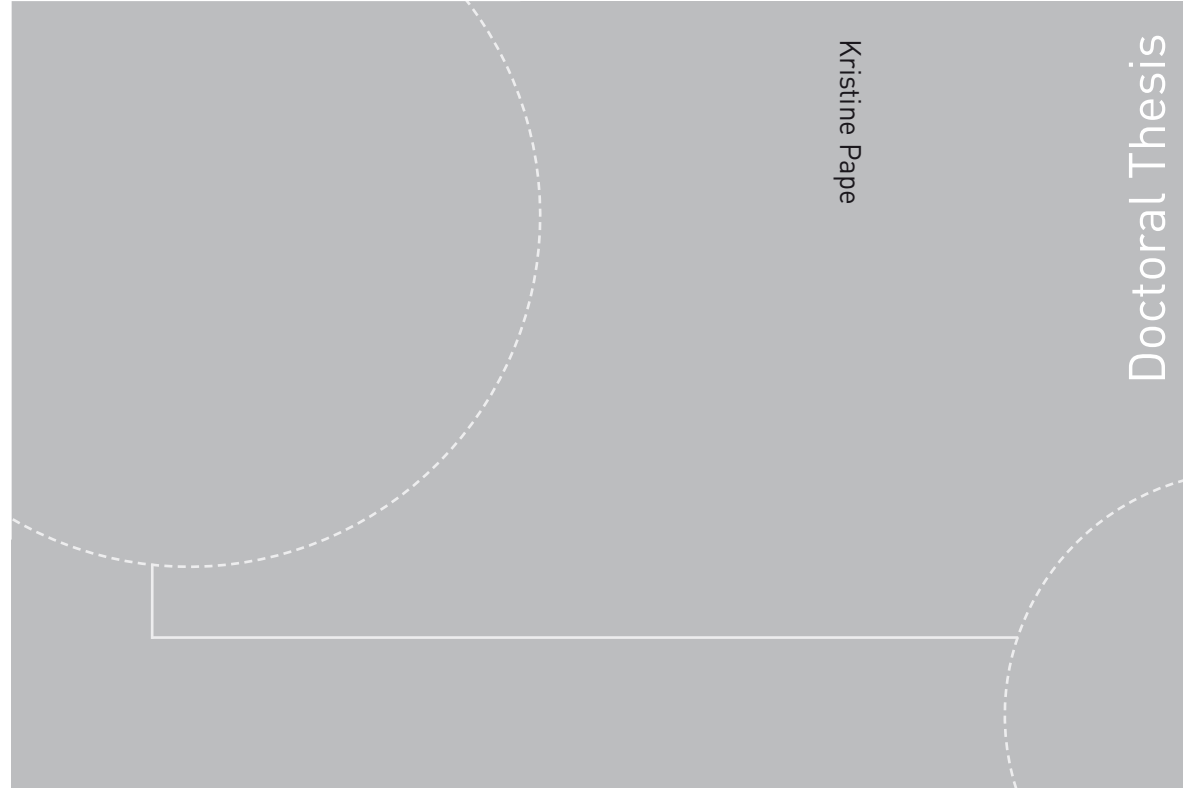


ISBN 978-82-471-4479-4 (printed version)  
ISBN 978-82-471-4480-0 (electronic version)  
ISSN 1503-8181



Doctoral theses at NTNU, 2013:183

Kristine Pape

**Health, school and family factors  
in adolescence and labour  
market integration problems in  
young adulthood.**

The HUNT Study.

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# Health, school and family factors in adolescence and labour market integration problems in young adulthood.

The HUNT Study.

Thesis for the degree of Philosophiae Doctor

Trondheim, 2205 2013

Norwegian University of Science and Technology

Faculty of Medicine

Department of Public Health and

General Practice



**NTNU – Trondheim**  
Norwegian University of  
Science and Technology

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Doctoral theses at NTNU, 2013:183



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## **Helse, skole og familiefaktorer i ungdomstida og senere trygdebruk og manglende arbeidslivsdeltakelse i ung voksen alder.**

Denne PhD avhandlingen undersøker sammenhengen mellom helse og sårbarhet i ungdomsårene og bruk av trygdeytelser som indikerer mangelfull integrering i arbeidslivet i ung voksen alder.

Sammenhengen mellom sårbarhetsforhold i ungdomstida og senere langvarig bruk av trygdeytelser i ung voksen alder ble utforsket ved å følge opp de nesten 9000 ungdommene som i 1995-97 deltok i Ung-HUNT1 (Helseundersøkelsen i Nord-Trøndelag). Ved hjelp av nasjonale registerdata var det mulig å innhente informasjon om mottak av ulike trygdeytelser ettersom ungdommene ble eldre, og i tillegg koble de enkelte ungdommene til deres respektive familiemedlemmer. Alle de fire artiklene som inngår i avhandlingen har en kvantitativ tilnærming og bruker moderne epidemiologiske metoder som søskenanalyser og longitudinelle analyser i tillegg til konvensjonelle regresjonsanalyser.

Omlag én av fire ungdommer i studiepopulasjonen var registrert med langvarig bruk av trygdeytelser i løpet av 20-årene (dagpenger, sosialstønad eller helserelevante ytelser som uføretrygd, rehabiliteringspenger, attføringspenger og sykepenger i mer enn 6 måneder i minst ett kalenderår). Halvparten av disse mottok helserelevante ytelser. I de ulike studiene som inngår i avhandlingen ble det identifisert flere individuelle helserelevante og sosiale faktorer hos ungdom som indikerte en økt sannsynlighet for bruk av trygdeytelser som ung voksen: Moderate men klare sammenhenger ble funnet for selvrapporterte lese- og skrivevansker, selvopplevd helse og angst- og depresjonssymptomer, mens en sterk sammenheng ble funnet for frafall fra videregående skole. I tillegg var flere familierelaterte faktorer slik som foreldrenes helse, foreldrenes arbeidsuførhet og familiens sosioøkonomiske status assosiert med ungdommenes fremtidige trygdebruk.

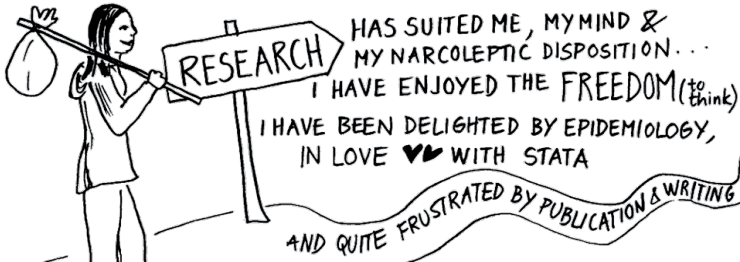
***Cand.med Kristine Pape  
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***Hovedveileder: Førsteamanuensis Steinar Krokstad,  
Biveiledere: Professor Johan Håkon Bjørngaard, professor Steinar Westin og  
professor Turid Lingaas Holmen***

*Ovennevnte avhandling er funnet verdig til å forsvares offentlig  
for graden PhD i samfunnsmedisin  
Disputas finner sted i Auditoriet, Medisinsk teknisk forskningscenter  
Fredag 14. juni 2013, kl. 12.15*



**Acknowledgements**



IT WOULD NOT HAVE BEEN THE SAME  
YOU ALL  
WHO HAVE BEEN CLOSE TO ME IN THESE YEARS - AT WORK

MY SUPERVISORS HELPED ME GET INTO THE RESEARCH CASTLE



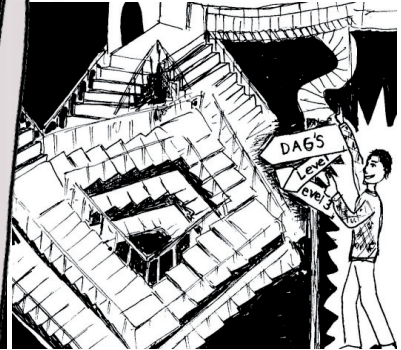
WITHOUT  
& IN LIFE :

AND NOT GET LOST (FOR TOO LONG...)

STEINAR W OPENED DOORS



JOHAN HÅKON HELPED ME NAVIGATE  
ACROSS MULTIPLE LEVELS



ROAR WISELY  
WATCHED OVER  
US ALL

TURID MILDLY  
WATCHED OVER  
MY COHORT



HAS BEEN AN INSPIRING PLACE  
TO WORK, THANKS TO  
JON M., SURUR & MANY OTHERS



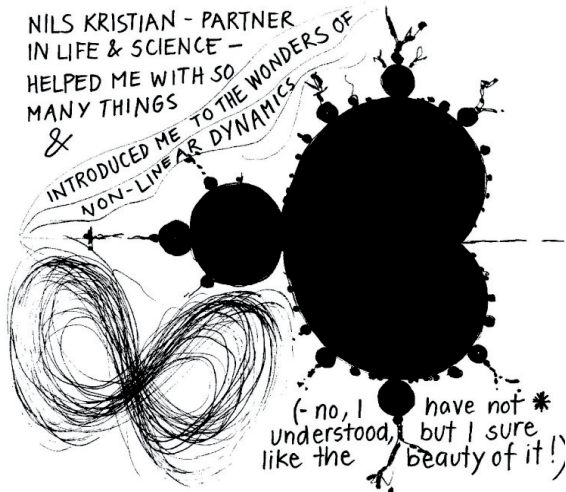
Social insurance  
group  
GAVE ME AN IDENTITY

Karin MADE ME PUSH  
MYSELF TO DO BETTER  
& QUALITY-CHECKED  
ALL MY SYNTAX

Morten KEPT ME  
(GOOD) COMPANY

Sara MADE MEETINGS  
(AND PARTIES) MORE  
SPIRITED

NILS KRISTIAN - PARTNER  
IN LIFE & SCIENCE -  
HELPED ME WITH SO  
MANY THINGS  
&  
INTRODUCED ME TO THE WONDERS OF  
NON-LINEAR DYNAMICS



JUNI & JOHAN FARGELA DAGENE &  
SATT ALT I PERSPEKTIV



HELSESØSTRE AT HALLSET & STRINDHEIM AND SMÅBARNSTEAM, ØSTBYEN  
REMINDED ME OF WHAT PUBLIC HEALTH IS ALL ABOUT.

MAMMA, PAPPA, FAMILY & FRIENDS ENCOURAGED, SUPPORTED & ENTERTAINED ME

*Trondheim, May 2013,*



\* see Skjørvold NK. Automated Blood Glucose Control. Doctoral thesis NTNU, 2012: 275, p. 8

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## **ABBREVIATIONS**

**ADHD**

Attention Deficit/Hyperactivity Disorder

**CI**

Confidence interval

**DP**

Disability pension

**GEE**

Generalizing Estimation Equations

**SCL-5**

Hopkins Symptom Checklist, 5-item short version

**HADS**

Hospital Anxiety and Depression Scale

**HUNT**

Helseundersøkelsen i Nord-Trøndelag; The Nord-Trøndelag Health Study

**NEET**

Term used to denote young people “neither in employment nor in education or training”

**NTNU**

Norges teknisk-naturvitenskapelige universitet (Norwegian University of Science and Technology)

**OECD**

The Organization for Economic Cooperation and Development (OECD) (organization which aims to promote policies that will improve the economic and social well-being of people around the world) with 34 member countries (as per 2012), including most European countries plus Australia, Canada, Chile, Israel, Japan, Korea, Mexico, New Zealand and the United States.

**OR**

Odds ratio

**RWD**

Reading and writing difficulties (used in the present work, not an “official” abbreviation).

**SES**

Socioeconomic status

## LIST OF PAPERS

The thesis is based on the following papers, which will be referred to by their Roman numerals:

### Paper I

Pape K, Bjørngaard JH, Westin S, Holmen TL and Krokstad S. Reading and writing difficulties in adolescence and later risk of welfare dependence. A ten year follow-up, the HUNT Study, Norway. *BMC Public Health* 2011; 11: 718.

<http://www.biomedcentral.com/1471-2458/11/718> (25.02.2013)

### Paper II

De Ridder KA, Pape K, Johnsen R, Westin S, Holmen TL and Bjørngaard JH. School dropout: a major public health challenge: a 10-year prospective study on medical and non-medical social insurance benefits in young adulthood, the Young-HUNT 1 Study (Norway). *J Epidemiol Community Health* 2012; 66: 995-1000.

### Paper III

Pape K, Bjørngaard JH, Holmen TL and Krokstad S. The welfare burden of adolescent anxiety and depression: a prospective study of 7500 young Norwegians and their families: the HUNT study. *BMJ Open* 2012; 2: e001942.

Doi:10.1136/bmjopen-2012-001942

### Paper IV

Pape K, Bjørngaard JH, De Ridder KA, Westin S, Holmen TL and Krokstad S. Medical benefits in young Norwegians and their parents, and the contribution of family health and socioeconomic status. The HUNT Study, Norway.

*Scandinavian Journal of Public Health*. Published online before print March 18, 2013, doi: 10.1177/1403494813481645.

## **SUMMARY**

### **Background**

In Norway and other western countries many young people experience labour market integration problems, as demonstrated by high rates of unemployment, sickness, disability and welfare dependence. Factors leading to such problems are complex and not well understood. In particular, there is a knowledge gap in how these problems are related to adolescent health and vulnerability, as such knowledge is needed for the understanding of mechanisms leading to non-inclusion or exclusion from work in young people and how this may be prevented. Many adolescents have chronic diseases, mental health problems and school problems, and their health and well-being is continuously influenced by their family and other close environments. Present knowledge indicates that these determinants are likely to influence adolescents' risk of work integration problems.

### **Aims**

The general objective of this thesis was to study work integration problems in young adulthood in relation to adolescent health and vulnerability, from a medical perspective and by the use of epidemiological methods. The objectives of the different papers were to study the prospective associations between selected health, school and family factors in adolescence (reading and writing difficulties, self-rated health, anxiety and depression symptoms, being a high-school dropout, parental anxiety and depression symptoms and parental benefit receipt and other family factors) and work integration problems in young adulthood, assessed by the receipt of long-term social insurance benefits.

### **Methods**

The relationship between adolescent factors and work-related outcomes in young adulthood was explored by following a Norwegian population cohort (Young-HUNT1) of almost 9,000 subjects for more than 10 years – from adolescence to young adulthood – combining questionnaire data completed between ages 12 and 20 years in 1995-97 with information on the long-term receipt of social insurance benefits from 1998 to

2007/2008. Adolescent data was linked to register data from several national databases and to data on their biological parents, including parental data from the HUNT2 Survey (1995-97). The main study exposures were based on self-reported information by adolescents (reading and writing difficulties, self-rated health, anxiety and depression symptoms) and parents (parental anxiety and depression symptoms and parental health) and on register data on adolescents (high-school dropout) and parents (parental benefit receipt and socioeconomic status). The main outcome was the receipt of long-term social insurance benefits in young adulthood intended to replace income during unemployment or sickness. Medical benefits included disability benefits, rehabilitation benefits and long-term sickness benefits (received for at least 180 days/six months during one calendar year). All social benefits included medical benefits in addition to unemployment benefits and social assistance (received for at least 180 days/six months during one calendar year). Associations between main study exposures and benefit receipt were explored by descriptive statistics and various logistic regression models, including longitudinal assessments and sibling comparisons.

## **Results**

In total, 2,396 (27%) individuals in the Young-HUNT 1 cohort (n=8907) received a long-term benefit during follow-up (all social benefits included) and 1,351(15%) individuals received a long-term medical benefit. Patterns of benefit receipt over time and associations with adolescent health measures depended on the type of benefit received (Thesis supplement). Sibling analyses indicated that benefit receipt was clustered within families (Thesis supplement). Self-reported reading and writing difficulties were associated with both medical benefits and all social benefits, including also after adjusting for mental health characteristics (Paper I). Self-rated health was associated with receiving both medical and non-medical benefits and dropping out of high school was strongly associated with receiving medical and non-medical benefits (Paper II). Anxiety and depression symptoms were associated with receiving medical benefits, but not with unemployment benefit (Paper III). Parental symptoms of anxiety and depression, however, were associated with adolescents' risk of both receiving medical benefits and unemployment benefits (Paper III). Parental medical benefits were associated with an adolescent's later risk of medical benefits, but the association was

substantially reduced when adjusting for family health (Paper IV). Additional findings in Paper IV also indicated that family health, parental education, parental income, divorce, parental unemployment and parental social assistance were independent predictors of young adult medical benefits.

## **Conclusions**

Work integration problems, assessed by the receipt of long-term social insurance benefits in young adulthood, were experienced at some time in their 20s by one out of four adolescents in the study cohort. Several specific health-related factors were demonstrated to increase adolescents' vulnerability to experience such problems in the transition to adulthood. Moderate but consistent associations were found for adolescent self-reported reading and writing difficulties, self-rated health, anxiety and depression symptoms and most family factors, while a strong association was found for high-school drop-out. More research is needed on the causes and pathways of work integration problems in young people in order to reduce the magnitude of the problem, including research from other disciplines and research with other methodological approaches (e.g. qualitative methods and intervention studies). In addition, policy measures are needed to ensure that young people are given a fair chance to succeed in obtaining necessary qualifications and in working life.



## 1 INTRODUCTION

The topic for this thesis is work integration in young people, and how failing work integration relates to health and vulnerability in adolescence. The relationship between adolescent factors and work-related outcomes in young adulthood was explored by following a Norwegian adolescent population cohort from their participation in the Young-HUNT1 Survey (1995-97) 10 years ahead in time using data linked from national registers. The thesis is based on four papers and some additional results, investigating various aspects of adolescent vulnerability related to health, mental health, school and family. These factors were selected because they were considered as being of particular relevance to young people.

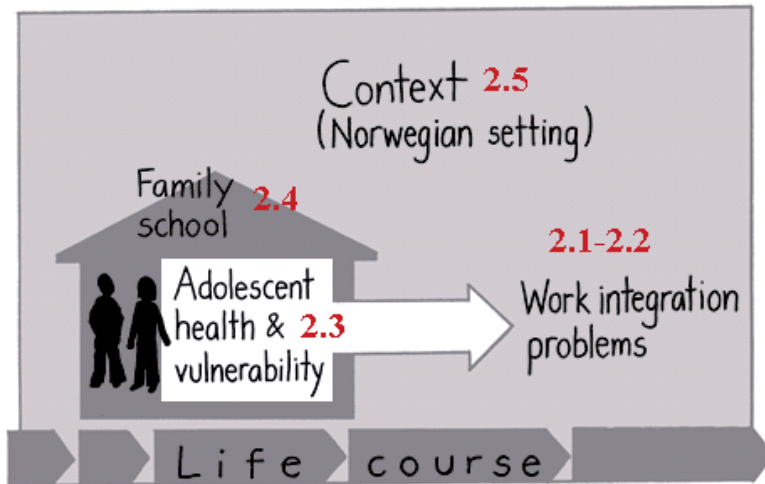
The current issues touch upon several disciplines and research fields. This dissertation is rooted in medicine and epidemiology and is not intended to shed light on all the other relevant perspectives, even if literature and contributions from other disciplines such as economy, psychology and social sciences are considered.

The dissertation takes the view of (at least) two medical approaches to the topic, which often may be difficult to separate in practice – being two sides of the same coin. The first is the sociomedical approach which is based on a concern for the lack of labour market integration in young people and which aims at assessing how and why this occurs. The second is the child and adolescent public health approach which aims to understand adolescent health today, using work participation or benefit receipt as a functional measure.

The background section (and also the discussion to a certain degree) elaborates on the aspects relevant for these two approaches, in a wider sense than what has been done in Papers I-IV. Figure 1.1 gives a schematic representation of the framework for the thesis and of how the main issues are presented in the background section: The first part (2.1 and 2.2) describes different aspects of labour market integration problems, what such problems signify and the relevance for public health. The second (2.3) part presents some factors related to adolescent health and vulnerability, as well as the relationship



between these factors and labour market integration problems. In the third part (2.4), family and social background factors are discussed. Finally, some aspects of the Norwegian study context relevant for the current issues are described (2.5) before summarizing (2.6).



