

Tid på dagen: Aktivitet: Varighet:

Legg til

Dag	Sted	Aktivitet	Varighet	Handling
Mandag	På skolen	Friminutt/ midttide, stå og gå	1 t 0 min	Slett/Endre
Tirsdag	På skolen	Friminutt/ midttide, stå og gå	1 t 0 min	Slett/Endre
	Ettermiddag/kveld	Turn	2 t 0 min	Slett/Endre
Onsdag	På skolen	Friminutt/ midttide, stå og gå	1 t 0 min	Slett/Endre
	På skolen	Kroppøving, hardt	45 min	Slett/Endre
Torsdag	På skolen	Kroppøving, hardt	45 min	Slett/Endre
	På skolen	Friminutt/ midttide, stå og gå	1 t 0 min	Slett/Endre
Fredag	På skolen	Kroppøving, hardt	45 min	Slett/Endre
	På skolen	Friminutt/ midttide, stå og gå	1 t 0 min	Slett/Endre
	Ettermiddag/kveld	Gå fort (tur, til venner, til trening)	1 t 0 min	Slett/Endre
Søndag	Helg/ferie/fridag	Gå fort (tur, til venner, til trening)	2 t 0 min	Slett/Endre

Tilbakemelding fra veileder

Hei igjen! Volleyball asså-). Det er det som står på planen.

Beskjeder til og fra veileder

Velkommen til Young & Active! Så fint at du er med! Planen din har blitt veldig bra! Det blir spennende å se om du klarer å gjennomføre det du har bestemt deg for. Husk å registrere aktivitet for hver dag i dagboken. Følg med i forumet og på infosen. Jeg sjekker innom profilen din hver dag. Du får tilbakemelding fra meg om en uke. (Send meg en beskjed her i meldingsfeltet dersom det er noe du lurer på.) LYKKE TIL! Hilsen Veileder

Mandag 28.11.10 12:01

Turninga tar juleferie nå, så jeg må kutte ned på planen... Det har dessuten vært iskaldt, så jeg har ikke gått så mange turer

Søndag 28.11.10 12:02

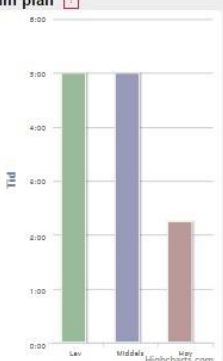
Skriv beskjed til veileder




Send beskjed

Siste fra forumet



01.06.2013 08:04
TØFFING: Her kan dere lese om en skikkelig tøffing av en 13-åring: <http://www.bt.no/spek/Tok-un-...>

Min plan ?



-Activity plan-

Min Side | Aktivitetsplan | **Dagbok** | Veiledning | Forum | Info

Du er logget inn som: yanda | [Logg ut](#)

Min aktivitetsdagbok

I dagboken registrerer du alt du har gjort av fysisk aktivitet i løpet av dagen (til skolen, på skolen, fra skolen, ettermiddag og helger.) Du kan også skrive litt om hvordan du har opplevd å være aktiv.

Velg uke: Uke 9 | Velg dag: Torsdag

Registrering av fysisk aktivitet

Her legger du til aktiviteter du er ferdig med. Du kan bare legge til aktiviteter for denne uken, så pass på å bli ferdig i løpet av søndagen. Pass på å få med ALL fysisk aktivitet (til skolen, på skolen, fra skole, ettermiddag/kveld og i helger).

Torsdag uke 9

På skolen	Kroppsoving, hardt	45 min
På skolen	Friminutt/ midtime, stå og gå	2 t 0 min
Ettermiddag/kveld	Dans, freestyle, showdans	2 t 0 min
Ettermiddag/kveld	Dans, freestyle, showdans	2 t 0 min


[Se alle aktiviteter denne uken](#)

Tanker om fysisk aktivitet og dagen i dag

Hvordan synes du det var å være aktiv i dag? Er det ellers noe du har lyst til å fortelle fra dagen din? [TIPS](#)

kanonball og ball-forberedelser på skolen, skoleball fra 6 til 12 på kvelden:D

[Se dagboken for denne uken](#)



Tilbakemelding fra veileder

Hei igjen! Volleyball asså:-). Det er det som står på planen.