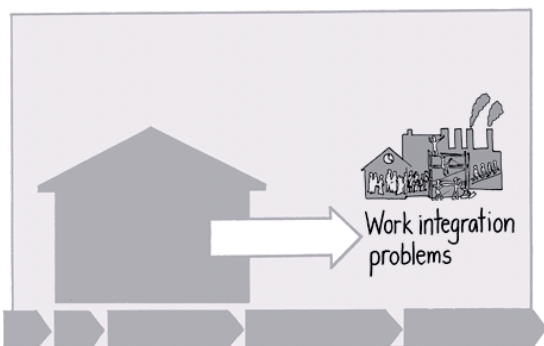
**Figure 1.1** Schematic representation of the framework for the thesis, including reference to the section in the background which elaborate on the different issues

## 2 BACKGROUND

Factors leading to labour market integration problems in young people are complex and not well understood. In particular, there is a knowledge gap in how they are related to adolescent health and vulnerability, as such knowledge is needed for the understanding of mechanisms that lead to non-inclusion or exclusion from work in young people and how this may be prevented.

Adolescence and the transition from adolescence to young adulthood are periods in life with particular importance for future health and work status. These are periods in which many changes take place, including school to work transition and the process of obtaining economic independence and being self-sustained. Whether one succeeds or not in this transitional phase may be crucial for life chances in general and for many aspects of work, socioeconomic status and health. This also implies that adolescence may be a window of opportunity to initiate measures that could prevent a negative development.

### 2.1 Problematic labour market integration in young adulthood



A considerable proportion of young people experience labour market integration problems. The economic and health consequences may be particularly dramatic when young people at the beginning of their adult lives and working careers are affected.

At the individual level such problems increase the risk of economic problems, health impairment and social marginalization or exclusion. At the societal level, such problems are associated with high social costs and reduced income for the state and social problems – with potential effects on the next generations. Thus, the young people not integrated or poorly integrated into the labour market is a major challenge for most Western welfare states.

In order to study the relationship between health and work in young people, it is necessary to take into account the particularities of young adults as a group.

### ***2.1.1 Labour market integration versus labour market exclusion***

In this work, the term “labour market integration problems” has been chosen to denote functional outcomes related to lack of work participation in young people. In adult and working populations, the term “labour market exclusion” or “exclusion from work” is normally used to denote exit from the labour market due to either job loss (having no work) or health impairment (too sick to work). However, to be excluded from the labour market implies that one is already included in the first place. The term is therefore less suited to use for young people, and in particular those who never have been working or those with little work experience. The key issue for young people is to enter the labour market in a good way and manage to stay there. Labour market integration or inclusion is therefore a more suitable measure and more important to assess for young people in the transition to adulthood. Policy and research have had a stronger emphasis on work exclusion to help find the causes and keep people working. For example, a substantial amount of literature exists on the causes and prevention of sickness absence. Several policy initiatives have also been introduced in order to keep people healthy and at work. The working population eligible for sickness absence is already a selected population of those who are working, and research findings and policies do not necessarily apply to young people whose main problem is to enter the labour market.

### ***2.1.2 Labour market integration problems – some definitions***

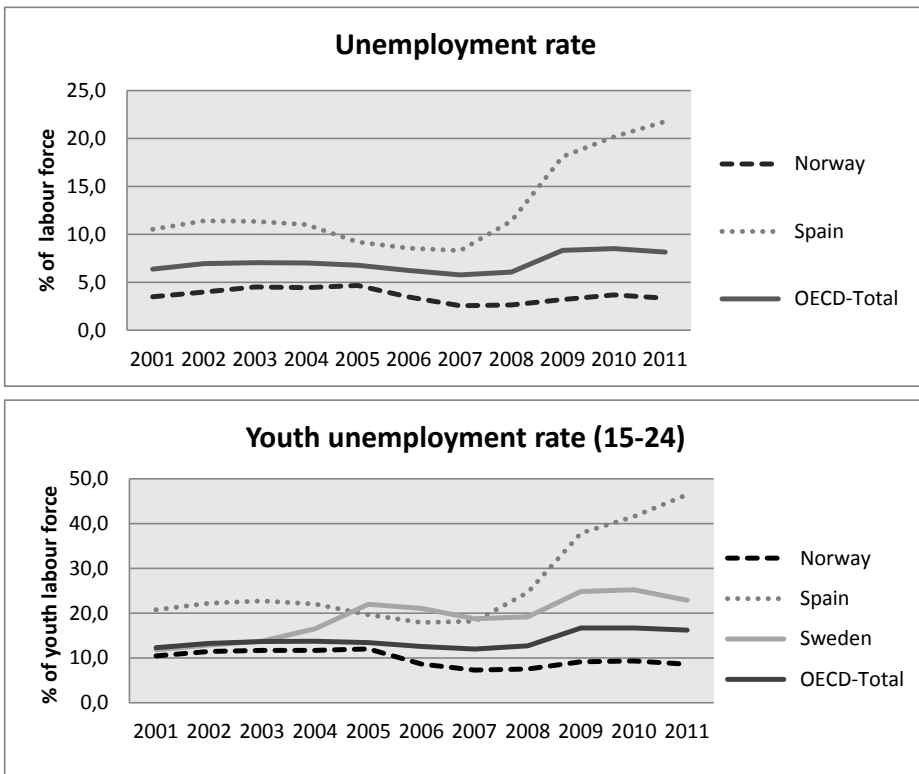
“Labour market integration problems” is a broad concept, and will usually include long or recurrent episodes of worklessness.

*Worklessness, non-employment and being economically inactive* are examples of terms used to denote the state when people are not working or earning their own income. For young adults the term NEET (neither in employment nor in education or training) has been used, and may be more suitable in this age group when many are still supposed to be in school. These general definitions based on non-participation and inactivity have the advantage of being easier to compare between countries since they are more

independent of the welfare system. However, as the causes and consequences of various inactive states differ according to their duration, relation to health, benefit eligibility etc., it is often necessary to look at these different states separately. It is possible to include many different states in the broad “inactive” category: retired, parental leave, domestic workers and voluntarily chosen prolonged vacation and leisure, but we will concentrate on the two states that are most often seen among young people; *unemployment* and *health-related worklessness* (sickness absence).

### ***2.1.3 Sickness, disability and unemployment***

How big is the problem with worklessness among young people in Western industrialized countries and in Norway? Different countries face different types of challenges regarding unemployment, sickness and disability depending on country characteristics such as the type of welfare regime and the national economy. A common challenge across all OECD countries is the large number of people leaving the labour market due to health problems or disability. Disability pension rates are considered as high (OECD average of 6% in 2007), and increasing in many countries (1). There has also been a change in who receives disability benefits; recipients are now younger, more often female and frequently have diagnostic labels indicating mental health problems. The recent 2008 economic downturn has resulted in increasing levels of unemployment, particularly in southern Europe and among young people. Trends in overall unemployment and youth unemployment over the last 10 years are shown in Figure 2.1.

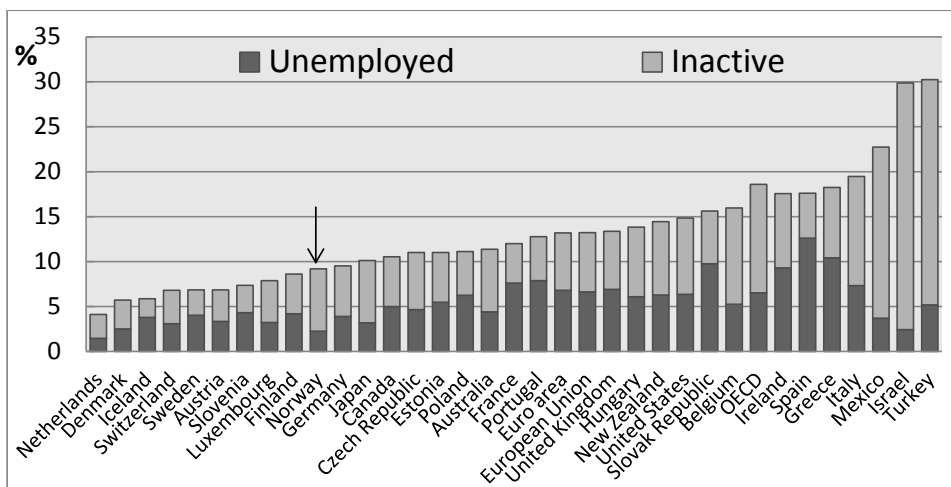


**Figure 2.1** Unemployment rates and youth unemployment rates 2001-2011 in Norway, OECD region (average) and selected countries for comparison (source: <http://www.oecd.org/statistics/>)

The spending by country on sickness, disability and unemployment are available in OECD statistics and reports (1, 2). On average, 2% of GDP in the OECD countries (2.3% in the European Union) was spent on disability and sickness programmes in 2009. Norway was the country that spent the most with 5.7% of GDP, while the other Nordic countries spent between 3.4 to 4.1% of GDP. In general, this spending was much larger than unemployment benefit spending, which on average in 2009 was 1% of GDP in OECD countries (1.2% in the European Union) and 0.4% of GDP in Norway.

Among the Norwegian population aged 18-29 in 2011/2012, 1.2% (9,800 persons) received disability pensions, 4.2% received long-term sickness benefits (work assessment allowance, approx. 28,000 persons) and 3% (approx. 24,000 persons) were registered as fully unemployed. In addition, the sickness absence percentage among young workers (below 30 years) was approximately 2%, 4% and 5% in the age groups 16-19 years, 20-24 years and 25-29 years (3).

Assessments of Norwegian conditions compared with other European countries have suggested *substitution effects* from unemployment to sickness related benefits, particularly for young people (4). The Norwegian welfare system offers a generous economic compensation for health-related worklessness (that is, if a medical diagnosis may be established), with the degree of compensation usually higher and the formal requirements for the applicant lower compared with the job seeking allowance (which require a continuous duty to report and active job search). This may be of particular importance to young people, for whom the economic support in the case of unemployment is poorer than in older adults, as young people are more often non-employed, have a lower level of education, lower levels of work experience and lower wages. In order to compare the proportion of young people outside the labour market in Norway with other countries, it may therefore be useful to assess both unemployment and other types of inactivity together, e.g. by the proportion of NEET. Figure 2.2 shows that the percentage of economically inactive young people in Norway is comparable to other Northwestern European countries, even if the youth unemployment rate is low.



**Figure 2.2** Percentage of the youth population (aged 15/16-24) neither in employment nor in education or training (NEET) in OECD countries in 2011. Source: OECD estimates based on national labour force surveys. (Cut-off date: 2 May 2012). [www.oecd.org/employment/database](http://www.oecd.org/employment/database).

## 2.2 Worklessness

The negative effects of non-participation in the labour market on health have been well documented, both at the societal and individual levels (5). Non-employment in young people can have both a different meaning and other consequences than in adults. For unemployment, sickness absence and disability, it is likely to believe that in young people, compared with older adults, the underlying vulnerability is more fundamental and the consequences more overarching, with an increased risk of marginalization and social exclusion. This is partially supported by the available documentation on the topic, which will be presented in the section below.

### 2.2.1 Indicator of present and future risk

First, young workless people are a group with a substantial underlying vulnerability, characterized by low educational levels, high psychiatric morbidity and social adversity (6-11). Second, prospective studies on adult populations have demonstrated that unemployment, sickness absence and disability are associated with increased mortality, disability and morbidity (12-19). Several studies have also indicated that the process

leading to worklessness or the workless state in itself may enhance negative health effects (20-23). The scarce existing evidence regarding young people indicates that these relationships also apply to this group (24, 25), and maybe to an even greater extent (15, 26, 27). Third, being inactive or workless is also associated with lower work participation in the future, especially for those with health-related worklessness (8). In a prospective study of Norwegian youth, Raaum et al. found that being outside school or work was associated with a reduced predicted probability of re-entering in the near future when teenagers were unemployed and when the period “outside” extended beyond one year. During early adulthood, when participation norms are stronger, even shorter breaks from education or work increased the risk of social exclusion (28).

In sum, worklessness in young people is a strong indicator of a present and future risk of health impairment and permanent work exclusion, which is especially the case with long-term worklessness. Moreover, these aspects are closely related to the well documented relationship between social position and health. Employment status may be considered as a measure of socioeconomic status and it is also closely related to the more traditional measures of socioeconomic status such as education, social class and income. (29).

### ***2.2.2 How to measure worklessness***

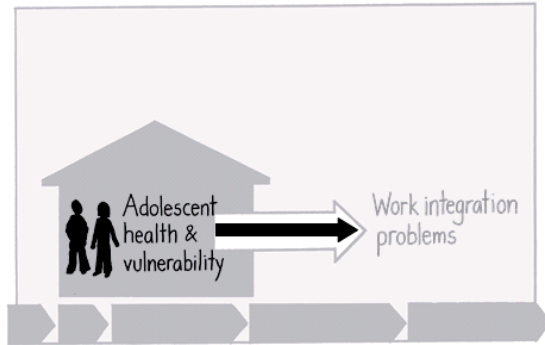
Economic inactivity may be measured by a lack of income or a lack of participation in work or education, with many countries keeping registers containing such information. Periods of unemployment or work disability are normally registered at the employment office, the social insurance agency or by an employer. Worklessness may be accompanied by cash transfers from the state, and registrations of such receipt may also be used.

The choice of measure depends on the availability of data, on the characteristics of the welfare scheme and on the underlying issue that one wishes to investigate. In Norway, information from employment offices, on beneficiaries and on income are included in national registers and many other countries keep records in similar ways. The



Norwegian registers, and how work integration problems were measured among the young adults in the present study, will be described more closely in the methods section.

## 2.3 Adolescent health, vulnerability and labour market integration



In this section, some aspects of adolescent health and vulnerability relevant for later labour market integration problems will be described. Despite a growing amount of literature on the causes of sickness absence and disability pension, these outcomes have

rarely been studied in association with adolescent exposures. In order to present the relevant existing knowledge, time spans will be extended to include exposures prior to adolescence and outcomes assessed later in adulthood. The main emphasis will be on prospective studies using disability pension and sickness absence as the outcome, but some relevant studies regarding unemployment, educational attainment and other life outcomes will also be mentioned.

### 2.3.1 What characterizes adolescent health?

According to WHO definitions, adolescence is the period between the ages of 10 to 19 years, and is sometimes divided into early adolescence (age 10-14) and late adolescence (age 15-19). In industrialized countries, adolescents account for 12% of the population. In a life course, adolescence is defined as the period after childhood and before young adulthood, and is characterized by rapid biological, cognitive and psychosocial development. It is usually introduced by the onset of puberty, and ends with the transition to adulthood and the acquisition of adult roles (30).

Adolescence is a period characterized by low morbidity and low mortality compared with other age groups, particularly in Norway and other high-income countries (31). Adolescent health has therefore not received much attention from politicians or in the health services. However, improved and systematic monitoring of young people's health

with the use of adolescent health surveys have provided more knowledge about the health status of young people, and of the specific health challenges that adolescents most commonly face. Health problems in adolescents may be problems persisting from childhood (chronic illness, acute childhood illness, conduct and behavioural disorders) or problems affecting young people in particular/ dis-proportionally (e.g. injury, risk-related conditions, mental illness). Additionally, the notion of the life-course perspective to adult health has led to an increased attention to adolescent health and health behaviour, leading to health problems and health inequalities later in life (e.g. lifestyle factors, mental illness, risk behaviour) (32).

### **2.3.2 Somatic health**

Population-based studies from Western countries have shown that 20-30% of young people report having a chronic illness (lasting longer than six months), while 10-13% report having a chronic condition that limits their daily life (33). The burden of such chronic conditions has probably increased as a result of better available treatment and the increased survival of many inborn defects and chronic conditions in childhood. In addition, the prevalence of certain conditions has increased (diabetes, asthma). Conditions that are common among adolescents and often lead to a doctor's visit are respiratory illnesses, skin conditions, headaches, musculoskeletal conditions or symptoms, ear, nose and throat conditions and mental symptoms or illnesses (34). Among 15-16-year-old and 18-year-old Norwegians, one out of seven reported asthma and 35-40% reported allergic conditions in national surveys (35). Health complaints are also commonly reported among adolescents, particularly among adolescent girls. Among Norwegian 10th graders (age 15), one out of five boys and almost one out of three girls reported at least one daily complaint (36), and the correlations between psychological and somatic complaints were high. In girls, complaints increased from the 6<sup>th</sup> to 10<sup>th</sup> grade (36). Nevertheless, adolescents generally rate their health as good or very good (90%) (35, 37).

Some health factors from early life have been associated with non-employment, disability pension and/or sickness absence in large prospective studies on Norwegian populations (38-42). Among these are low birth weight, low gestational age and

childhood chronic disease (measured by the receipt of basic/attendance benefits age 0-16). Health factors measured at age 11 were associated with an increased risk of work disability in adulthood in a longitudinal study from the UK (43). Health factors measured at conscript (males only, aged 18-20) associated with later DP (disability pension) are health behaviour (alcohol use), self-rated health, height, BMI/obesity, hypertension and having a physical or mental diagnosis (40, 44-48). Health has also been associated with educational attainment and other life outcomes. In a U.S. study, poor childhood health was found to predict educational attainment (49), adult health and adult social class, with Koivusilta et al. finding that health-compromising behaviours and poor perceived health in Finnish adolescents predicted a low educational level in adulthood (50). Height at age 18 years was found to predict educational attainment later in life among Swedish men (51).

### ***2.3.3 Mental health***

Mental disorders and mental health problems affect between 10 and 20% of adolescents (prevalence), and have probably been increasing over the last few decades (52, 53). The most common conditions in adolescents are anxiety, depression, conduct disorders, learning disabilities, ADHD (attention-deficit/hyperactivity disorder), eating disorders and substance misuse disorders (52-54). Some mental health problems start in childhood (anxiety, ADHD, Asperger's syndrome), while others have their typical onset in adolescence (depression, eating disorders, self-harm and substance misuse) or young adulthood (schizophrenia). Some conditions may also present in childhood but not reach clinical relevance, or be diagnosed before adolescence. Diagnosing mental disorders may be particularly challenging in adolescence, as symptoms such as mood swings, acting out or risky drug use can easily be dismissed as "normal" for adolescents. Anxiety and depression symptoms are commonly reported among adolescents and especially among girls after entering puberty. The lifetime prevalence among U.S. adolescents aged 13-18 years was 32% for anxiety disorders (severe impairment 8%) and 14% for mood disorders (severe impairment 11%) (54). Norwegian studies have indicated that 15-20% of adolescents (12-17 years) have considerable depressive symptoms, and a point prevalence of depressive disorder of 5% (52).

There is evidence to suggest that mental health in adolescence is important for later labour market participation. First, the nature of mental health problems may make the transition to adulthood particularly stressful and increase the risk of sustained vulnerability into adulthood; mental disorders are known to interfere with many aspects of life, including with family and peers, learning/schooling and social activities. Many mental disorders are lifelong or recurrent conditions, and there is an important comorbidity between different types of mental disorders and between mental disorders and learning disabilities and somatic conditions. Additionally, most mental disorders are heritable and associated with adversity. Secondly, mental health problems are commonly seen among the non-employed: More than half of all young Norwegians with disability- and long-term sickness benefits have a psychiatric diagnosis (7-11). Today, mental disorders are the leading cause of sickness absence in many countries and between one-third and one-half of disability benefit claims in the OECD countries are for reasons of ill mental health (55). Common mental disorders have been established as important risk factors for sickness absence and disability pension in adult populations (56-58). Third, the current labour market, which is characterized by an increased demand for social skills, specialized skills and education, may reduce the employability of individuals with mental health impairments. Young people with social anxiety, elusive personality traits and those having grown up in families with socioeconomic problems may be at particular risk when they face the contemporary individualistic trends which emphasize that job candidates have to “sell” themselves.

Childhood temperament (age 11) has been shown to be associated with an increased risk of work disability in middle age in a UK longitudinal study (59). Reporting low emotional control or behavioural problems at conscript have been associated with an increased risk of early disability pension (DP) (48, 60), and having a psychiatric diagnosis at conscript has been shown to be a particularly strong predictor for early DP (both overall and for DP with a psychiatric diagnosis) in large prospective population studies from both Norway and Sweden (40, 44, 48, 60). Results from the Christchurch Health and Development Study in New Zealand have demonstrated that symptoms of adolescent anxiety and depression and other mental illnesses are associated with a lower educational attainment, lower workforce participation and increased welfare

dependence (61-65). Adolescents with conduct problems from the British 1946 birth cohort were found to experience high levels of economic, educational and global adversity in adulthood (66). Also, several studies have demonstrated a strong association between cognitive ability and work disability (40, 44, 67). This was true for both assessments of abilities at age 10-11 and at conscript, and the effect on work disability was observed in both young adulthood and throughout adult life. The association between cognitive abilities and work disability seems to be mediated through educational attainment, and be independent of the association between mental disease and work disability.

#### ***2.3.4 Health behaviours***

Adolescence is a time when new health behaviours are laid down, and such behaviours may be important for health and well-being in the short- and long term (68). Some behaviours may have immediate health consequences, such as physical exercise, risky sexual behavior, drug misuse/intoxications and the safe use of roads. Other health behaviours like smoking, dietary patterns or inactivity may have more long-term effects, such as risk factors of adult morbidity and mortality. Health behaviours such as alcohol use are also strongly associated with behavioural and health problems (69, 70).

Moreover, health behaviors are known to track into adulthood and may influence health and morbidity throughout life. Health behaviours in adolescence are associated with educational achievement and labour market outcomes (46, 47, 50, 71), although these factors are less likely to be the actual cause. In relation to the topics in this thesis, there are two aspects of health behaviours that warrant attention: 1) Health behaviours are strongly related to socioeconomic status and have received attention as drivers of health inequalities, generational continuities of ill health and as a possible pathway between social disadvantage and health; 2) Health behavior in adolescence may be a target for health promotion and preventive interventions, as most behaviours are modifiable, which may break the pathways mentioned above (72).

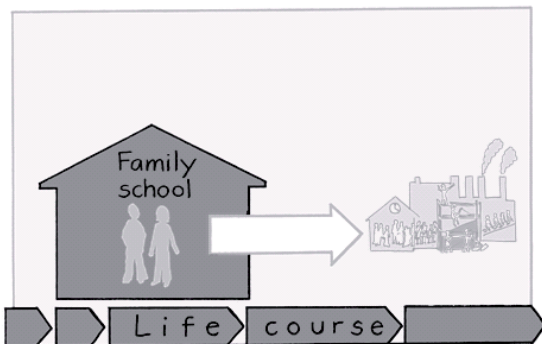
#### ***2.3.5 Reading and writing skills and school drop out***

Individual factors related to school may also be of importance for adolescent vulnerability. Learning disabilities are conditions that affect the way some children and

adolescents with normal cognitive abilities learn, and may involve reading, writing, spelling, reasoning and mathematics. Specific reading disability (dyslexia) is the most common of these disabilities, and affects approximately 10% of school-age children and adolescents (28, 73). Dyslexia and other learning disabilities are closely related to health problems, and associated with a wide range of internalizing and externalizing mental health problems (74). Furthermore, reading disability is distributed along a social gradient and boys are more often affected than girls. Young people with reading problems/dyslexia are at risk of low education attainment, school dropout, psychosocial problems, low self-esteem and suicidal ideation (75, 76).

Reading and writing difficulties and high school dropout are two specific school-related factors that may increase the risk of labour market integration problems, as young people entering working life today face high demands for a formal education and good ability to read and write (77, 78). Norwegian children diagnosed with dyslexia at age 10 (who were part of a population cohort) were found to have high levels of unemployment in adulthood, but only slightly lower educational attainment levels compared with a representative sample of the population cohort that they were a part of (76, 79). A low literacy proficiency in adult population samples has been associated with higher levels of unemployment and work disability (77, 80), while low educational attainment is associated with a lower work participation and higher risk of work disability (39, 44, 81, 82).

## 2.4 Life course perspective and proximal social determinants

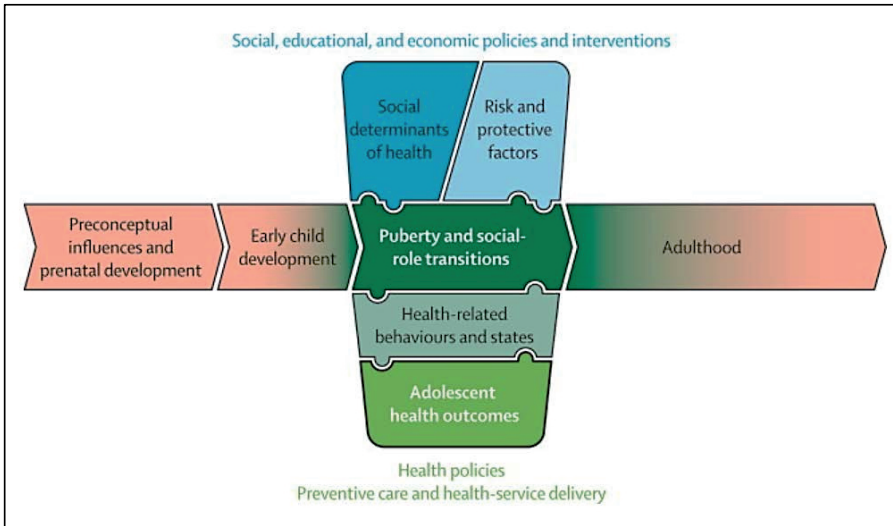


In order to understand the relationship between adolescent vulnerability and labour market integration, it is necessary to consider the influences from the environments in which adolescents live such as family and school. In addition, the

relationship needs to be considered in a life-course perspective, as it may be influenced by early factors and also because work and health factors continuously influence each other throughout the life course.

#### ***2.4.1 Conceptual framework for adolescent health***

A series of articles on adolescent health was recently published in the Lancet with the aim of increasing the attention to and interest in adolescent health. Here, a framework was proposed to understand adolescent health and development, and illustrated by the figure shown below (Figure 2.3). This framework emphasizes the importance of *adolescence as a key developmental stage* in the life course (horizontal axis in Figure 2.3), including how social contexts and social determinants act in this particular stage (vertical axis in Figure 2.3) (30). The life course perspective is important, both for knowing that early life adversity and disadvantage are associated with adolescent health and well-being and that adolescent health and health behaviour may influence health later in life. Social health determinants are social factors at the personal, family, community and national levels, all of which may affect health. The strongest determinants of adolescent health worldwide are structural factors such as national wealth, income inequality and access to education (83). Within a country like Norway, other more proximal determinants may be more important, i.e. the circumstances of daily life such as family, school and peers.



**Figure 2.3** The “conceptual framework for adolescent health” as presented by Sawyer *et al.*(30), see the text for further description

#### 2.4.2 Life course perspective

In 1998, the sociologists Bäckman and Palme demonstrated that a strong association between background SES (father’s social class) and sickness absence in young adulthood was mediated through diverse factors in childhood and adulthood (84). They suggested two complementary explanatory models – that childhood circumstances trigger a chain of socially unfavourable conditions leading to ill health and sickness absence in adulthood (“unfavourable life career hypothesis”) and that bad childhood conditions increase the constitutional vulnerability to risks and pressures in adulthood (“social imprint hypothesis”). Despite the fact that the life course perspective was common in other disciplines (like sociology), it has not been until the last decade that the life course approach has become widely used and acknowledged in the study of health and chronic disease (85). Life course epidemiology has been defined as “the study of long-term effects on later health or disease risk of physical or social exposures during gestation, childhood, adolescence, young adulthood and later adult life” (85). Several life-course epidemiological studies have demonstrated that people’s susceptibility to disability pension- or long-term sickness absence in adult life may be rooted in their past. Several biological and social background factors from childhood



have been associated with work disability, in addition to biological and social factors from adolescence, young adulthood and working age (39-41, 43, 44). However, none of these studies have had a particular focus on adolescence, which may be caused by a lack of relevant data on adolescent health, but also possibly because adolescent health has been regarded as less important. For the work of this thesis, it is important to understand the association between adolescent exposure and work integration in young adulthood within the framework of the life-course perspective, even if the present study only covers short and selected periods and factors of the life course.

### ***2.4.3 Family background and family context***

The family context and family factors are of great importance to adolescents and adolescent health. Social gradients in child and adolescent health based on parental/background socioeconomic status have been shown for a wide range of health issues (86, 87), including mental health problems (88, 89), health complaints (90), low self-rated health (91), overweight (92) and health behaviours (93-95). Other family-related factors have also been shown to be of importance to young people's health, e.g. parental (mental) health problems, parental non-employment, family conflict, adverse experiences and family environment (96-104). Family provides the social environment during upbringing and also usually defines a group which shares the same genes. Until recently, it was difficult to separate these effects, although genetic and epidemiologic studies based on twin samples (and other family samples) have provided evidence that has brought us closer to the "nature vs. nurture" issue. Substantial genetic contributions to the variance of many specific conditions and diseases have also been found.

Family factors have been shown to increase young people's risk of labour market integration problems, and parental socioeconomic status has shown a strong relationship with sickness absence and disability pension in young adulthood (39, 82) that seems to be partly mediated by one's education. Using data from the Swedish twin registry, Samuelsson et al. found that to a large extent the association between SES and DP was explained by factors shared by family members (twins) (105). Kristensen et al. have demonstrated that social disadvantage during childhood and adolescence could account for 30-40% of the explanation of whether young adults participated in work or not at by

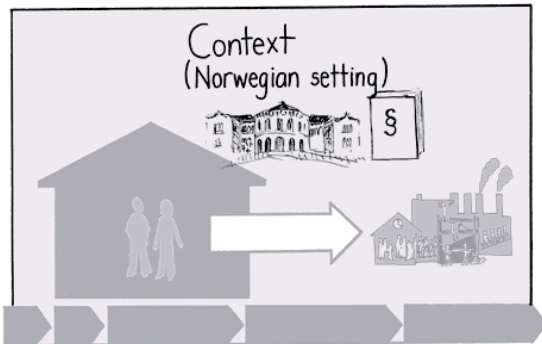
age 29 (41). A Finnish study has shown a dose-response relationship between the extent of social adversity during childhood (reported as an adult) and adult work disability (106). Parental marital status (incl. divorce), parental disability, low social support in adolescence and contact with child authorities are among other family-related factors shown to be associated with later work disability (39, 48, 60). The presence of parental psychopathology among adolescents has been revealed to impair psychosocial functioning at age 24 (107). Additionally, exposure to single parenthood in childhood has been associated with a range of negative life outcomes, including educational attainment, income and welfare dependence (108).

A moderate genetic liability to disability pension has also been demonstrated in large twin studies from Sweden and Finland (109, 110) (heritability estimates for all diagnoses 36%, musculoskeletal diagnoses 35-37%, mental diagnoses 42-49%, cardiovascular diagnoses 48%, other diagnoses 24-27%). Both studies showed that the importance of genetic factors for DP was largest for the younger twins. Shared early family environmental factors were also found to play a role in DP due to depressive disorders; otherwise, the environmental influences on DP were primarily age-specific. A recent study also suggests a genetic contribution to the variation of sickness absence (heritability estimate 36%) (111).

#### ***2.4.4 School***

Exposures that emerge in adolescence such as peer and neighbourhood factors, as well as a connectedness with school may be of particular importance to adolescents in the transition to adulthood (30, 83). School context has been found to be associated with health factors in adolescents (112, 113), and schools may be an important target for preventive health measures and for preventing dropout. In Norway the neighbourhood context now seems to be of decreasing importance, as demonstrated in studies on educational attainment (114).

## 2.5 The Norwegian setting



The relationship between adolescent vulnerability and later labour market integration problems is obviously influenced by economic, social and cultural context. This section describes the Norwegian study setting and briefly how it relates to other settings.

### 2.5.1 School system/education

The Norwegian education system is characterized by public schools with good and equal accessibility, including a statutory right to an upper secondary education and training for all young people between the ages of 16 and 19. Tertiary education is also highly available for most young people as most institutions of higher education are state-run, free of charge and with the state offering an extensive study financing programme with grants and loans for all young people (Norwegian State Educational Loan Fund). The organizing of Norwegian secondary schools, particularly for the vocational programmes, has been the object of criticism and has also been associated with the high dropout rates. Vocational programmes are four years (usually two years of schooling and two years of apprenticeship), and through reforms in the 1990s the theoretical subjects were given a greater importance in the vocational programmes, possibly contributing to excluding those with weak theoretic abilities (11).

### 2.5.2 Labour market

The Norwegian labour market has been stable over the last decade, with declining unemployment rates in young people. However, Norwegian youth are almost three times as often unemployed compared with the rest of the population, and thus *relatively* more affected by unemployment than youth in other European countries. Characteristics of the Norwegian labour market is shown in Table 2.1. The labour market opportunities for young people may have been affected by changes in the structure and contents of

occupations and industries that have taken place over the last decades. In Norway, there has been a particular decline in employment within the primary sector, as well as in industry- and sea transport sectors. In this setting, young people with low levels of education and mental disorders may fall through (11). These trends are generally seen all over Europe, with a shift of low-skilled activities away from the OECD regions (OECD, 2010). People with the double burden of chronic illness and low education seem to have become increasingly marginalized from the labour market, with deindustrialization also possibly playing a part in this process (115). A Norwegian register study found that non-employment for young people with chronic diseases followed economic cycles, while non-employment for young people with low levels of education followed economic cycles, in addition to an increasing levels of non-employment over time (81).

Working life may have become more stressful, thereby possibly contributing to sickness absence and inactivity in young adults (116). There has been an increase in temporary work and inconvenient work hours, as well as increasing demands for reading/writing skills and other specialized skills. Nonetheless, Bratsberg et al. did not find any specific evidence for an increasing risk of exclusion from the 1990s through the 2000s for those with low levels of skills (117).

**Table 2.1** Characteristics of the Norwegian labour market in 2001 and 2011. OECD averages for 2011 are shown for comparison (2)

	Unit	Norway		OECD
		2001	2011	2011
Unemployment rate	% of labour force	3.5	3.3	8.2
Youth unemployment rate	% of youth labour force (15-24)	10.5	8.6	16.2
Long-term unemployment (12 months and over)	% of total unemployment	5.5	11.6	33.6
Employment rate	% of working age population	77.5	75.3	64.8
Employment rate of women	% of female population (15-64)	73.8	73.4	56.7
Employment rate of older workers	% of population aged 55-64	67.4	69.6	54.4
Temporary employment	% of dependent employment	9.3	7.9	12.0
Part-time employment	% of total employment	20.1	20.0	16.5
Average annual working time	Hours per worker	1 429	1 426	1 776
Average annual wage	2011 USD PPPs	33 304	43 990	44 757
Growth of real GDP	% change from previous year	2.0	1.5	1.8
Employment growth	% change from previous year	0.4	1.4	1.2
Wage growth	% change from previous year	2.5	3.0	0.6

### 2.5.3 Welfare state

A welfare state is the denotation of a system of welfare benefits administered and guaranteed by the state with the aim of offering its population some type of social protection (118). The Nordic welfare states are characterized by universal social policy programmes (in contrast to being means tested) and equality in opportunities and outcomes as a goal (119). These countries all have large public sectors and extensive transfer programmes and services. The Nordic countries are often referred to as a cluster of welfare states called “social democratic welfare states”, which have been associated with positive health outcomes compared with other types of welfare regimes, including child health outcomes (120-122). A recent article comparing 26 European countries

found that generous and equality oriented welfare state arrangements were associated with better employment opportunities among groups with a low education and ill health, thereby suggesting that “welfare resources trump welfare disincentives”(123). This could indicate that young vulnerable individuals also have better employment opportunities in Norway and the Nordic countries.

**Table 2.2** Benefits included in various parts of the study and their definitions. Source: NAV, (118)

Norwegian benefit	Definition	Time/coverage <sup>***</sup>
Disability pension (DP)	Granted to insured persons (insured minimum three years) between the ages of 18 and 67 whose working capacity is <i>permanently</i> reduced by at least 50% due to illness, injury or defect.	Permanent = 52-90%
Other long-term medical benefits <sup>*</sup>	Granted to insured persons (insured minimum three years) between the ages of 18 and 67 whose working capacity is reduced by at least 50% due to illness, injury or defect <i>and</i>	Up to 4 years
Rehabilitation allowance	- undergoing active medical treatment	66% (min 2 B.a. <sup>**</sup> )
Vocational rehabilitation allowance	- undergoing vocational measures	
Limited disability pension	- tried medical and vocational measures and was still considered to have a certain possibility of becoming employed.	
Sickness benefits (daily cash benefits in the case of sickness)	Granted according to income to insured persons incapable of working due to sickness (requires annual income $\geq 0.5$ B.a. <sup>**</sup> and prior occupational activity for at least four weeks).	52 weeks 100%
Unemployment benefit	Partially compensates for loss of income due to unemployment (working hours reduced by at least 50%), must be a genuine jobseeker, i.e. capable of work and registered as an applicant with the Labour and Welfare service. Previously earned income ( $\geq 1.5$ B.a. <sup>**</sup> last year, $\geq 3$ B.a./3 years) is a condition for entitlement to unemployment benefits.	Up to 104 weeks = 62.4%
Social assistance	Cover basic subsistence costs on a temporary basis for people who cannot support themselves through gainful employment with their own savings or with the aid of other financial rights.	

<sup>\*</sup>From 2010 replaced by the work assessment allowance (arbeidsavklaringspenger in Norwegian).

<sup>\*\*</sup>B.a. = basic amount is used to determine benefits in the National Insurance Scheme, it is annually adjusted in accordance with the wages (the B.a. from May 2012 is NOK 82 122).

<sup>\*\*\*</sup>For most benefits the maximum coverage is 6 B.a. (NOK 492 732).

#### ***2.5.4 Social insurance and benefit schemes***

The Norwegian welfare scheme offers economic support for life sustenance and living expenses through universal benefits such as unemployment benefits, national insurance pensions and family benefits, and is organized by The Norwegian Labour and Welfare Service (NAV), with local offices in each municipality in Norway (124). In general, the economic compensation offered in the case of worklessness is generous in Norway compared with other countries, especially for those in paid work and for those with health-related worklessness. The income maintenance/cash transfer programmes which are intended as replacement for wages during unemployment or sickness absence within the Norwegian social insurance scheme are shown in Table 2.2:

#### ***2.5.5 Non-employment trends***

Overall, the number of Norwegians receiving health-related benefits has shown an increasing trend over the last twenty years, while unemployment has been slightly decreasing. This has generally been observed for all age groups, including young people. The amount of sickness absence has increased somewhat over the last few decades, mostly for women, whereas the general- and unspecific diagnoses have become more common compared with other diagnoses (125, 126). The number of disability benefit recipients has also increased over time, though the proportion of benefit receivers as a percentage of the working age population has remained stable at around 9.5% over the last decade. Most disability benefit recipients are older adults, and only 3% are under the age of 30. However, an increase in new disability benefit claimants has been observed in young people under 25, and this has caused a considerable amount of concern (127). Some explanatory factors that have been proposed are possible changes in the health of young people (related to drugs and family break-up), changes in the diagnosing of mental disorders among young people and changes in working life climate and conditions, with an increased need for communication and social skills (11).

Psychiatric disorders contribute with more lost working years than any other diagnostic group (128). The proportion of disability benefits with a psychiatric diagnosis increased from 1992 to 2003, and on average, was given at a younger age (46 years) than

disability benefits for other diagnoses (53-55 years). In 2011, psychiatric diagnoses were a more common cause of DP than musculoskeletal disorders for the first time (129).

The proportion of the working age population in Norway receiving disability benefits is among the highest in the OECD, and Norway has the highest sickness absence rates in the OECD. In contrast, unemployment rates in Norway have remained low at between 2-3% over the last decade, including during the recent economic recession, with substitution effects from unemployment to sickness absence and disability generated by the Norwegian welfare system being one explanation for this pattern (see 2.1.3). Moreover, Norway is one of the world's leaders in terms of the percentage of the working population between the ages of 16-67 years, especially for women. Since all who are working in principle are “at risk” for benefits (as opposed to those who are family dependent – which is prevalent in many countries), it may be inevitable that a larger share of the population are on social insurance benefits.