Beskjeder til og fra veileder

Velkommen til Young & Active! Så fint at du er med! Planen din har blitt veldig bra! Det blir spennende å se om du klarer å gjennomføre det du har bestemt deg for. Husk å registrere aktivitet for hver dag i dagboken. Følg med i forumet og på infosiden. Jeg sjekker innom profilen din hver dag. Du får tilbakemelding fra meg om en uke. (Send meg en beskjed her i meldingsfeltet dersom det er noe du lurer på.) LYKKE TIL! Hilsen Veileder

Mandag 25/11 10:22

Turninga tar juleferie nå, så jeg må kutte ned på planen... Det har dessuten vært iskaldt, så jeg har ikke gått så mange turer

Søndag 01/12 11:30

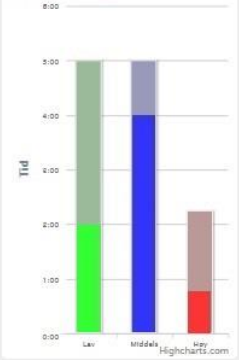
Skriv beskjed til veileder

[Send beskjed](#)




Siste fra forumet

01.06.2013 08:04
TØFFING: Her kan dere lese om en skikkelig tøffing av en 13-åring:
<http://www.bt.no/spek/Tok-un...>



Denne uken



Highcharts.com

-Activity registration and diary-

Min Side | Aktivitetsplan | Dagbok | **Veiledning** | Forum | Info

Veiledning

Hver uke får du tilbakemelding fra veileder. Tilbakemeldingen tar utgangspunkt i registreringene og dagboknotatene dine fra uken som har gått.

Tilbakemelding fra veileder

Velg uke: Uke 9

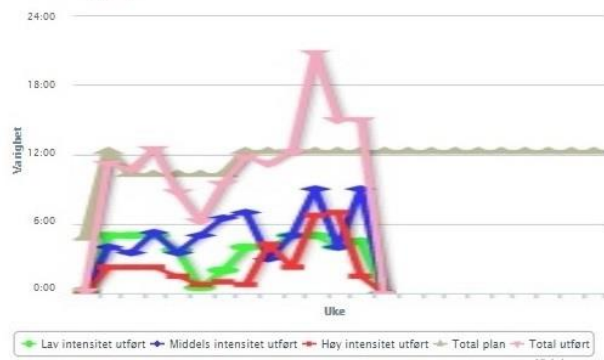
Hei igjen! Volleyball asså:-). Det er det som står på planen. Flaks at du synes det er gøy! Det er jo et ballspill som kanskje mer enn noe annet krever god teknikk, hvis ikke blir det ikke noe spill, bare 'serv, over, serv, over'. Men når man først får grep om det og får noen balvekslinger, så er det veldig gøy. Det nytter ikke å vinne en kamp alene, man må spille som et lag, men det er jo veldig kult å sette den avgjørende ballen, da! Grattis:-). Vi vet noe om at en av de aller viktigste forutsetningene for å ha det gøy i aktivitet, er å være aktiv sammen med andre. Det betyr ikke at de som driver med individuell idrett ikke har det gøy, de er jo også aktive sammen med andre individuelle utøvere. Og det er det som er hele poenget, at man har noen å dele de morsomme øyeblikkene med og også de tøffe øktene. Jeg håper du husker på dette den dagen du slutter på turning og ikke lenger har gymtimer på skolen. Da er det kjempelurt å alliere seg med en venn som du kan gjøre tur- og treningsavtaler med. Det umiddelbare treningseffekten varer dessverre ikke så lenge hvis du ikke trener jevnlig, men de gode vanene og ditt gode forhold til å bevege kroppen (det vil si motivasjon for å være i aktivitet) kan vare resten av livet!

Oppfordrer deg til å legge inn et ekstra gir nå i ukene fram mot ny test (tre uker igjen!). Jeg synes at du virker veldig aktivitetsbevisst på en sunn måte:-). Du henter ut aktivitet der du kan og du er mye ute. Fortsett med det!

Hilsen Veileder:-).

Ps: Målene dine er fortsatt ikke lagret...håper ikke det er noe krøll. Trykk lagre mål (rosa knapp):-).

Min utvikling ?



Highcharts.com

Tilbakemelding fra veileder

Hei igjen! Volleyball asså:-). Det er det som står på planen.

Beskjeder til og fra veileder

Velkommen til Young & Active! Så fint at du er med! Planen din har blitt veldig bra! Det blir spennende å se om du klarer å gjennomføre det du har bestemt deg for. Husk å registrere aktivitet for hver dag i dagboken. Følg med i forumet og på infosiden. Jeg sjekker innom profilen din hver dag. Du får tilbakemelding fra meg om en uke. (Send meg en beskjed her i meldingsfeltet dersom det er noe du lurer på.) LYKKE TIL! Hilsen Veileder

Mandag 25/11 10:21

Turninga tar juleferie nå, så jeg må kutte ned på planen... Det har dessuten vært iskoldt, så jeg har ikke gått så mange turer