## **2.6 Summary of background**

Worklessness is common in young people and a strong indicator of present and future risk of health impairment and permanent work exclusion, although there is a lack of knowledge of how it is related to adolescent health and vulnerability. Many adolescents have chronic diseases, mental health problems and school problems, and their health and well-being are continuously influenced by their family and other close environments. Existing knowledge indicates that these determinants are likely to influence adolescents' risk of work integration problems. Reading and writing difficulties, anxiety and depression symptoms and school dropout are all common factors in adolescents that seem to be of particular relevance for the life chances of young people, and which may be treated, ameliorated or prevented. The family may be of particular importance for adolescents in the transition to adulthood through social, biological and behavioural influences.

The multiple social, biological and environmental factors acting on several levels (individual, family, society etc.), including over the life course, make it difficult to establish assumptions regarding cause and effect (causal inference) when studying the relationship between adolescent factors and later worklessness. Such assumptions of causality require a strong theoretical foundation that in practice may seldom be justified in epidemiological studies, particularly so in social epidemiology. Nevertheless, a causal understanding is often desirable in order to influence policymaking and interventions to improve the public's health. This study uses modern epidemiological methods to explore which factors may be (causally) linked to worklessness and which may be explained by other background characteristics with an emphasis on the family (level).

### **3 AIMS**

#### **3.1 General objective**

The general objective of the thesis was to study the association between selected factors of health and vulnerability in adolescence and work integration problems in young adulthood, while several forms of work integration problems were assessed by the receipt of social insurance benefits for life sustenance recorded in national registers. Because the association between adolescent factors and young adult benefit receipt is likely to be confounded by various factors, we aimed to address confounding properly by using different methods, including sibling comparison, and also to explore the role of family and family context.

#### **3.2 Specific aims of the studies**

The specific aims of the studies were to investigate:

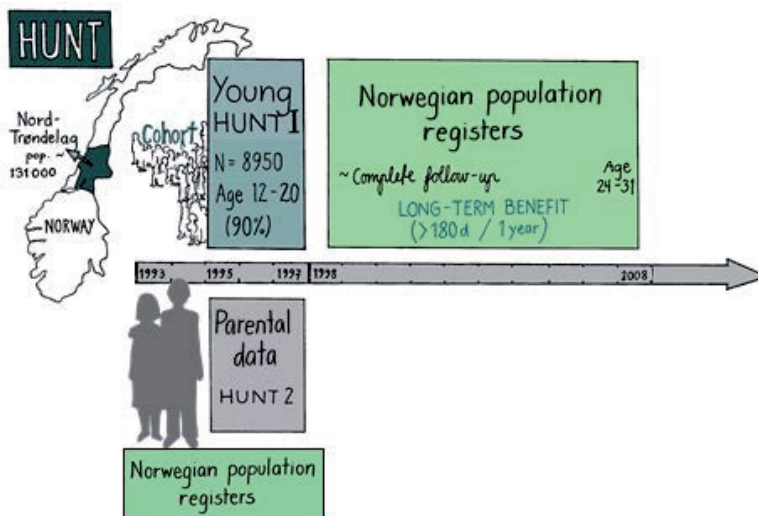
- Benefit receipt patterns in the study cohort (Thesis supplement, section 5.1).
- The association between self-reported reading and writing difficulties in adolescence and welfare dependence in young adulthood, including the role of health and mental health in this association (Paper I).
- The association between self-rated health in adolescents, high school dropout and long-term receipt of medical and non-medical social insurance benefits in young adulthood (Paper II).
- The association between self-reported anxiety and depression symptoms in adolescents and their families and later medical benefit receipt in young adulthood (Paper III).
- The association between medical benefits in young adults and their parents, the role of family health vulnerability and the ways in which socioeconomic gradients act in these associations (Paper IV).



## 4 METHODS

### 4.1 Study design

Papers I-IV are based on prospective cohort studies that follow almost 9,000 persons for more than 10 years – from adolescence to young adulthood – combining questionnaire data completed at ages 12-20 in 1995-97 with information on long-term receipt of social benefits from 1998 to 2007/2008. The adolescent survey data was linked to register data from several national databases and to data on their biological parents, with the linkages made possible by the 11-digit personal identification number unique to every Norwegian and by a family code kept by Statistics Norway. The main outcome was the receipt of long-term social benefits intended to replace income during unemployment or sickness, and benefit receipt was of primary interest as a measure reflecting work integration problems.



**Figure 4.1** Schematic representation of the main data sources

### 4.2 The Nord-Trøndelag Health Study (HUNT)

The HUNT Study constitutes a large database with information about approximately 120,000 people from the county of Nord-Trøndelag, including data from several

population surveys (130, 131). The adult surveys were completed in 1984-86 (HUNT1), 1995-97 (HUNT2) and 2006-08 (HUNT3), whereas the adolescent surveys took place in 1995-97 (Young-HUNT1), 2000-01(Young-HUNT2) and 2006-08 (Young-HUNT3). The HUNT Study includes data from questionnaires, interviews, clinical measurements and biological samples, integrates family data and individual data and can be linked to national registries. The present study used data from surveys undertaken in 1995-97, when the entire population in Nord-Trøndelag, 13 years and older, was invited to participate in the Young-HUNT1 Survey (adolescents) and the HUNT2 Survey (all adults aged 20 and above).

**Table 4.1** Attendance rate in the Young-HUNT 1 Survey. The gray fields indicate the school-attending population used in this study

	Number invited	Response rate questionnaire		Response rate questionnaire and clinical data	
	n	n	%	n	%
<b>Young-HUNT1</b>					
Middle school	5004	4743	94.8	4598	91.9
Secondary school	4913	4207	85.6	3810	77.5
“Not in school”	285	34	11.9	31	10.9
Total	10202	8984	88.1	8439	82.7

#### 4.2.1 The Young-HUNT1 Survey

The main adolescent study cohort consisted of participants in the Young-HUNT1 Survey. Young-HUNT is the adolescent part of the HUNT Study, and was established by the Young-HUNT1 Survey in 1995-97 (132). The entire adolescent population in Nord-Trøndelag was invited to fill out a questionnaire and meet for a clinical examination, which was organized by schools in their area; hence, the questionnaire was filled out during one class hour in an exam setting and the examination was also performed during school hours. Among the 9,917 invited adolescents who were attending middle or secondary school, 8,950 completed the questionnaire, thus corresponding to a response rate of just above 90%. Among the invited population not attending school the response rate was low, so these individuals were not included in our study cohort. The 8,950 responding adolescents constituting our study cohort were

therefore *school-attending adolescents*, with the details regarding participation, non-responders and study variables in Young-HUNT1 being made available in a recently published cohort profile (132).

#### **4.2.2 The HUNT2 Survey**

Data on adolescents' (Young-HUNT1 participants) parents were collected from the HUNT2 Survey. In the HUNT2 Survey, the participants were asked to fill out an extensive health questionnaire and to meet for an examination, and a total of 65,237 participated (70% of those invited). Among parents of Young-HUNT1 participants, 7260 mothers (81%) and 6122 fathers (68%) participated in the HUNT2 Survey.

### **4.3 Norwegian population registers**

#### **4.3.1 The National Education Database (NUDB)**

The National Education Database (NUDB) is produced by Statistics Norway and includes individually based statistics on education since 1970 (<http://www.ssb.no/mikrodata/>). The most important of the annual files is the situation file with students registered (enrolments) by October 1, the completed education file (graduates) from the previous school/academic year and a file containing the population's highest attained level of education (133).

#### **4.3.2 FD-Trygd (Statistics Norway's events database)**

FD-Trygd (Statistics Norway's events database) includes details on demographics, social conditions, social security, employment, search for work, state employees, income and wealth for the entire Norwegian population from 1992 to the present (134). The data are dynamic, meaning that all new *events* in each personal life course are registered with separate date variables. Events are entries into benefits, exits from benefit schemes and changes in a person's relationship to the benefit scheme. The database contains information from registers in Statistics Norway, the Norwegian Labour and Welfare Organization (NAV), previously called the National Insurance Administration (Rikstrygdeverket), the Employment Directorate (Aetat) and Taxation (Skattedirektoratet). The list of variables and documentation reports can also be found

at: [www.ssb.no/english/mikrodata\\_en/](http://www.ssb.no/english/mikrodata_en/) (→ Data collections→ FD-Trygd, dynamic data (134, 135).

The demographic files contain information on demographic changes in relation to taking up residence and marital status, as well as containing a table of family compositions, details on country of birth and other constant variables. The present study used information on the year of birth and the year of death, and had the reference number of Young-HUNT1 participants linked to a reference number for the biological mother and biological father.

Information on income is available for each person in the population for every year since 1993, which is collected from various administrative and statistical sources and includes all registered income. In the study, “total income” was used, which is the sum of wage income, business income and income from social insurance benefits during the calendar year.

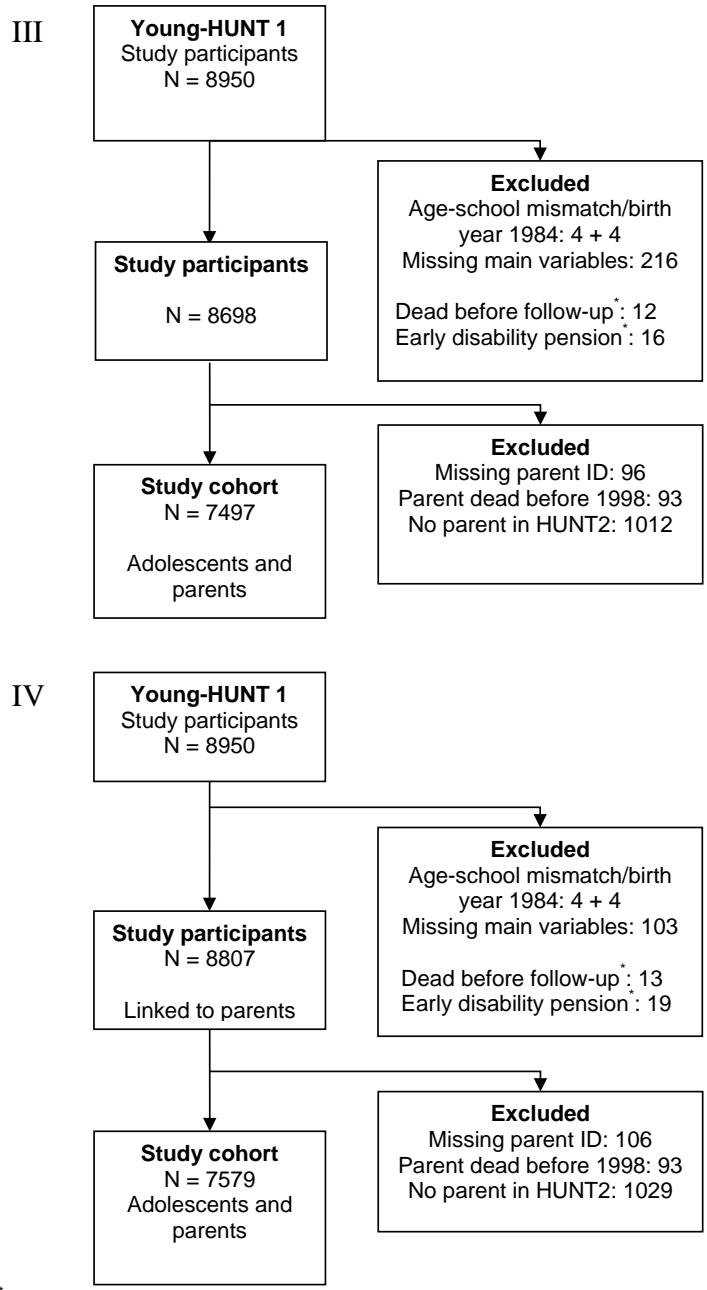
Registers from the Norwegian Labour and Welfare Organization (NAV) cover persons in receipt of national insurance sickness benefits, rehabilitation allowance or vocational rehabilitation allowance and disability pension benefits. Register data from the Employment Directorate (Aetat) cover ordinary job seekers and job seekers on government initiatives, as well as data on the occupationally handicapped and the occupationally handicapped on government initiatives.

#### **4.4 Study materials**

In Papers I and II, the study material consisted of the Young-HUNT cohort being linked to the National Family Register, the National Education Database and FD-Trygd. We excluded all those who died before or during the follow-up period (46), those who received disability pension at age 18 or 19 and those who had already started a social insurance process in 1998 that resulted in disability pension (101). Four individuals with school-age mismatch and four individuals born after 1983 were also excluded, thus leaving 8,795 participants. The number of participants included in the various analyses was determined by the number of non-missing responses on the main study variables.

In Papers III and IV, the study material consisted of the Young-HUNT1 cohort and parents of the Young-HUNT1 participants – linked together by the family register and to the National Education Database, FD-Trygd registers and parental data from the HUNT 2 Survey. The initial exclusion of adolescents was restricted to those who died with a DP before 1998 or before the age of 20 (the start of follow-up), as this was considered a better approach than the former – where information obtained during the course of follow-up was used for initial exclusion. Adolescents for whom the parental ID was missing, whose parents were dead before follow-up (1998) or for whom no parent participated in the adult HUNT 2 Survey were excluded. The number of participants included in the various analyses was also here determined by the number of non-missing responses on the main study variables and is shown in Figure 4.2.





\* numbers are not identical in the two papers due to different numbers of participants remaining after excluding those with main variables missing

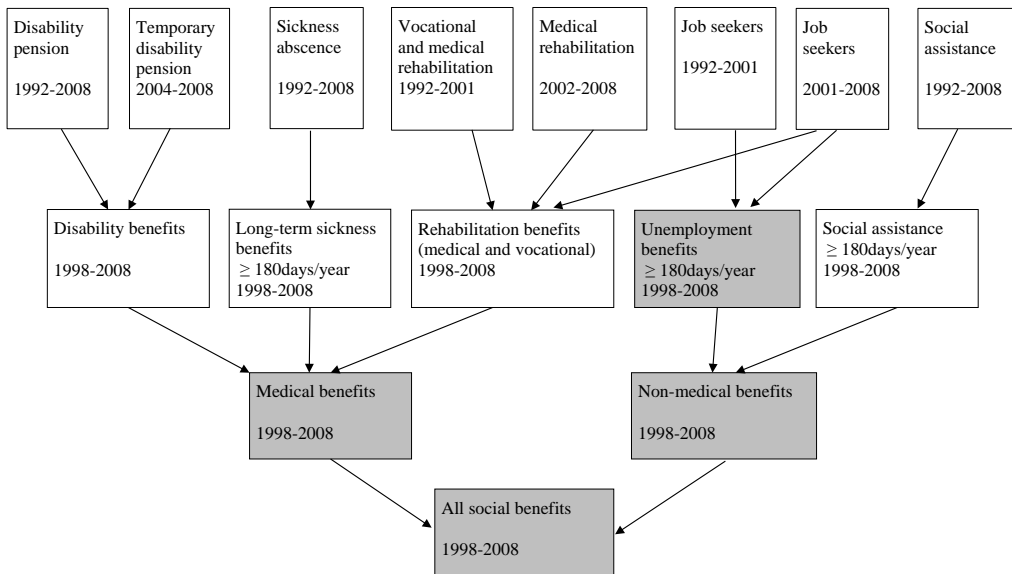
**Figure 4.2** Flow chart showing how the study cohorts were derived in Papers III and IV

In the Thesis supplement, the study material consisted of the Young-HUNT1 cohort linked to FD-Trygd, n= 8907 (after excluding eight individuals with an age-school mismatch and those who died (13) or were granted a DP (22) before 1998 or before age 20 (the start of follow-up)).

## 4.5 Study variables

### 4.5.1 Benefit receipt

Information on benefit receipt was collected from FD-Trygd registers, and Figure 4.3 gives an overview of the files that were used. .



**Figure 4.3** The different files from FD-Trygd and how they were merged in order to collect information on benefit receipt and to construct the outcome measures (coloured gray)

We chose to measure the receipt of long-term benefits intended to replace income in the case of sickness or unemployment, as such benefit receipt indicates work integration

problems and welfare dependence. In the papers and the thesis, the terms “benefit receipt”, “welfare dependence” and “work integration problems” are all used to denote the same functional outcome measure<sup>1</sup>.

### *Types of benefit*

The relevant benefits were:

- Disability benefits
- Rehabilitation benefits (vocational or medical rehabilitation allowances)
- Sickness benefits
- Unemployment benefits (daily cash allowance (“dagpenger” in Norwegian))
- Social assistance

Each benefit has its own eligibility criteria and economic coverage, which are defined by law and managed by the Norwegian Labour and Welfare Service (see Table 2.2 ). With the exception of social assistance, all benefits are universal in principle, i.e. available for all people living in Norway (members of the National Insurance Scheme). In contrast, social assistance is a means-tested benefit distributed at the municipal level, and is only meant to cover basic living expenses for people who cannot support themselves economically. We chose to include social assistance in our study since this is the only benefit that young people may receive before having been employed (sickness benefits and unemployment cash benefits require a minimum length of prior employment with a minimum income).

### *Long-term benefits*

*Long-term benefits* include disability benefits, rehabilitation benefits (which are long-term by definition), sickness benefits, unemployment benefits and social assistance received for at least 180 days/six months during one calendar year.

---

<sup>1</sup> Ideally, only one term should have been used consequently throughout the project. The use of different terms reflects that there is no established terminology suitable for the purposes of the project, that the papers have been written for an international audience (not necessarily understanding “benefit receipt” as a functional measure) and that the papers and the thesis have been written over several years.

### *Definitions of benefits used*

All *social benefits* include all the benefits described above, while *medical benefits* include disability benefits, rehabilitation benefits (vocational or medical rehabilitation allowances) and sickness benefits. These are all benefits given to people whose wage earning capacity is reduced because of health problems, and which require a doctor's certificate and a medical diagnosis. *Non-medical benefits* include unemployment benefits and social assistance (only registered job seekers in receipt of daily subsistence allowance from the employment office were registered with unemployment benefits).

### *Measures of benefit receipt*

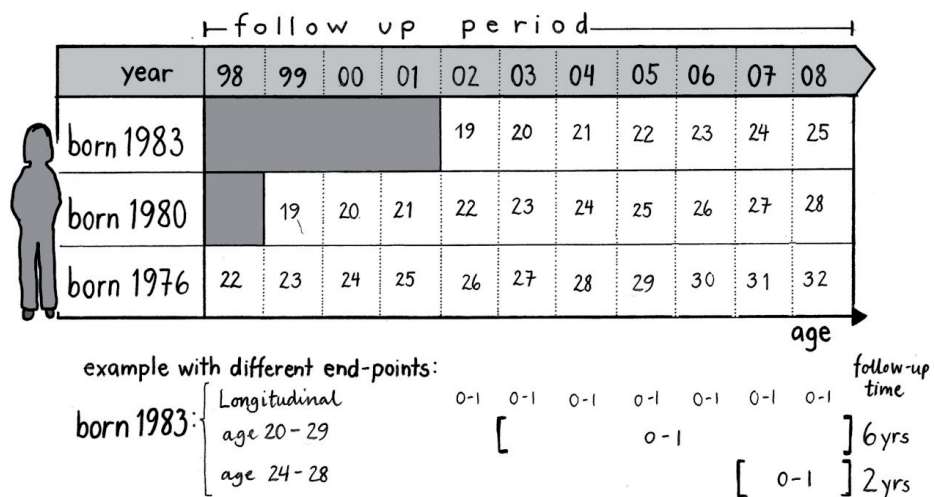
Information on benefit receipt was collected from register data in the *follow-up period* from 1998 (the first year after Young-HUNT1) to 2007 or 2008 (depending on the last available update of FD-Trygd files). Participants were followed from the year that they turned 19 years (eligibility for medical benefits start at 18 years) to 2007 (Papers I and II) or 2008 (Papers III and IV), except those who died during follow-up who were followed to the year that they died. Figure 4.4 gives a visual impression of the follow-up period for three example individuals born in 1983, 1980 and 1976. Individuals born in 1983 were followed from age 19 in 2002 to age 25 in 2008, individuals born in 1980 were followed from age 19 in 1999 to age 28 in 2008 and individuals born in 1976 were followed from age 22 in 1998 to age 32 in 2008. For each calendar year in this follow-up period, benefit or no benefit was registered according to the participant's age. This information was used for descriptive purposes and longitudinal assessments.

The *main* outcome variables were constructed as dichotomous measures by using information on benefit receipt from several calendar years in the follow-up period (mainly from the five-year period from age 24-28 and the ten-year period from age 20-29<sup>2</sup>) and defined by benefits being received during at least one calendar year in this predefined period (1), in contrast to no registrations with benefit during this period (0).

---

<sup>2</sup> These age intervals were chosen in order to have "simple" measures, sufficiently many cases of benefit receipt combined with maximum follow-up time. For Papers I and II the age of 24 years was chosen as the lower limit in order to start registration of benefit receipt after registration of school drop-out, and in order to include the individuals born 1983 (who only reached 24 years at the end of the follow-up period to 2007).

The number of calendar years that a participant could be followed in the age spans defined by the outcome variable depended on the year of birth (and death) and was defined as *follow-up time*. This is exemplified in the lower part of Figure 4.4 by a participant born in 1983, who contributed with six years of follow-up time for benefit receipt from age 20-29 and two years of follow-up time for benefit receipt from age 24-28. Follow-up time was included as a covariate in all the analyses.



**Figure 4.4** The follow-up period was from 1998 to 2008, and registrations of benefits were done according to age during this period, starting with the year that the participants turned 19 (eligibility for medical benefits start at 18 years). The example shows how the most commonly used end points were registered for an individual born in 1983.

The following measures were used in the different papers<sup>3</sup>:

- Paper I: All social benefits and medical benefits. Main outcome from age 24-28 (five-year period), longitudinal/yearly registrations from age 19.
- Paper II: Medical and non-medical benefits. Main outcome from age 24-28 (five-year period), at age 19-23, at age 26 and longitudinal/yearly registrations from age 19.
- Paper III: Medical benefits and unemployment benefits. Main outcome from age 20-29 (10-year period) and longitudinal from age 20 (descriptive and GEE).
- Paper IV: Medical benefits. Main outcome from age 20-29 (10-year period) and longitudinal from age 20 (descriptive and GEE).
- Thesis supplement: All different benefits for each year during follow-up and for the entire follow-up period. For some analyses (Figure 5.2, Section 5.1.3), the participants were classified in only one benefit group with benefits ranged using the following hierarchal structure: disability benefit>rehabilitation benefits>sickness benefits>unemployment benefits>social assistance>no benefits.

#### **4.5.2 Adolescent variables**

##### *Reading and writing difficulties (Paper I)*

Participants were classified as having reading and writing difficulties (RWD) if they answered yes to the question, “Do you currently receive help for reading or writing problems?”, or if they reported major problems with either reading or writing during the previous 12 months (separate questions for reading and writing problems with options for major problems, some problems and no problems).

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<sup>3</sup> The original notion of a more general measure including all social benefits as the best suited outcome measure has been necessary to reconsider in the course of the study. Unemployment, economic welfare dependence and work disability are three different and distinct conditions, and even if these are associated and often overlap in practice, they are clearly separate entities in research – each condition having its own literature, theory basis and also a different connection to health and medicine. In addition, the economic recession has changed Europe in important ways since 2008 and increased youth unemployment in many countries (but not in Norway). An outcome measure which includes both unemployment and sickness/disability has therefore been problematic in several ways, and we have chosen to put more emphasis on medical benefits in the two latest articles.

### *Self-rated health (Paper II, supplement (Paper IV))*

Self-rated health was assessed by the question, “How is your health at the moment?”, dichotomizing the four response alternatives into: “good/very good” versus “poor/not so good”.

### *Anxiety and depression symptoms (Paper III, supplement (Papers I and IV))*

Adolescent symptoms of anxiety and depression were measured with the five-item Hopkins Symptom Checklist (SCL-5) (136), in which adolescents were asked to report on the presence or absence of five symptoms during the last 14 days (feeling blue, feeling fearful, feeling hopeless about the future, worrying too much about things and experiencing nervousness or shakiness inside). A four-point scale was also used, ranging from 1 (“not bothered”) to 4 (“very much bothered”). The average SCL-5 scale score (range 1 to 4) was calculated for those who had answered at least three of the five question by adding up the scale scores on each item and then dividing the total sum by the number of items answered. The adolescent symptom load was categorized as high or low according to established and recommended cut-off values of the SCL-5 scores (136). The high adolescent symptom load group included adolescents with SCL-5 scores of 2.0 or above, whereas the low adolescent symptom load group included adolescents with SCL-5 scores below 2.0.

### *Other health measures*

*Somatic health* was assessed by the self-reported presence of *chronic disease* (has a doctor ever diagnosed you with epilepsy, migraine, diabetes or asthma or have you had another disease lasting more than three months) and *disability* (medium or much impairment of hearing, movement or somatic illness or much impairment of vision). *Somatic symptoms* were included as a continuous scale score based on a self-reported presence during the last 12 months (never, seldom, sometimes or often) of eight different symptoms (headache, neck or shoulder pain, aching of muscles or joints, stomach pain, nausea, constipation, diarrhoea and palpitations) (Cronbach’s alpha 0, 74). Additionally, in the Thesis supplement (section 5.1.3) the number of symptoms reported as “sometimes/often” (in contrast to “never/seldom”) was added up and this

score was dichotomized into the two lowest tertiles (none or one symptom) versus the highest tertile (two or more symptoms).

*Conduct and attention problems* were assessed using variables from a school adjustment scale containing 14 school-related items, each with four alternative answers (never, sometimes, often and very often). Six questions related to conduct and attention problems ("quarrels with the teacher", "gets into fights", "gets scolded by the teacher", "shirks school", "has difficulties concentrating in class" and "cannot be quiet/calm in class") were summed up separately, rescaled in the range 0 to 1 and used in the analyses as a continuous variable (Cronbach's alpha 0.67). In the Thesis supplement (section 5.1.3) the score was dichotomized into the two lowest tertiles versus the highest tertile.

*Alcohol consumption* was categorized as having ever been drunk more than 10 times or not, whereas *smoking status* was assessed by self-reported daily smoking or not. *BMI* was calculated based on height and weight measurements and performed by trained nurses who followed a standard protocol using standardized meter bands and weight scales. *Well-being* was measured with four questions (current satisfaction, strong/good vs. humoured tired/worn out, generally happy vs. sad, nervousness) validated for the HUNT Study (137). *Self-esteem* was measured by four questions from Rosenberg's self-esteem scale (138), while *school absence* because of sickness during the last 12 months was based on self-reported information. *Health-service use* was assessed by self-reported information of health service contacts during the last 12 months (family doctor, medical specialist, psychologist, physiotherapist, chiropractic, homeopath, other, hospital admission and school health services).

### *Demography*

*Age at baseline* and *sex* were included as study variables. *Follow-up time* was the number of calendar years that the individual participants could be followed with regard to benefit receipt during the follow-up period from 1998-2008 (see section 4.5.1).



#### **4.5.3 Educational attainment/high school dropout (Papers I and II)**

Data from the National Education Database was used to assess whether the participants had completed high school or not in the calendar year when he or she turned 24 years old. Those not registered as having completed secondary school at age 24 were defined as “high school dropouts”.

#### **4.5.4 Family and parental factors**

##### *Family risk factors*

Family-related risk factors were based on self-reported information from Young-HUNT1 and register data on the demography of adolescents (birth year) and parents (age/birth year). Family risk factors (dichotomous) were *divorce* (adolescent reported divorce of parents), *single parent* (adolescent reported living with only mother or father), *living alone* (adolescent reporting living alone) and *teenage parent* (one or both parents below the age of 20 when the adolescent was born according to the register data).

##### *Siblings*

Siblings in the cohort (Papers I, III and thesis supplement) were identified by the maternal ID number obtained from the Family Register.

##### *Family socioeconomic status*

*Parental educational level* (all papers) was assessed in The National Education Database by the 1995 level of completed education in nine categories (0-8), representing primary education (0-2) secondary education (3-5) and tertiary education (6-8) (133).

*Parental income* (Paper IV) was assessed in FD-Trygd registers by the mean annual income (in Norwegian currency) during the five-year period from 1993 to 1997. We used the total income, including income from social insurance benefits, as a continuous variable and divided it into three categories according to percentiles (first tertile representing the 1/3 with the lowest income).

### *Parental health*

Parental health was based on the mother's and father's health information from HUNT2. *Parental symptoms of anxiety and depression* (Papers III and IV) were assessed with the Hospital Anxiety and Depression Scale (HADS), which is a validated 14-item scale that consists of two seven-item scales covering anxiety (HADS-A) and depression (HADS-D) (139). Each item was scored on a four-point scale ranging from 0 to 3, and was added up, thus resulting in a continuous score between 0 and 21 for each subscale. In Paper III, a high parental symptom load was defined as having a score of 8 or above (recommended cut-off value) on *at least one* of the subscales (HADS-A and/or HADS-D). Three groups were identified according to whether no parent, one parent or both parents had a high anxiety or depression symptom load.

*Family health* (Paper IV) was assessed by adolescent and parental health measures. The parental health measures included self-reported chronic illnesses (cardiovascular disease, asthma, endocrine disease, rheumatic disease, cancer and other chronic disease), musculoskeletal conditions (fibromyalgia, arthrosis, muscular disease, whiplash, injury/fracture), limiting longstanding illness, disabilities (visual, auditory, motor, somatic disease, mental disease), mental distress, subjective symptom scales (anxiety and depression symptoms, musculoskeletal symptoms, psychosomatic symptoms), self-rated health and health behaviour/lifestyle (smoking, alcohol drinking behaviour, physical activity and body mass index).

### *Parental benefit receipt (Papers III and IV)*

Parental benefit receipt was based on registrations in FD-Trygd from 1992 to 1997.

*Parental medical benefits* included receipt of long-term sickness benefits (>180 days during one calendar year), rehabilitation allowance or vocational rehabilitation allowance and disability benefits. In Paper IV, the main exposure variable was defined as *at least one parent having at least one registration* with medical benefits during the six-year period from 1992 to 1997 (1), in contrast to no registrations with medical benefit for either parent (0). In addition, the number of calendar years from 1992-97 with a registration of medical benefits was added up to a total for both parents together.

*Parental unemployment* was defined by long-term receipt of subsistence allowance from the employment office (>180 days during one calendar year in the period from 1992-

97), whereas *parental social assistance* was defined by long-term receipt of social assistance (>6 months during one calendar year in the period from 1992-97).

#### **4.6 Ethics**

All participants in the HUNT Study, adults and adolescents, signed a written consent for participation and the use of data for research. In addition parental consent was obtained for those aged below 16 years. The HUNT Study was approved by the Regional Medicine Ethical Committee and the Norwegian Data Inspectorate, and the present study was also approved by the Regional Medicine Ethical Committee.

#### **4.7 Analyses**

Descriptive statistics, logistic regression analyses and multinomial regression analyses were used to explore the associations between exposures in adolescence and the receipt of long-term social insurance benefits in young adulthood.

Descriptive statistics included percentages of study participants who were receiving long-term benefits at different ages during follow-up according to the main study variables.

In Paper I, the associations between RWD and benefit receipt was explored using logistic regression analyses on complete case data (n=7817), reporting odds ratios and predicted five-year risks of benefit receipt in the period from age 24 to 28. Medical benefits and all social benefits were separately assessed. Analyses were adjusted for the possible confounding of age, living situation, somatic health and parental education in one model and for mental health issues (including somatic symptoms, psychological distress, conduct and attention problems and alcohol consumption) in a separate model, as these factors could represent both confounding and mediating factors.

Paper II assessed the relationship between self-rated health in adolescence, high school dropout and benefit receipt from age 24-28. Benefit receipt from age 19-23 was compared with benefit receipt from age 24-28 using descriptive statistics, while five-year risks of receiving medical and non-medical benefits from age 24-28 were estimated according to adolescents' self-rated health and high school completion. In complete case

data (n=8339), multinomial logistic regression analyses were used to predict risk differences in the five-year risk to receive: 1) medical benefits, and 2) non-medical benefits relative to 3) no benefits according to self-rated health and high school dropout. Adjustment for parental education and sex was performed in a separate model. The risk differences were estimated with covariates at their mean and follow-up time at five years.

In Paper III, logistic regression analyses were used to explore the associations between adolescent and parental anxiety and depression symptom levels (psychological distress) and receipt of medical benefits from age 20-29 on the imputed data set (n=7497). Additional analyses were performed with unemployment benefits as an alternative outcome. Odds ratios were estimated for a one point increase in adolescents' SCL-5 score (range 1-4) and by comparing groups according to adolescent and parental anxiety and depression symptom levels (high vs. low). Adjustments for adolescent somatic health and for parental education and family risk factors were made in two separate models (in addition to sex, age and follow-up time), which regarded health as a potentially important confounder and family-related factors as potential confounders and/or intermediate factors. In the sibling subsample, a fixed-effect logistic regression model (140) was used to compare the anxiety and depression symptom level (the continuous SCL-5 score) *within* sibling groups to control for factors shared by siblings such as parental health, family socioeconomic status, home environment, etc.

In Paper IV, the association between adolescents' family characteristics and receiving a medical benefit as a young adult (20-29 years old) was explored using imputed data with information on 7,579 adolescents and both of their parents. Main analyses used logistic regression to estimate the odds ratio of medical benefit receipt from age 20-29 in the offspring according to parental receipt of medical benefits. Potential confounding and effect modification by family factors, including measures of socioeconomic status and family health, was addressed in age- and sex-adjusted regression models. Confounding by family health was investigated by adjusting for the family health risk score, which included all adolescent and parent health measures associated with parental

medical benefits (see section 4.7.3 and details in the paper). Sensitivity analyses were performed on complete cases (N = 3648).

#### ***4.7.1 Logistic regression***

In all papers logistic regression analyses were used. Odds ratios were used to compare the relative odds of receiving benefits given exposure to the variable of interest (e.g. health, RWD, parental benefits, etc.). In order to increase interpretability, predicted five-year risks (Paper I) and risk differences (Paper II) of a positive outcome (benefit receipt) given certain exposures were estimated from the results of the logistic regression models with covariates at mean values.

#### ***4.7.2 Sibling comparison***

In Papers I and III, sibling comparisons were used to adjust for residual confounding from unobserved family-level confounders (141). This method take advantage of the fact that siblings are exposed to many of the same background factors (such as parental characteristics, physical and social home environment, neighbourhood, etc.). Almost one-third of the adolescents in the Young-HUNT1 cohort had one or more sibling in the cohort, thereby allowing us to compare the anxiety and depression symptom level within sibling groups and control for all the unobserved characteristics shared by siblings. In Paper I, a within-siblings comparison was performed using a multilevel logistic regression – subtracting the siblings mean RWD score from each individual's value on the RWD variable. In Paper III, we used sibling fixed effects models (141).

#### ***4.7.3 Propensity score***

In Papers I and IV, health risk scores (similar to propensity scores used for adjustment purposes) were constructed in order to adjust for confounding by health (142). Health variables were included as predictors in a logistic regression model with the main study exposure (0-1) as the dependent variable. Adolescent somatic health measures were used to predict RWD in Paper I, whereas in Paper IV, adolescent and parental health measures were used to predict parental medical benefit receipt. Based on the coefficients from these regression analyses, health scores were constructed as the predicted probability of RWD (Paper I) and parental medical benefit (Paper IV).

#### ***4.7.4 Effect measure modification***

Effect measure modification by sex, age and other study variables was explored by including interaction terms in the regression analyses between these variables and the main study exposures. In Paper I, RWD status and gender interaction was included in all analyses and interaction by school level, and maternal education was also explored. Paper II included assessments of interaction between school dropout and sex and school dropout and self-reported health in the multinomial regression analyses. In Paper III, potential effect measure modification by sex and age was explored by including interaction terms between SCL-5 scale scores and sex and SCL-5 scale scores and age at baseline in the analyses. In Paper IV, possible effect measure modification by sex, family socioeconomic status and health was assessed by including interaction terms between each of these variables and parental benefit receipt in the analyses.

#### ***4.7.5 Longitudinal assessments***

GEE (Generalized Estimating Equations) analysis was used in Papers I, III and IV for the assessment of adolescent factors on young adult benefit receipt over time and in the course of the follow-up (143). This analysis is a population-averaged longitudinal assessment that allowed us to use multiple registrations of benefit receipt for each individual, each year in the follow-up (according to age) and also by dividing the follow-up in three periods according to age: 20-22 years, 23-25 years and 26-28 years. The development over time was assessed by adding an interaction term between study exposures and time (age or age groups) and separate effects at different periods in the follow-up.

#### ***4.7.6 Intra-class correlation coefficient***

The clustering of benefit receipt on the sibling (family) level was assessed by comparing the variance on the family level to the overall total variance. The conditional intra-class correlation coefficient (ICC) was calculated, thus reflecting the underlying propensity to receive a benefit that could be attributed to unknown factors on the family level (apart from those individual- and familial factors included in the analyses) (144).

#### **4.7.7 Missing imputation**

Multiple imputation was done in order to account for missing data in Papers III and IV. More than 90 variables on health, demography and benefit receipt for adolescent study participants and their biological mother and father were also included. Since we had such a rich dataset, including variables associated with non-participation in adult health surveys, we believe that the required assumption of “missing at random” was reasonable. We performed the multiple imputation procedure using chained equations (“mi impute chained” command) in STATA 12, creating 20 datasets (145). Continuous variables were imputed using linear regression, semi-continuous distributions/skewed variables were imputed using predictive mean matching and binary variables were imputed using logistic regression. The multiple imputation procedure was conducted following recommendations in the current guidelines, see (146).

The analyses were conducted using STATA 11 and STATA 12 software (StataCorp LP, Texas, USA). The results from logistic regression analyses were presented as odds ratios (OR) and/or as predicted risks or risk differences, with the odds ratios from the fixed-effect logistic regression and the multilevel analysis (sibling comparison) having a cluster-specific interpretation. All of the analyses were reported with 95% confidence intervals (CI).