Søndag 11/2 11:02

Skriv beskjed til veileder

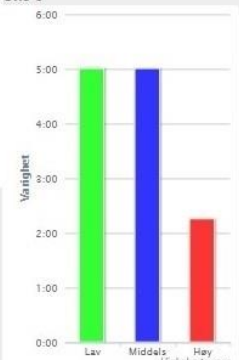
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Siste fra forumet




01.06.2013 08:04

TØFFING: Her kan dere lese om en skikkelig tøffing av en 13-åring: <http://www.bt.no/sprek/Tok-un...>



Uke 9



Highcharts.com


-Feedback-

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Du er her: [Forum](#) > [Mat og drikke](#) >

SUNN FROKOST!




veileder

Bra med tips til sunne pannekaker! Er er et annet forslag, nemlig GROVE SCONES (disse er KJEMPE gode og VELDIG sunne). Lages på 1-2-3: <http://www.tine.no/oppskrifter/bakst/scones-og-muffins/grove-scones>

Servers lunkne med lett gulost eller Philadelphia Light. Nytt!


18.03.2013 16:07 Sist endret: 21.03.2013 10:04



yanda

Jeg har en oppskrift på sunne pannekaker
Det du trenger er:
1,5dl havregryn
2ts sukker
1egg
vaniljesukker hvis du vil ha
Så rører du det sammen
Etter det så legger du det sammen og som en oval
Stek i panna i ca 2min før du snur
Du kan ha syltetøy eller brunost på hvis du vil


18.03.2013 14:07



yanda

Går også ann og lage sunne pannekaker met egg og havregryn :)

16.03.2013 22:41



veileder


SUNN FROKOST ER VIKTIG! Noen av dere ønsker tips til rask, god og SUNN frokost. Her er noen tips:

1. Havregrøt med raspet eple og kanel (lettkokt havregrøt koker du på fem minutter, veldig sunt og metter godt)
2. Havregrøt med rosiner, mandler og kanel
3. Havregrøt med banan og skummet melk
4. Omelett med paprika og skinke
5. Grove knekkebrød med magert pålegg (skinke, makrell i tomat, mager ost, egg)
6. Cottage cheese med frukt eller bær
7. Skyr med frukt eller bær
8. Sunn frokostblanding (pass på at det er lite sukker og mye fiber i blandingen, ikke ta på sukker eller veldig søtt syltetøy, velg heller fruktbiter eller noen rosiner)
9. Yoghurt naturell med tørket frukt og nøtter
10. Grove vaffler! (Lag røren kvelden i forveien: <http://www.melk.no/oppskrifter/frokost-kvelds/melkeretter-groter/grove-vaffler/>)

Ikke drikk jus til frokost på hverdagene, jus inneholder masse sukker! Nektar inneholder enda mer! Velg skummet melk eller vann eller te uten sukker.

Har du andre forslag? Legg det inn her i forumet!
God frokost!!!

01.03.2013 16:15



veileder

Tilbakemelding fra veileder

Hei igjen! Da var prosjektet avsluttet for din del og dette blir siste tilbakemelding fra meg. Br...

Beskjeder til og fra veileder

Velkommen til Young & Active! Så fint at du er med! Planen din har blitt veldig bra! Det blir spennende å se om du klarer å gjennomføre det du har bestemt deg for. Husk å registrere aktivitet for hver dag i dagboken. Følg med i forumet og på infossen. Jeg sjekker innom profilen din hver dag. Du får tilbakemelding fra meg om en uke. (Send meg en beskjed her i meldingsfeltet dersom det er noe du lurer på.) LYKKE TIL! Hilsen Veileder

Mandag 20/11 10:22

Turninga tar juleferie nå, så jeg må kutte ned på planen... Det har dessuten vært iskaldt, så jeg har ikke gått så mange turer

Søndag 9/12 11:02

Skriv beskjed til veileder



Send beskjed

Siste fra forumet 01.06.2013 08:04

TOFFING: Her kan dere lese om en skikkelig toffing av en 13-åring: <http://www.bt.no/sprek/Tok-un...>

Tilbake til Forum


Svar

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Du er logget inn som: yanda | Logg ut

Hvorfor får man hold?




Beina er gode og humøret høyt mens du jogger av sted i fin stil. Men plutselig merker du en begynnende smerte i den ene siden. Hold. Du forsøker tappert å løpe videre, men det blir verre og verre, og etter hvert stopper du opp med en forpint grimase. De fleste av oss har opplevd å få hold, men hvorfor får vi det?