## 5 RESULTS

### 5.1 Thesis supplement

#### 5.1.1 *Benefit receipt in the follow-up period*

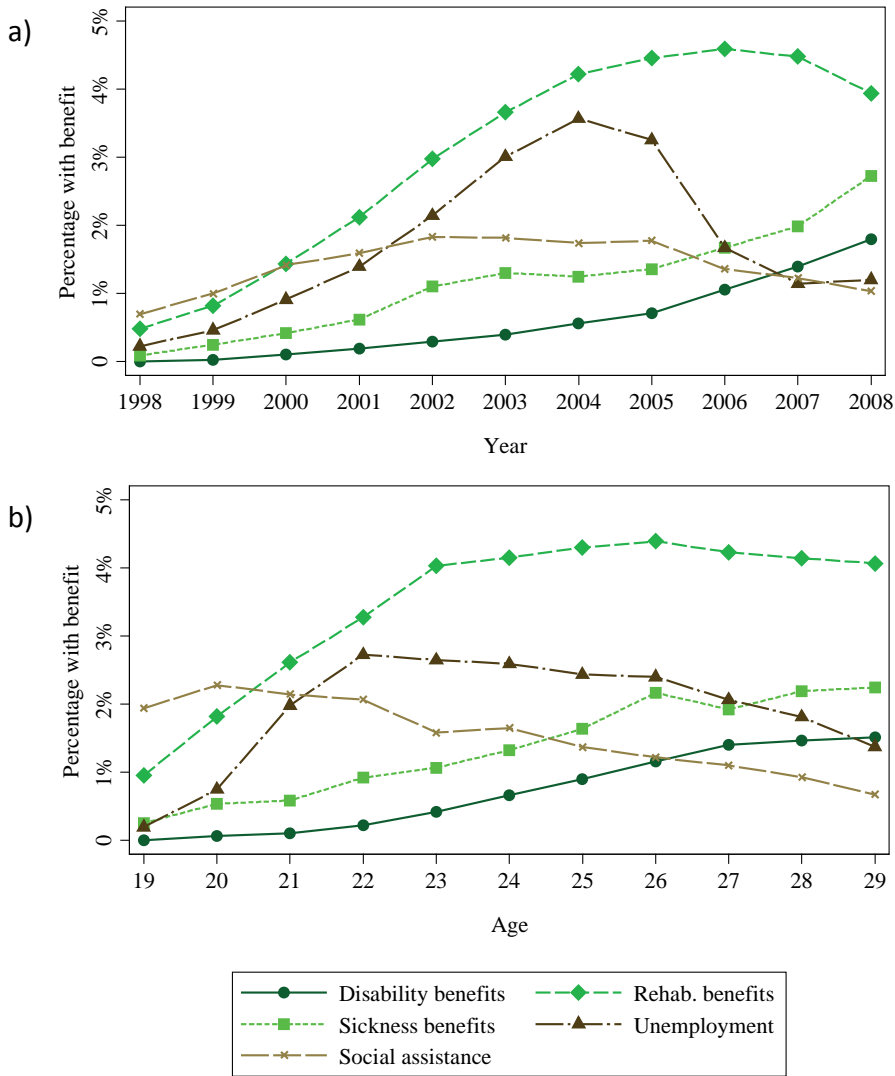
In total, 2,396 (27%) individuals in the Young-HUNT 1 cohort (n=8907) received a long-term benefit during follow-up (all social benefits included) – 1,280 (29%) of these were girls and 1,116 boys (25%). In total, 1,351 individuals received a long-term medical benefit (15% of the cohort) – 796 girls (18%) and 555 boys (12%).

The number of participants registered with benefits from age 20-29 was 2,307 (26 %) for all social benefits and 1,271 (14%) for medical benefits, while the number of participants registered with benefits from age 24-28 was 1,704 (19 %) for all social benefits and 1,061 (12%) for medical benefits. The number of participants in the cohort receiving different types of benefits is shown in Table 5.1 and Figures 5.1 and 5.2.

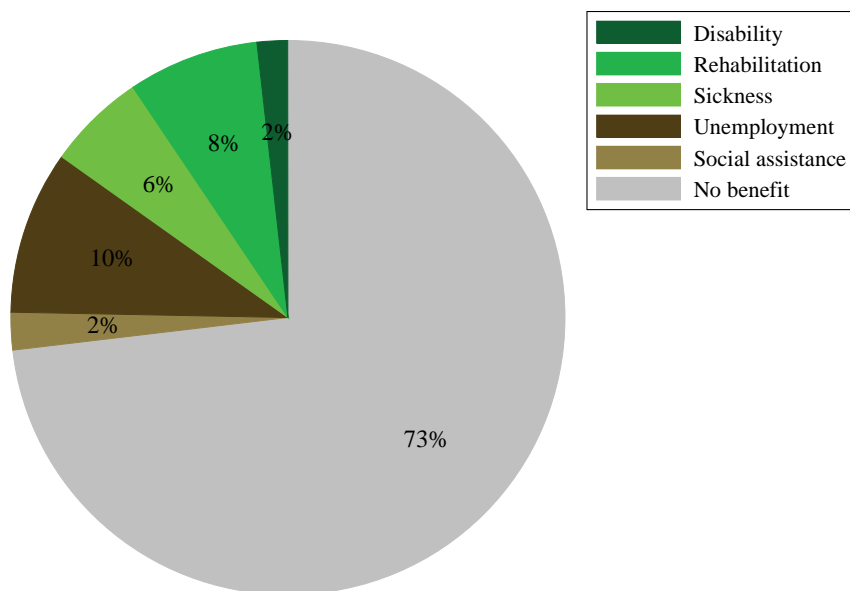
**Table 5.1** Number of participants receiving different benefits during follow-up from 1998-2008 (allowing for more than one benefit per participant), age when benefit was received for the first time and the percentage which also received other benefits during the follow-up period

	Type of benefit				
	Disability	Rehabilitation	Sickness	Unemployment	Social assistance
Number (%)	161 (2%)	830 (9%)	948 (11%)	1085 (12%)	580 (7%)
Percentage girls	55%	52%	61%	46%	47%
Median age when first received (years)	26	23	25	23	21
Percentage with other types of benefits	98%	84%	59%	31%	66%





**Figure 5.1** Percentage of participants ( $n=8907$ ) receiving different benefits during follow-up from 1998-2008 (allowing for more than one benefit per participant) according to: a) year and b) age in the follow-up period



**Figure 5.2** Pie chart representing the proportions of the Young-HUNT 1 cohort ( $n=8,907$ ) with different types of benefits in the follow-up period allowing for only one type of benefit per person (benefits ranged DP>rehabilitation>sick-leave>unemployment>social assistance)

### 5.1.2 Clustering of benefit receipt within siblings

In the Young-HUNT 1 cohort ( $n=8,907$ ), 3,263 (33%) individuals had one or more sibling in the cohort (registered with the same mother), which made it possible to assess the clustering of benefits on the family level.

The conditional intra-class correlation coefficient (ICC) for receipt of all social benefits was 28% (model adjusted for sex and age), indicating that 28% of the propensity of benefit reception could be attributed to the family/sibling level. The corresponding ICC for medical benefits was 21%.

### 5.1.3 Health characteristics and benefit receipt patterns

Self-reported health measures were associated with benefit receipt, which is shown in Table 5.2.

**Table 5.2** Percentage of Young-HUNT 1 participants (n=8907) reporting on various health factors according to the type of benefit received during follow-up (benefit group classified according to hierarchy: DP>rehab>sick-leave>unempl>soc.ass.)

	Type of benefit					
	None	Disability	Rehabilitation	Sickness	Unemployment	Social Assistance
N	6511	161	677	513	847	198
Mean age (years)	16.0	16.2	16.1	16.3	16.3	15.3
Male sex	52	45	48	30	55	48
<b>Self reported health measures (dichotomized) <sup>a</sup></b>						
Psychological distress	14	21	24	21	17	23
Conduct/attention	24	27	34	30	33	43
Somatic symptoms	32	38	43	48	39	45
Self-rated health not good	9	24	20	14	15	24
Disability	6	22	12	9	6	5
Chronic disease	21	39	31	28	20	23
<b>Self-reported health services utilization last year</b>						
Family doctor	48	40	48	56	47	38
Specialist	23	25	30	32	23	16
Psychologist	2	12	6	4	3	8
Physiotherapist	8	16	10	8	7	5
Admitted	6	12	12	11	7	7
School health service						
None	64	66	65	67	69	61
1-3 times	34	29	33	31	30	34
More than 3 times	1	4	2	2	1	5
School absence last year						
Less than 1 week	79	79	70	72	77	70
1-2 weeks	17	17	21	20	18	20
More than 2 weeks	4	4	8	8	6	10
<b>Health behaviour and other health-related measures</b>						
BMI (mean)	21.2	22.2	21.9	21.8	21.8	21.6
Daily smoker	8	12	21	14	16	24
Drunk >10 times	27	17	35	36	36	24
Divorced parents	16	22	33	23	27	45

<sup>a</sup> Psychological distress: SCL-5 score 2.0 or above; conduct/attention: scale score upper tertile; somatic symptoms: scale score upper tertile=2 or more symptoms; disability: medium or much impairment of hearing, movement or somatic illness or much impairment of vision; chronic disease (reporting of epilepsy, migraine, diabetes, asthma or other disease lasting more than three months).

## **5.2 Paper I**

### ***Reading and writing difficulties in adolescence and later risk of welfare dependence***

#### ***A ten year follow-up, the HUNT Study, Norway***

We examined the association between self-reported reading and writing difficulties (RWD) among Young-HUNT1 participants (age 12-20) and the five-year risk of receipt at age 24-28 years of: a) all social benefits, and b) medical benefits. A total of 725 out of 8,498 eligible study participants reported RWD (8.5%), and at the end of follow-up 1,012 participants (11.9%) had received medical benefits and 2,022 participants (23.8%) had received any social benefits. Participants in the RWD group more often received medical benefits at all ages during the follow-up period compared with those not reporting such problems. In the crude age adjusted logistic regression model, the estimated five-year risks for receiving medical benefits was higher in the RWD group compared with the non-RWD group, both in girls (0.23, 95% confidence interval (CI) 0.18-0.30 and 0.12, 95% CI 0.11-0.14, respectively) and boys (0.15, 95% CI 0.11-0.20 and 0.09, 95% CI 0.08-0.10, respectively). The adjustments for potential confounders (age, follow-up time, living situation, maternal education and somatic health) and confounding/ mediating factors (drunkenness, somatic symptoms, anxiety and depression symptoms and conduct and attention problems) did not alter these results substantially, thus indicating that the association between RWD and welfare dependence could to a small extent be accounted for by the variables we had included in our models. The same pattern was found in the analyses using all social benefits as the outcome. When comparing siblings differentially exposed to RWD, the effect of RWD status on benefit receipt was stronger in girls.

## **5.3 Paper II**

### ***School dropout: a major public health challenge: a 10-year prospective study on medical and non-medical social insurance benefits in young adulthood, the Young-HUNT 1 Study (Norway)***

In this paper, we examined the associations between self rated health among adolescents participating in the Young-HUNT1 Survey (n=8795), high school completion by age 24 and medical and non-medical social insurance benefits in young adulthood (age 24-28) available from national registers. A total of 17% of the adolescents was registered as

being high school dropouts at age 24, and the predicted five-year risk of receiving benefits between ages 24-28 was 21% (95% confidence interval (CI) 20% to 23%). Among those who had received medical benefits from age 19-23, 66% also received benefits from age 24-28, while only 38% of those with non-medical benefits from age 19-23 received benefits from age 24-28. High school dropouts had a five-year risk of receiving benefits of 44% (95% CI 41 to 48) compared with 16% (95% CI 15 to 17) in those who completed high school (adjusted for self-rated health, parental education and sex). There was a 27% school dropout rate in adolescents who reported poor health compared with 16% in those who reported good health. The predicted five-year risk of receiving any long-term social insurance benefits in adolescents who reported poor health was 33% (95% CI 30 to 37) compared with 20% (95% CI 19 to 21) in those who reported good health.

#### **5.4 Paper III**

##### ***The welfare burden of adolescent anxiety and depression: a prospective study of 7,500 young Norwegians and their families: The HUNT Study***

In a cohort of 7,497 adolescents, we studied the influence of anxiety and depression symptoms in adolescence (assessed by the SCL-5 score) on work integration in early adulthood assessed by the receipt of long-term medical benefits from age 20 to 29. We also studied the impact of parental anxiety and depression (assessed by the HADS score) on adolescents' future risk of medical benefit receipt. Adolescents with high levels of anxiety and depression symptoms had an increased risk of receiving medical benefits from age 20 to 29. Parental anxiety and depression symptom load was an indicator of their adolescent's future risk of medical benefit receipt, and adolescents with both parents reporting high symptom loads seemed to be at a particularly high risk. Confounding from family factors was not a likely explanation, as associations were present among siblings differentially exposed to anxiety and depression. Comparing siblings, a one point increase in the mean SCL-5 score was associated with a 65% increase in the odds of medical benefit receipt from age 20-29 (adjusted OR, 1.65, 95% CI 1.10 to 2.48). The anxiety and depression symptom load was only weakly associated with unemployment benefits.

## 5.5 Paper IV

### *Medical benefits in young Norwegians and their parents and the contribution of family health and socioeconomic status: The HUNT Study, Norway*

In the study cohort of 7,579 adolescents followed for 8.5 years (range 1 to 10 years) on average, 1,011 (13%) received long-term medical benefits from age 20-29. More girls (614, 16%) than boys (397, 11%) received medical benefits. Adolescents whose parents had received long-term medical benefits at some time during the six-year period from 1992 to 1997 (26%) were more likely to receive such benefits themselves from age 20-29 compared with adolescents without benefit-receiving parents (age- and sex-adjusted odds ratio (OR) 2.16, 95 % confidence interval (CI) 1.86-2.49). An adjustment for family health using a wide range of available health measures reduced this estimate considerably (to OR 1.66, 95% CI 1.38-1.99), whereas an adjustment for family socioeconomic factors had less of an impact (to OR 1.98, 95% CI 1.70-2.30). Most of the family factors included in the study were associated with adolescents' future risk of medical benefits: Parental medical benefits (OR 1.56, 95% CI 1.29-1.88), family health (high risk/upper quintile vs. low risk/lower quintile OR 1.54, 95% CI 1.15-2.06), parental education (low vs. high OR 1.62, 95% CI 1.18-2.22), parental divorce (OR 1.46, 95% CI 1.20-1.79), having teenage parents (OR 1.51, 95% CI 1.19-1.0), parental unemployment (OR 1.28, 95% CI 1.09-1.51) and parental social assistance (OR 1.57, 95% CI 1.26-1.95) were all strongly associated with adolescents' later medical benefit receipt in the fully adjusted model. A dose-response relationship was evident when grading the amount of parental medical benefit receipt in 1-3 years, 4-6 years and 7-12 years, with corresponding fully adjusted odds ratios of 1.48 (95% CI 1.20-1.83), 1.55 (95% CI 1.20-2.01) and 2.56 (95% CI 1.66-3.94), respectively.



## 6 DISCUSSION

### 6.1 Main results

Labour market integration problems, assessed by long-term receipt of social insurance benefits in young adulthood, were registered in approximately one out of four Young-HUNT1 study participants, and half of these received medical benefits. The four papers all concern adolescent's risk of receiving such benefits, and the main results and contributions to the existing knowledge were:

*1. Individual health and health-related characteristics measured in adolescence were associated with receiving long-term social insurance benefits in young adulthood.*

Self-reported reading and writing difficulties were associated with both medical benefits and all social benefits, also after adjusting for mental health characteristics (Paper I).

Self-rated health was associated with receiving medical and non-medical benefits (Paper II). Anxiety and depression symptoms were associated with receiving medical benefits, but not with unemployment benefit (Paper III). Other health measures were also associated with receiving benefits (Thesis supplement, section 5.1.3).

*2. School dropout was strongly associated with receiving long-term social insurance benefits in young adulthood.*

The results in Paper II demonstrated a strong relationship between high school dropout/completion and receiving medical and non-medical benefits, which suggested educational attainment as one pathway in the relationship between adolescent factors and young adult benefits. In Paper I, high school completion was lower in the RWD group and among those in the RWD group ending up with benefits.

*3. Family characteristics measured in adolescence were associated with receiving long-term social insurance benefits in young adulthood.*

Parental symptoms of anxiety and depression were associated with adolescents' risk of receiving medical benefits and unemployment benefits (Paper III), and parental medical benefits were associated with adolescent's risk of medical benefits (Paper IV).

Additionally, the findings in Paper IV indicated that family health, parental education,



parental income, divorce, parental unemployment and parental social assistance were all independent predictors of young adult medical benefits.

A more general discussion and interpretation of findings will be given later in this section. First, strengths and limitations related to the study design and accuracy of findings will be assessed. Are the findings trustworthy? Are the estimates reliable? Are the measures good enough? Are the study samples representative? And to what extent may the findings be generalized to other study settings? This will be assessed in a systematic discussion of study design, precision and validity.

## **6.2 Precision (lack of random error)**

All estimations in statistics and epidemiology are done with a component of chance called random error (147). The aim of our methods is to minimize the influence of chance and to consider its impact by variance estimates – reflecting the precision. The precision of a study depends on the number of participants, the proportion of exposed and unexposed and the prevalence of the outcome. In the present study, the study sample was fairly large and already determined by the number of participants in the Young-HUNT1 Survey. The study exposures were also common factors among the adolescents in the cohort, and the study outcome was assessed over a period of time in order for a sufficient proportion of the cohort to be registered with the outcome. This resulted in high levels of precision in the main analyses in all papers. In all analyses, we used 95% confidence intervals as a measure of precision. When comparing siblings, the N was substantially reduced and the effect measures less precise, which was illustrated by wide confidence intervals. Moreover, stratification of the study sample resulted in a reduced precision, especially when attempting to stratify by for example both age and sex.

## **6.3 Validity (lack of systematic error)**

The presence of systematic errors may lead to incorrect results or that the results are not suitable to describe what (e.g. the population) they were intended to. Systematic errors may be introduced in a study by the way the study participants are selected, by the measures used to assess their characteristics and by the analytical approaches. The main

categories of systematic errors are selection bias, information bias and confounding (147).

### **6.3.1 Selection bias**

Selection biases are distortions that result from the procedures used to select subjects and from factors that influence study participation (147). As a consequence, the association between the exposure and outcome among those selected for analysis may differ from the association among those eligible. Selection bias may have been introduced in our study at different stages when conditioning on common effects.

In Papers I and II, we excluded study participants who died during follow-up, as well as those who received a disability pension during follow-up who were already on sickness benefits in 1998. By doing so, we used information on the outcome status in the initial selection process, thereby introducing a potential selection bias. The group in question was small and did not bias the estimates in this case. In Papers III and IV, we included these participants.

Invitations were based on school registers. Youth not participating in the Young-HUNT1 study were mostly not in school when the study was conducted, did not want to participate or did not get consent from guardians (less than 1% in the age group 13-15 years). Some were unable to participate because of disabilities. The exact number of such disability was not registered, but the number was low. The high response rate indicates that the study cohort represents the population fairly well, and that no serious selection bias is present. Even so, it is likely that at least a part of the non-participating adolescents represent a group at increased risk of worklessness in young adulthood and which even already may be in a dropout process. This implies that the prevalence of dropout and benefit receipt in the study cohort might be lower than in the entire adolescent population (source population), and that a potential bias – if present – most likely would lead to an underestimation of the associations between the study exposures and benefit receipt in the present studies.

### **6.3.2 Missing data**

In all the analyses in the study, the conditioning on non-missing values of certain variables may have led to selection bias in our estimates, which is the case when performing analyses on complete case data. The levels of missing information in the Young-HUNT 1 Survey were modest and not regarded as a major problem in Paper I, Paper II or in the Thesis supplement. In Papers III and IV, the numbers of participants with missing data was a larger problem, as we also conditioned on participation in HUNT 2 for at least one parent, potentially leading to biased estimates. Smaller numbers of missing data were also observed for all health variables, which added up to large numbers when all these variables were included in the analysis adjusting for health in Paper IV.

Adolescents with missing parental data (only information on one parent for the main study variables) were in general more vulnerable, with higher proportions of medical benefits from age 20-29 than the study cohort as a whole. From studies on participation in HUNT 2/3, we also know that non-participants (parents) had a lower socioeconomic status and higher mortality and demonstrated a higher prevalence of several chronic diseases (148).

In order to account for missing data, we performed a multiple imputation. We included more than 90 variables on health, demography and benefit reception for adolescent study participants and their biological mother and father. Since we had such a rich dataset, including variables associated with non-participation in adult health surveys, we believe that the required assumption of “missing at random” was reasonable (146). The main results on imputed data in Papers III and IV did not differ substantially from the results on complete case data, hence indicating that the missing data did not bias the estimates. However, we cannot exclude that a selection bias was introduced with the initial exclusion of the approximately 1,000 adolescents, with no participating parents being from the study cohort.

### **6.3.3 Information bias**

Information bias arises from the mismeasurement of study variables, also called measurement error, as all quantitative data are prone to measurement error. The use of measurements in survey data to divide participants into defined groups or to put diagnostic labels on people is problematic since the risk of placing people into the wrong group (misclassification) is present even when validated clinical cut-off scores are used to define caseness. If the probability of being misclassified is the same across all study groups and in all study subjects and not dependent on the actual values of other variables (exposure, outcome and confounding variables), the misclassification is non-differential and the bias is predictable. However, if the probability of being misclassified is dependent on other variables, there is differential misclassification which introduces a bias that is more unpredictable (147). In our study, the most important potential source of information bias is a misclassification of the categorical and dichotomous measures, particularly in Papers I and III.

In general, measurements of the exposure variables in our study were considered as independent of the study outcome ensured by the cohort design. However, for the oldest participants in the study, it is possible that they were already in a dropout process when answering the questionnaire. In that case, the outcome status could have influenced self-reported measures. In Paper II, this could have led to an overestimation of the associations between self-rated health and dropout and self-rated health and benefit receipt.

#### *Main exposures*

In Paper I, reading and writing difficulties (RWD) were measured using self-reported information from the Young-HUNT questionnaire, which included several questions on reading and writing. The questions were not validated and could be exposed to measurement error – particularly for those with weak reading skills. Misclassification of RWD was therefore a potential limitation in this study. The measure of RWD used in the analyses was chosen, as we considered this the most simple and objective for representing a group with RWD-related problems, and for which the potential misclassification was considered non-differential. A more composite measure

containing more complex questions and subjective measures could lead to the over-reporting of problems by depressed or school-struggling adolescents and under-reporting by those with RWD. However, sensitivity analyses revealed that the association between RWD and welfare dependence was approximately the same, using alternative operationalizations of RWD status, including strictly self-reported problems and separate measures for reading and writing problems.

In Paper II, the misclassification of self-rated health is a possible limitation. In the Young-HUNT 1 questionnaire, there were four answering alternatives that we chose to dichotomize in our study. Self-rated health is commonly used and has been validated as a general health measure in adolescents and adults. In the Young-HUNT cohort, self-rated health in adolescence has been found to be significantly associated with a broad spectrum of independent variables reflecting medical, social and personal factors (37). Being in a process of dropping out of school could therefore lead to differential misclassification of self-rated health.

In Paper III, assessments of anxiety and depression (symptoms) were performed using validated questionnaires, the SCL-5 scale for adolescents and the HADS for adults (parents) (136, 139). We used these measures of anxiety and depression symptoms as both continuous- and dichotomous measures defining groups with high and low symptom levels according to established and recommended cut-offs. When these scales are used with a cut-off level in order to define “cases”, this could introduce misclassification, especially in symptom loads around the case level. In our study, potential misclassification is a particular concern regarding the SCL-5 scale score, which has only been validated in adult populations over the age of 15, in which a cut-off point (corresponding to a clinical diagnosis of anxiety or depression) of 2 has been suggested (136). Validations of related scales in adolescent populations have suggested a lower cut-off score (population aged 14-16 (149)), and cut-off scores probably also depend on age. In our study, a lower cut-off would result in a larger group with a high symptom level, increasing the sensitivity of the SCL-5 as a diagnostic tool for anxiety and depression, but also increasing the group of false positive individuals (particularly among the older participants). In order to account for the potential bias resulting from

such misclassification, we performed the analyses using symptom variables as continuous measures in addition to upper quintile scores assessed in subgroups according to school level (middle or secondary school) and sex. All analyses showed the same overall trend.

### *Outcome measures*

Our measures of benefit receipt were taken from FD-Trygd, which is a national database established and maintained by Statistics Norway (135). The information in the data files is in general highly reliable, being the basis for all payments and cash transfers from the state. In the observation periods used in our study (1998-2008 for main outcome measures and 1992-1997 for parental benefits), there have been several changes in the data structure, benefit structure, etc., all of which are potential sources of errors in the files. One example is registrations of medical rehabilitation benefits, for which there was a break in 2001-2002 due to a change of structure and sources for the information. Such errors are not considered important for our study, and will not be discussed more in detail (see [http://www.ssb.no/english/mikrodata\\_en/](http://www.ssb.no/english/mikrodata_en/)) (134). In the operationalization of our measures of benefit receipt there is also a potential for errors since we used information from several data files, and the collection of relevant data from some files was sometimes analytically challenging.

The way we constructed our measures of benefit receipt may have been a source of misclassification, primarily by the under-registration of the number of benefit recipients. We chose to include only unemployment registrations accompanied by cash transfers (“dagpenger” in Norwegian) from the state. Persons registered as long-term job seekers without cash transfers were registered with “no benefit”, while for the receipt of sickness absence benefits and unemployment benefits, we chose only to include those registered with more than 180 days with one particular benefit during one calendar year. By doing so, persons with long periods of benefit receipt could have been registered with “no benefit”, both those with (repeated) episodes shorter than 180 days and those with episodes longer than 180 days that lasted over two calendar years, but with less than 180 days in each year. However, potential misclassification is regarded as

non-differential and independent of the other study variables, and it seems unlikely that this would have any important impact on the results.

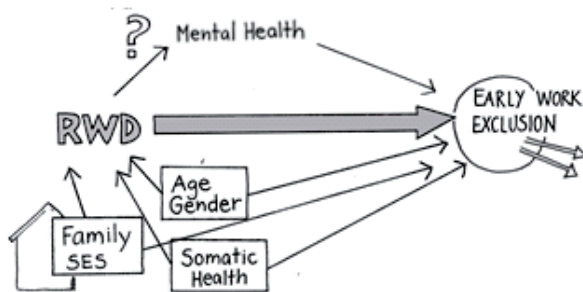
#### **6.3.4 Confounding**

Confounding is a mixing of effects that may result from a factor that acts as a common cause of the exposure and outcome in question. If an important confounding factor fails to be acknowledged and included in the analyses, a false assumption of the association between the exposure and outcome may be the result. Confounding is a particular methodological challenge in social epidemiology, as social factors and determinants may be difficult to measure and operate on several levels (macro – societal level, micro – individual level).

In our study it was of interest to identify whether certain adolescent factors were associated with work integration problems in young adulthood, and to explore whether these associations could be assumed to represent causal relationships. For all the analyses in the study, we worked out an epidemiological model based on a priori assumptions and established knowledge on the possible chain of causes. We identified the potential roles of different important factors as confounders, intermediate factors and effect modifiers, and used causal DAGs (directed acyclic graphs) in establishing the basic models (see Figure 6.1 for an example). Factors identified as potential confounders were measured and included in the analyses in separate models.

In Paper I, adjustment for potential confounders (age, sex, follow-up time, living situation, maternal education, somatic and mental health) did not substantially affect the association between RWD and receiving benefits at age 24-28. In Paper II, the association between high school dropout and receiving benefits at age 24-28 was not affected by adjustment for self-rated health, sex and maternal education. In Paper III, the association between adolescent anxiety and depression symptoms and medical benefits from age 20-29 was somewhat confounded by somatic health problems, as indicated by a 10% decrease in the point estimates upon adjustment. The association between parental anxiety and depression symptoms and medical benefits from age 20-29 was confounded by parental educational level and family risk factors. In Paper IV,

the association between parental and offspring's medical benefit receipt in young adulthood was substantially reduced when introducing family health, thus indicating a possible confounding by health.



**Figure 6.1** Example of a simplified DAG from Paper I: The association between reading and writing difficulties (RWD) and labour market integration problems may be potentially confounded by the presence of somatic conditions and family factors such as socioeconomic status, while mental health problems most probably represents an intermediate factor.

However, adjustment for measured and identified confounders may not have been sufficient to obtain unbiased estimates, and there are several sources of residual confounding (confounding still present after adjustment). First, the adjustments for possible confounding factors were based on adolescent self-reported information on one occasion only, and these measures may have been insufficient to capture important aspects of, for example, somatic and mental health (comorbidity). Secondly, *unobserved* factors – issues that were not included in our set of variables (like parental neglect, intellectual abilities and personality) may be of importance. Some of these factors could also have influenced the way participants responded to the questions. Third, *unobservable* factors – issues that are difficult to measure or quantify – may also cause residual confounding.



Many of the unobserved (or unobservable) factors important for adolescent health and well-being, and which were relevant as confounders in our study, were characteristics of the close environments in which the adolescents live, e.g. family, school and neighbourhood. Comparing adolescents' exposures *within* sibling groups allowed us to control for factors that are shared by siblings (such as parental health, family socioeconomic status, home environment, neighbourhood, etc.), which allowed us to reduce the residual confounding that could be attributed to the environment shared by siblings in Papers I and III.

### **6.3.5 External validity (generalizability)**

To what extent is it possible to generalize the findings in this study to other settings and contexts? Adolescent factors, work integration problems and the relationship between them differ between populations and over time. The particularities of the Norwegian study context (some of which were presented in Section 2.5), and in particular the Norwegian social insurance scheme, must be considered. Still, there are reasons to believe that the current findings may apply to the Norwegian study setting, as the Norwegian population is relatively homogenous regarding health, labour and welfare. Some exceptions may be the large cities, where the population is much more heterogeneous (in particular Oslo), and ethnic minorities, which were underrepresented in the Young-HUNT1 cohort.

On the other hand, reading and writing problems, common mental disorders and school dropout are challenges that young people currently encounter all over Europe, and there are no indications that these issues are less relevant or less linked to labour market integration in other European countries than in Norway. The relationship between medical benefits in parents and offspring in Paper IV is mostly relevant for a Norwegian setting, and for other Scandinavian countries with similar welfare systems. However, the importance of other family-related exposures may also apply to other countries.

Most of the analyses in the study report overall estimates for the entire cohort, i.e. boys and girls between the ages of 12-20. Generalizing the findings to this entire group of young people must also be done with care, as the study samples and study designs did

not allow us to explore age and sex dimensions in depth. Age and sex were included in all analyses, and in general, there were no signs of statistical interaction between these dimensions and study exposures. However, this does not mean that the associations were similar for all groups.

#### **6.4 Interpretation of the main findings**

The setting is Norway – one of the richest countries and most developed welfare states in the world, which on repeated occasions has been declared as “the best country in the world to live in”, while the time frame is the 1990s and the first decade of the 21<sup>st</sup> century. Since 1994, all young Norwegians have a statutory right to secondary education and more than 95% of children and adolescents attend *public* primary and secondary schools, both of which are free. Health services are mostly public, free to all children under age 18 and highly subsidized for adults. More than 75% of the working age population is employed, including 73% of women, and less than 4% of the population is registered as unemployed, while the youth unemployment rate is 10%. The proportion of immigrants is still small, particularly outside the big cities such as in Nord-Trøndelag County. The overall health of the population is good; nevertheless, approximately 10% of the population is on disability benefits. Sickness absence rates are high in comparison with other European countries, although such data comparisons could be misleading <sup>4</sup>. Work disability is most frequently justified by symptom-based medical diagnoses related to mental health problems or musculoskeletal conditions.

In the scenario described above, we have studied a group of young people in the transition from adolescence to young adulthood, and witnessed that many of the young persons experienced problems that may affect their future life and health. We have identified some specific factors in adolescents that seem to be associated with an increased risk of labour market integration problems and welfare dependence in young adulthood. These factors have been presented earlier and have been discussed in the

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<sup>4</sup> Partly due to the length of sick leave allowances (52 weeks) in the Norwegian social insurance scheme, which is longer than in most other countries, and with long-term absences (> 26 weeks) contributing with over half of the total absence.

papers, and in the following, some of the more general interpretations of our findings will be discussed.

#### ***6.4.1 Adolescence and transition to adulthood as important phases***

All the papers demonstrate that processes contributing to inclusion or exclusion take place in adolescence and young adulthood. Factors already present in adolescence influence the individual trajectories, and may contribute to increasing the risk of school dropout (Paper II) and non-employment (all papers) in early adulthood. The effects of adolescent factors seem to last over time, as demonstrated by the descriptive figures in all papers and the GEE analyses. Moreover, school dropout and receipt of benefits in the early 20s, in particular medical benefits, increase young people's risk of receiving benefits in the second half of their 20s. These findings indicate that the processes leading to work exclusion and worklessness in adulthood, may have started at a younger age. In addition, these processes may influence adult health and health inequalities, as long-term worklessness in young adulthood has been shown to predict adult morbidity and mortality (see background Section 2.2.1). These findings support the life-course approach as a suitable framework for the study of worklessness and work disability and adolescence as an important stage to assess within this framework.

#### ***6.4.2 Causes and pathways***

The results of the present work emphasize the complexity of the relationship between health and work. Receiving benefits in young adulthood in our study was associated with many factors reflecting different life aspects and contexts/levels, with these associations also dependent on the type of benefit (Papers I-III and Thesis supplement). This complexity may reflect characteristics of adolescence, as the different aspects of life are more intertwined during this period, especially for health. Self-rated health in adolescence has been shown to be associated with a broad spectrum of variables that reflect medical, social, psychological and lifestyle factors (37). Hence, the subjective nature of health in general and of sickness absence in particular, may also contribute to increased complexity.

Complexity is the hallmark of sickness absence, and research has revealed that a wide range of factors related to most aspects of life are related to work disability: genes and environment, past and present living conditions and several contextual levels – including country, community, general practitioner, neighbourhood and family (57, 58, 110, 111, 150-154). These predictors have also been shown to vary according to characteristics of sickness absence and disability (such as the length or the medical diagnosis). Moreover, the processes leading to worklessness are also complex and depend on the context. For example, health-related worklessness involves several stages (being sick, experiencing disability, being work impaired, deciding to work or not, etc.) (56), and each stage may be influenced by different factors.

Is it then possible to draw any conclusions on causes and pathways based on the present studies? Many of the factors related to health, school and family in adolescence which were studied in the papers may be considered to increase the vulnerability in young people and their liability to become workless. These factors are not per se *sufficient* causes in explaining work integration problems in young adulthood, though they may contribute by adding to the accumulation of risk over time, by acting in chains of risk leading to adverse outcomes and/or by increasing the underlying susceptibility to ill-health and adversity.

It is more difficult to draw any conclusions regarding the pathways by which the factors in the studies may lead to work integration problems. Pathways and mediating factors were not explored in the present work, as this is conceptually and analytically challenging and would require another study (design) (147). Qualitative research approaches may be needed in order to understand these processes, and it may also be necessary to assess causes and pathways separately for different types of worklessness. However, with support from the available literature, at least two *main pathways* may be suggested, namely through *health* and through *education*.

The results in Papers I and II indicate that school dropout may be one possible pathway in the relationship between RWD and benefit receipt and self-rated health and benefit receipt. This is supported by life-course studies which have described educational

attainment as an important intermediate factor between parental SES/education, cognitive abilities and childhood temperament and sickness absence/disability pension (39, 59, 67, 82).

For the relationship between anxiety and depression symptoms and benefit receipt educational attainment could also be an intermediate factor, as anxiety and depression symptoms may impair learning and school attainment. However, more importantly, adolescents with high anxiety and depression symptoms have an increased risk of experiencing mental illness later in life, which may also be the direct cause of work impairment (63, 65, 155). Upmark et al. suggest two main mechanisms by which background and psychosocial characteristics may predict a DP with a psychiatric diagnosis: 1) Predicting the effect of an underlying psychiatric disease on working capacity, and 2) Indicating a reduced employability and reduced working capacity per se (48). The association between anxiety and depression symptoms and benefit receipt in Paper III was much stronger for medical benefits than for unemployment, thus supporting an effect through mental health rather than through low education/reduced employability.

In the relationship between childhood adversity and later DP, Harkonmäki et al. propose three mediating pathways: through SES, health behaviour and mental health (106). These pathways could also be of importance for the associations between parental and family factors and benefit receipt in the offspring, which will be discussed further in the next section.

### **6.4.3 Family**

One of the main conclusions from our study is that family factors strongly influence the risk of non-employment in young adulthood: First, there is evidence for the importance of family characteristics at the individual level: Paper III demonstrate that parental symptoms of anxiety and depression were associated with offspring's risk of medical benefits and unemployment in young adulthood. In Paper IV, most of the family factors included in the study were of importance for sickness absence and disability in young adulthood, with evidence for "independent" effects of parental education, parental

medical benefits, parental health, divorce, parental unemployment and parental social assistance (when all factors were included simultaneously in the same regression model). Both Papers III and IV illustrate that adolescents' health risks may be insufficiently measured at the individual level. Parental health measures contributed with important predictive power both for symptoms of anxiety and depression and overall health. Secondly, a certain variance of benefit receipt in young adulthood may be attributed to the family level for both medical benefits and all social benefits (Thesis supplement, section 5.1.2).

These findings add new knowledge regarding the importance of family in the lives and life courses of young people today. However, the existing literature, including our study, has not been able to provide specific information on why and how family characteristics might play such a large role. In particular, it is unclear whether the family/parental influences act through shared background characteristics, or whether children and adolescents exposed to parental anxiety and depression, health impairment, unemployment or divorce are affected in more direct ways.

The relationship between parental anxiety and depression symptoms, parental medical benefits and offspring medical benefits could have been influenced by a shared genetic disposition to, e.g. depressive disorders, substance misuse or somatic diseases. Twin studies have also demonstrated that genetic influences might be important for the liability towards disability pension and sickness absence (109, 110). Such "genetic disposition to disability" (as a consequence of ill-health influences) could also be of importance for the intergenerational association of benefit receipt in our study.

Family environment and parental factors may also exert a negative influence on the development, health and well-being of the offspring (91, 96, 97, 99, 100, 103, 107). Thus far, the association between family and intergenerational influences and vulnerability to become workless in the offspring is not well understood, including the role of genetics.

#### **6.4.4 Health and health selection**

In the Norwegian debate on sickness absence, particularly regarding young people on medical benefits, health has seldom been attributed a major role. More attention has been drawn to non-medical individual factors, thereby contributing to increased stigmatization and moralization. Even so, what we observed in our study cohort was that almost all the dimensions of adolescent health were associated with the receipt of benefits in young adulthood and also with school dropout, which is the topic for another parallel PhD project. Dropping out of school and receiving long-term benefits have consequences for present and future socioeconomic status: High school dropout is a direct measure of educational attainment, and also predictive of future social class and income. Receiving long-term benefits is a direct measure of working status, and also predictive of future socioeconomic position. Thus, our findings indicate that adolescent health contributes in selecting individuals into adult groups of socioeconomic status regarding educational attainment, income and employment status.

Such health selection in adolescence and the transition to adulthood have been described in other studies. A Finnish study demonstrated that psychosomatic symptoms at age 16 were associated with educational attainment at age 22 and 32 (156), while data from the 1958 British cohort only showed an association between self-rated health at age 16 and social class in adulthood for men (157). Other studies have also found that health problems in childhood are significant determinants of outcomes linked to adult socioeconomic status (49, 158, 159). In contrast, the studies from the Northern Swedish Cohort have found less evidence for health selection processes in the transition to adulthood. Overweight, and only among women, was the only health indicator at 16 and 21 years which was related to being a blue-collar worker at age 30 years (160). Also, health selection was not related to the socioeconomic gradient in health at 30 years of age (161).

However, health selection has received less attention, has been less demonstrated and is less acknowledged than “social causation” hypotheses that health is influenced by socioeconomic position and employment status. Health selection processes may be particularly important in the early years when the foundation for socioeconomic status

is laid, so in order to study these processes a life-course approach with good data on health in childhood and adolescence is needed. In an article by Steven A. Haas, one of the concluding remarks regarding these issues was "...that health and SES (socioeconomic status) are deeply interconnected, with constant interaction and reciprocal feedback mechanisms over the life course" (49). The relationship between health and socioeconomic status, including processes of health selection and social causation, remains to be fully understood.

Our study indicated that health problems that make young people vulnerable to receive medical benefits are perhaps insufficiently assessed at the individual level. To date, very few studies have used parental health measures when studying health vulnerability in adolescents. This study indicates that parental health might give important additional information regarding future health risk and resilience at a stage in life where health can be difficult to assess.

#### ***6.4.5 The role of socioeconomic status***

Since the publication of the Black Report in 1980 (162), which reported on large health inequalities in the UK, there has been an increased amount of attention to social inequalities and social gradients in many aspects of health in the Western welfare states, including sickness absence and disability. In the 1990s and early 2000s the social determinants of sickness absence and disability pension were properly addressed in several epidemiological studies, which contributed to an increased acknowledgement of- and focus on such factors (151, 163).