Selv om hold er noe mennesker i hele verden opplever, er det litt av et mysterium. Generelt er forskerne enige om at hold er en avgrenset smerte like under ribbeina som kan ramme både venstre og høyre side av kroppen. Smerten oppstår og forsvinner plutselig og er som regel ikke forbundet med noe farlig. Det er mange teorier om hva hold skyldes, men vitenskapen vet fortsatt ikke hva som er den egentlige årsaken. De vanligste teoriene er enten at smertene skyldes sammentrekninger i milten, trøtthet i mellomgulvet, at organene i magen ristes under løping, at magesekken er full eller at man har spist eller drukket noe med mye karbohydrater for trening. Siden vi foreløpig ikke vet nøyaktig hva det er som gjør at vi av og til får hold, er det mye viktig informasjon å hente fra sin egen kropp. Man må rett og slett prøve seg fram for å finne ut hvor mye man kan fylle magen med før en løpetur for eksempel. God tur! (www.forskning.no)

Trening og mat!

I forbindelse med trening kan det være vanskelig å vite hva, når og hvor mye du skal spise. Riktig kosthold før og etter trening gir større treningskapasitet. Dersom du skal være i aktivitet lenge, for eksempel spiller cup med mange kamper etter hverandre eller gå en lang fjelltur, er det også viktig å få i seg riktig næring underveis.




Før trening: Spis et skikkelig måltid 2-3 timer før trening. Dette måltidet bør bestå av mest karbohydrater og litt proteiner, f.eks brødmat med egg, kjøtt eller ost (frokost/lunsj), kornblanding med melk/yoghurt (frokost/lunsj), middag med ris, pasta eller potet. Husk også at det er viktig å drikke nok, minst ½ liter de siste timene før trening.

Under trening: Drikk vann i små porsjoner underveis. Dersom økten varer i over en time, kan du fylle på med litt sportsdrikke, litt tynn saft eller enn banan.

Etter trening: Et lite måltid (yoghurt eller litt frukt) rett etter trening er lurt dersom du har trent lenge og hardt. Det er ikke nødvendig å fylle på med næring rett etter en vanlig treningsøkt. Da holder det å spise et vanlig sunt måltid noen timer etter trening.

(Kilde: bramat.no)

Hvorfor blir du støl?



De fleste har opplevd å bli støl og stiv etter trening eller anstrengende fysisk aktivitet. Her kan du lese litt om hvorfor vi får vondt i musklene en og to dager etter trening og om det er noe vi kan gjøre for å unngå støhet.

Hvorfor blir du støl?

Alle former for fysisk trening fører til nedbrytning av muskelfibrer i muskulaturen. Dette er en del av treningsprosessen og nødvendig for at man skal kunne komme i bedre form. Etter en treningsøkt vil musklene gjennomgå en reparasjonsprosess, slik at vi på nytt kan bli klar for nye aktiviteter. Etter en slik reparasjon vil musklene være litt sterkere og litt mer utholdende enn de var før treningen.

Opphopning av avfallsprodukter i musklene

Når man trener, vil man ofte overstege noe som vi kaller den aerobe terskelen. Dette nivået sier noe om kroppens evne til å kvitte seg med avfallstoffer fra nedbrytningsprosesser og forbrenning. Kommer man over denne terskelen, trener man såkalt anaerobt. Man får da en opphopning av avfallsprodukter fordi treningen har en slik intensitet at kroppen ikke klarer å kvitte seg med dem. En slik opphopning av avfallsprodukter i muskulaturen vil føre til at man føler seg om og stiv dagen etter trening. Omhøten er helt normal og varer vanligvis en dag eller to.

Hva kan du gjøre for å unngå å bli stiv og støl?

Etter hvert som man trener, vil musklens evne til å reparere seg selv øke, og omhøten etter trening minsker i omfang og varighet. Når man starter å trene, vil man som regel ikke kunne unngå denne "stivheten" den første tiden. Men etter hvert som man kommer i bedre form og musklene blir vant til trening, vil stivheten avta mer og mer. Folk flest sier at tøying av musklene etter trening hindrer at man blir stiv, men sannsynligvis er ikke dette helt riktig. En stor forskningsstudie konkluderer med at tøying i forbindelse med trening trolig har liten eller ingen innvirkning på muskelstøhet hos friske. Tøying er derimot viktig for å opprettholde bevegelsen i musklene, noe som i sin tur kan forebygge skader senere.

Tilbakemelding fra veileder

Hei igjen! Da var prosjektet avsluttet for din del og dette blir siste tilbakemelding fra meg. Er...

Beskjeder til og fra veileder

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Mandag 28/11 10:23

Turninga tar juleferie nå, så jeg må kutte ned på planen... Det har dessuten vært iskaldt, så jeg har ikke gått så mange turer

Søndag 6/12 11:02

Skriv beskjed til veileder

Send beskjed

Siste fra forumet

01.06.2013 08:04

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