To explore social gradients has been a main aspect of the present work and such gradients have been assessed and considered carefully in all the papers. In theory, we pictured two possible scenarios: A low socio-economic status (SES) could make adolescents more vulnerable to other factors (such as RWD, anxiety and depression symptoms, low self-rated health and school dropout), or a low SES could be associated with an increased risk in itself so that adolescents were less influenced by other factors. However, even if socioeconomic gradients were present in all the main factors studied in the different papers, the relationship between these factors and benefit receipt did not



seem to differ *according* to socioeconomic status. In other words, reporting reading and writing difficulties, poor health or a high level of anxiety and depression symptoms, dropping out of high school or having parents on medical benefits changed the risk of benefit receipt in almost the same way for adolescents with both high and low SES backgrounds.

However, this does not mean that socioeconomic status is irrelevant or of little importance for adolescents in the transition to adulthood and for labour market integration. On the contrary, parental socioeconomic status is a major risk factor for welfare dependence in young adulthood, regardless of other vulnerabilities. And even if there was no evidence for statistical interaction, this implies that the absolute risk increase was consequently larger in the lower SES group. In addition, young people's educational attainment (and thereby their own socioeconomic status) was strongly related to the receipt of benefits in our study (as demonstrated in Paper II ) and also to receiving an early DP, shown in a study on Norwegian population data by Gravseth et al (39).

## **6.5 Implications for practice and policy**

In this section some implications from the present work are discussed in short. The main emphasis is on health related aspects reflecting that this work and this author see the current subjects primarily from a health perspective. However, integrating the health perspective with other perspectives from social and educational sciences may be essential for success in preventing labour market integration problems in young people. There seems to be a widespread agreement of the need to address these problems because of their detrimental consequences for individuals and the society.

It is necessary to make some reservations regarding the use of quantitative studies based on data from individuals, like the present one, to suggest practical implications. Traditionally, epidemiology has been regarded as a descriptive research discipline. Even so, modern epidemiological research (including the present study) often aims to establish assumptions regarding causal pathways. Such assumptions may contribute to a better understanding of the underlying bio-psycho-social processes leading to symptoms

and disease, indicate directions for further research and identify potential targets for intervention. However, the limitations of epidemiological methods regarding causal inference should be acknowledged, and one must be careful to draw conclusions based on the present studies only. Finding an association between an exposure and an outcome in a population study does not necessarily mean that it is possible to influence the outcome by intervening on the exposure. For some purposes, intervention studies may be feasible ways to test out selected findings in practice.

Two different approaches to the present issues have been presented earlier; the sociomedical/social insurance approach and the child and adolescent public health approach. From the sociomedical perspective, the important question regarding prevention would be, “How can we prevent these young people from dropping out of school and work?”, while the question from the child and adolescent public health angle would be, “How can we improve child and adolescent health to ensure that their life chances are optimized?” The answers to these questions are partly overlapping, and this thesis has demonstrated that work integration problems often start in adolescence or earlier, and suggested that such problems may be prevented by addressing child and adolescent health issues.

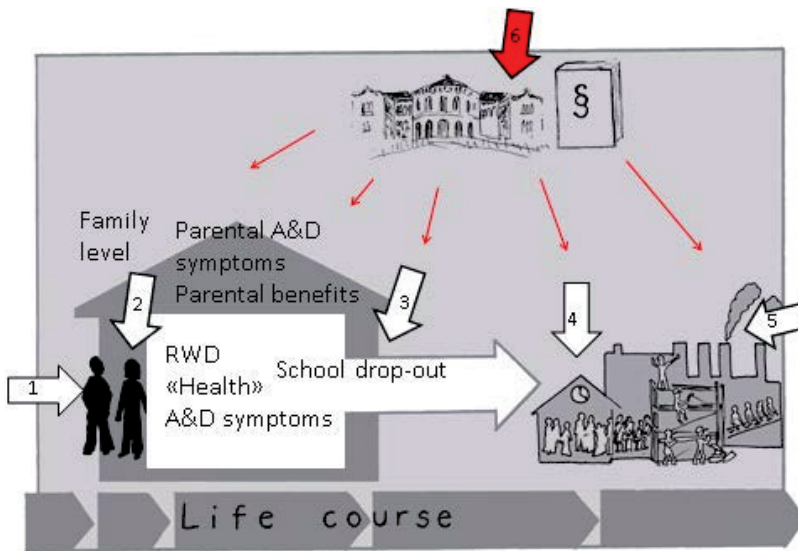
The present studies do not identify single factors which justify screening and/or targeting<sup>5</sup> in order to reduce work integration problems in young people. For example, even if we found consistent associations between symptoms of anxiety and depression and medical benefits in Paper II, the associations were modest and most adolescents with high symptom levels did *not* receive benefits. However, the present studies demonstrate that several factors may contribute to increase adolescents’ vulnerability to experience labour market integration problems in young adulthood. An implication of this may be that rather than targeting specific conditions or factors, a more general attention to adolescent vulnerability may be indicated. Our findings also indicate the need to see adolescent vulnerability in a family perspective. Broad initiatives targeting

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<sup>5</sup> The exception from this might be school drop-out, which is the topic for another ongoing PhD project at our department by Karin De Ridder.

adolescence (30, 83, 164) and family (165) as overarching structures, have been proposed as a way of improving child and adolescent health.

Prevention may be done by health promotion and by increasing resilience factors in addition to addressing risk factors and vulnerability. Figure 6.2 presents possible prevention strategies, or rather “entry points”, in relation to the findings of the current studies, with the arrows numbered from one to six pointing at relevant stages in the process leading towards permanent exclusion from the labour market:



**Figure 6.2** Main factors in the study associated with labour market integration problems in young adulthood assessed by the receipt of long-term social insurance benefits (A&D = anxiety and depression, RWD = reading and writing difficulties). The arrows indicate where preventive measures may be relevant. See the text for explanations; the numbers on the arrows correspond to numbers in the text

- 1. Prevent health problems and promote health and well-being, reduce vulnerability and increase resilience*
- 2. Prevent negative intergenerational continuities and promote positive intergenerational influences*
- 3. Prevent vulnerable adolescents from marginalization (processes)*
- 4. Prevent negative health consequences of dropout and worklessness*
- 5. Increase labour market inclusiveness*
- 6. Improve relevant policy and politics*

Preventive interventions could be universal (for all independent of risk), selected (for groups of high-risk individuals) or indicated (applied to individuals who are already in a dropout process) (164). Additionally, efforts may be done on a national level, on a regional or local level, on an organization level, on a group level and on an individual level.

In order to reach out to all young people, school and the educational system is a highly relevant target both for the prevention of dropout and worklessness in early adulthood and for health promotion. School interventions have shown to be effective in other fields such as improving physical activity (166). Moreover, the school system and the educational system may need modification in order to ensure that all young people have a better chance to attain a certain level of education or skills, or at least avoid the consequences of informal dropout.

There may also be a need to address the current issues more systematically in the health services. For example, special attention to future working life integration may be needed when following young people with chronic conditions. However, measures within the health care system must be carefully considered as there is also a risk of medicalization of the problems. Worklessness in young people has already to a certain extent been “medicalized” in Norway, as illustrated by the fact that half of all the young people in our cohort experiencing worklessness had been given a diagnostic label qualifying for health-related benefits. Again, schools may be the natural arena for offering universal high-quality health services to young people, with an emphasis on health promotion and

with inter-disciplinary approaches to help young people to cope with their health problems – aiming to increase function and capacity and to prevent medicalization and inequities.

Above all, as indicated by the red arrow in Figure 6.2, it is important to consider how adolescent vulnerability and work integration problems in young adulthood could be addressed by improving policy and politics. Such measures are the most powerful tools to achieve changes at the population level. Politics and policy can change social security legislation, labour market policy and health care and educational systems. Seen in a historical and international comparative perspective, the national policy in Norway in this area has been successful. Compared with other countries, a high proportion of the Norwegian population is employed, even in young adulthood. But there is obviously more that can be done in different sectors and at the national-, regional- and organizational levels. One major challenge to be dealt with is the limited opportunities in the labour market for young people with a disability and/or low levels of education. Finally, increased awareness and priority of young people and their health and vulnerability may be needed at all levels.

## 7 CONCLUSION

This work has identified some individual risk factors related to health, school and family that seem to make adolescents vulnerable in the transition to adulthood, as well as in the labour market integration process. Reading and writing difficulties, anxiety and depression symptoms and school dropout were common problems among the adolescents in the study, which were later related to worklessness and receiving long-term social insurance benefits. Family factors also seemed of particular importance for adolescents in the transition to adulthood, contributing with additional risk and vulnerability.

In this dissertation the main emphasis has been on the *health related* aspects of adolescent vulnerability and work integration problems. In order to understand these phenomena there is obviously also a need to consider other aspects, using different approaches and frameworks from other disciplines.

More research is needed on the causes and pathways of work integration problems in young people, including with the use of qualitative methods. The current results also need to be tested out in other study contexts. Health selection processes in the transition from adolescence to adulthood should also be explored using extensive health data, preferably on several occasions and with available information on parental health. Carefully planned and applied intervention studies will – for some purposes – be needed in order to find sensible ways to reduce the magnitude of the problem.

In addition, policy measures are needed to ensure that all young people have the possibility to attain a certain level of education or skills and to be properly integrated into the labour market. Increased attention should be given to the role of family and family health, with an emphasis on preventing the intergenerational transmission of disadvantage. At all levels, adolescents and adolescent health should be put on the agenda. Lastly, proper investments in good schools and integrated school health services and programmes should be made – aiming at reducing dropout and preventing inequities.



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# Paper I



RESEARCH ARTICLE

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# Reading and writing difficulties in adolescence and later risk of welfare dependence. A ten year follow-up, the HUNT Study, Norway

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## Abstract

**Background:** Welfare dependence and low work participation among young people have raised concern in many European countries. Reading and writing difficulties (RWD) might make young people vulnerable to work integration problems and welfare dependence through negative influences on education and health. Our main objective of this study was to examine if RWD in adolescence affected the risk of welfare dependence in young adulthood.

**Methods:** Baseline information on self-reported RWD, health and family was obtained for 8950 school-attending adolescents in Nord-Trøndelag County, Norway, participating in the Young-HUNT1 survey, 1995-97. All individuals were linked to biological parents to identify siblings and parental education from national registers. Welfare dependence was assessed by the reception of social benefits (medical and economic) from the national social insurance database (1998-2007). Only long-term benefits (> 180 days) were included.

**Results:** The adolescents who reported RWD at baseline were more likely to receive medical or social benefits during follow-up compared with those who did not report RWD. In girls with RWD, the adjusted 5-year risk (at age 24 to 28) for receiving medical benefits was 0.20 (95% confidence interval 0.14-0.26), compared with 0.11 (0.09-0.12) in girls without RWD. In boys the corresponding risks were 0.13 (0.09-0.17) and 0.08 (0.07-0.09).

**Conclusions:** The associations between RWD in adolescence and welfare dependence later in life suggest that increased attention should be paid to these problems when discussing the public health aspects of work integration, since there might be a potential for prevention.

## Background

Youth unemployment and high rates of welfare dependence have raised concerns regarding young adults' work-life integration in many European countries [1]. Reading and writing difficulties (RWD) may play a key role, as young people entering working life today face high demands for formal education and a good ability to read and write [2].

RWD are common conditions, affecting about 10% of school-age children and adolescents [3,4]. RWD are closely related to health problems; some medical conditions may have a general negative influence on school participation and learning while others are more specifically

associated with RWD [5-8]. RWD are also associated with a wide range of internalising and externalising mental health problems [9-13]. Moreover, RWD are distributed along a social gradient [4,14] and boys are more often affected than girls [15]. Young people with RWD are at risk of low education attainment, school dropout, psychosocial problems, low self-esteem and suicidal ideation [16,17]. Negative influences on education and health might also make these youngsters vulnerable to work integration problems and welfare dependence.

In Norway, individuals experiencing failure to obtain sufficient income through paid work will usually receive social benefits as an economic compensation [18,19]. These may be medical benefits, requiring that work ability is hampered by ill-health, and economic benefits, which may be given in the case of unemployment or

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economic hardship. Welfare dependence, defined as receiving such social benefits, is therefore a suitable measure to assess long-term consequences of RWD in the Norwegian context.

When assessing the role of RWD on welfare dependence, the role of health, socioeconomic status and other confounding factors must be addressed. Mental health problems are associated with adverse life outcomes and work disability [20,21] and might be considered as both an underlying cause as well as an intermediate factor in the association between RWD and welfare dependence: While internalising problems most commonly are considered an effect of RWD, the direction of the associations are somewhat unclear regarding externalising problems [12]. Parental education may be of particular importance as it is associated with both the prevalence of RWD and welfare dependence. Moreover, the family context itself may confound the associations; the consequences of RWD may depend upon the family composition.

RWD are common conditions among young people which have a potential for prevention and intervention. They may increase vulnerability to working exclusion as demands in working life to day are increasing. Yet, medical literature has so far to a small extent seized to understand this issue in a life course perspective. Thus the overall aim of the present study was to examine whether RWD in adolescence were associated with welfare dependence in adulthood, when adjusted for health issues in adolescence. In order to account for residual confounding related to family context we wanted to compare the siblings in our cohort. Furthermore, we wanted to assess how mental health issues affected the relationship between RWD and later welfare dependence and whether an association between RWD and welfare dependence differed according to gender or parental education.

## Methods

### Study participants

The Nord-Trøndelag Health Study (HUNT) is a large population-based study that invite participation of all inhabitants aged 13 and above in the county of Nord-Trøndelag [22]. Nord-Trøndelag county (total population in 2009: 130 708) is situated in the middle part of Norway and is geographical, demographical and occupational fairly representative of Norway as a whole, but lacking large cities. Between 1995 and 1997, all adolescents attending middle and secondary school (originally ages 13-19, but some participants were 12 and 20 years) were invited to participate in the first survey of the adolescent part of HUNT, Young-HUNT1. Totally 8950 students (90%) completed a questionnaire during class hours. Participants were linked with biological parents

through a national family register code in order to identify siblings, and information on parental education was accessed from the Norwegian National Education Database and from parental data from the HUNT 2 study (1995-97) [23]. We linked individual data from the Young-HUNT1 survey with information from the social insurance database (kept by the National Insurance Administration and available in Statistics Norway's events database [24]). This database contains complete records of social insurance benefit reception and allowed us to follow all the cohort members in the period 1998-2007.

We excluded all participants who died before the end of follow-up ( $n = 46$ ) and eight individuals with age-school mismatch. We also chose to exclude 101 individuals receiving a disability pension (DP) at age 18 or 19 and those who were already on sickness benefits in 1998 and later ended up with a DP. This group includes individuals with mental retardation, chromosomal abnormalities and extensive medical problems, for whom reading and writing difficulties are common, but of minor importance in relation to work ability. Of the remaining 8,795 participants, we obtained information on reading and writing difficulties for 8,498 who were included in the analyses.

### Ethics

Each student signed a written consent form to participate in the study and parents or guardians of students aged less than 16 also gave their written consent. The study was approved by the Regional Medicine Ethical Committee and the Norwegian Data Inspectorate.

### Dependent variable - welfare dependence

We constructed two different measures of welfare dependence based on the type of benefits 1) *medical benefits* (comprising sickness benefit, medical or vocational rehabilitation and disability pension (DP) in the Norwegian social insurance scheme) and 2) *all social benefits* (adding unemployment benefit and social support). We only included *long-term* benefits as we wanted our outcome measure to reflect individuals at substantial risk of future work exclusion. We included the benefits which in nature are long-term (DP, medical or vocational rehabilitation), and other benefits received at least 180 days during one calendar year. We constructed a dichotomous variable of having received or not received benefits (medical benefits and all social benefits) each year during follow-up from the year participants turned 19. We also constructed a dichotomous variable of having received or not received benefits (medical benefits and all social benefits) in the 5-year period from age 24 to 28 for use in the regression analyses. The window of ages 24 to 28 was used in order to

have sufficiently many cases of benefit receipt combined with maximum follow-up time.

### Self-reported reading and writing difficulties

Subjects were classified as having reading and writing difficulties (RWD) if they answered yes to the question "Do you currently receive help for reading or writing problems?" or if they reported major problems with either reading or writing during the last 12 months (options were major problems, some problems and no problems for both reading and writing problems).

### Covariates

Information on age, gender, living situation, somatic health problems and mental health was collected from the questionnaire at baseline. Parental education at baseline was assessed using parental data on education from the Norwegian National Education Database, supplemented by self-reported educational level in HUNT 2. *Living situation* was categorized as living with both parents, living with one parent and new partner, living with one parent only, living with other adults, living alone or living with a partner.

In order to adjust for a broad range of *somatic health* indicators, we constructed a propensity score predicting reading and writing difficulties [25]. The propensity score contained questions concerning disabilities (vision, hearing, and movement), diseases (epilepsy, migraine, diabetes, asthma, other disease lasting more than three months), use of health services (contact with medical specialist, hospital admission) and long-term school absence because of sickness. The propensity score was included in the analyses as a continuous variable, ranging from 0 to 1.

*Somatic symptoms* was included as a continuous scale score based on the self-reported presence during the last 12 months (never, seldom, sometimes or often) of eight different symptoms (headache, neck or shoulder pain, aching of muscles or joints, stomach pain, nausea, constipation, diarrhoea and palpitations) (Cronbach's alpha 0, 74). *Anxiety and depression symptoms* was measured with the validated 5-item Symptoms Check List (SCL-5) [26,27]. *Conduct and attention problems* were assessed using variables from a school adjustment scale containing 14 school-related items, each with four alternative answers (never, sometimes, often and very often) [28]. Six questions related to conduct and attention problems ("quarrels with the teacher", "get into fights", "get scolded by the teacher", "shirks school", "has difficulties concentrating in class" and "can not be quiet/calm in class") were summed up separately, rescaled in the range 0 to 1 and used in the analyses as a continuous variable (alpha 0, 67). *Alcohol consumption* was categorized as having ever been drunk more than 10 times, or not.

*Parental education* was measured as primary, secondary and tertiary education. Data were available for 8, 085 (95%) of the mothers and 7, 442 (88%) of the fathers. Maternal education was used in the multivariable analyses due to little missing data and 87% of the adolescents (92% at age 12 to 15) living with their mother. *Siblings* (having the same mother) in the study cohort were identified through the family register. In total, 3, 000 subjects had at least one sibling in the cohort.

### Analyses

The associations between RWD and benefit reception were explored in complete case data (N = 7, 817). Multivariable logistic regression analyses were performed with benefit reception in the 5-year period from age 24 to 28 as the outcome measure in two conceptual models. In model 1, we adjusted for the confounding of age, living situation, somatic health and parental education. In model 2, we adjusted for mental health issues (including somatic symptoms, anxiety and depression symptoms, conduct and attention problems and alcohol consumption) additionally, as these factors could represent both confounding and mediating factors. Reception of medical benefits and all social benefits was assessed separately.

Logistic regression analyses were used to estimate predicted 5-year risks and corresponding odds ratios (OR), all reported with 95% confidence intervals (CI). Predictions were made using the program *predxcat* [29], keeping covariates at their mean and setting follow-up time to 5 years. All analyses included RWD-status and gender interaction. Effect measure modification by school level and maternal education was explored separately by adding interaction terms in the analyses (between RWD-status and school level and RWD-status and maternal education). Longitudinal assessments using all observations in the follow-up period were conducted in population-averaged models, using generalized estimation equations (GEE) analyses [30]. The development over time was explored by including an interaction term between RWD-status and time (years).

Sibling comparison was used mainly as a way of adjusting for family level covariates by comparing individuals with their own siblings (those having the same mother) instead of with all the other individuals in the cohort. We used multilevel mixed-effects logistic regression. Within-siblings comparisons were performed with sibling-mean centring—subtracting the siblings mean RWD from each individual's value on the RWD variable [31]. All Analyses were conducted using STATA 11 software (StataCorp LP, Texas, USA).

### Results

Descriptive statistics of the study cohort according to RWD status is presented in Table 1. A total of 725

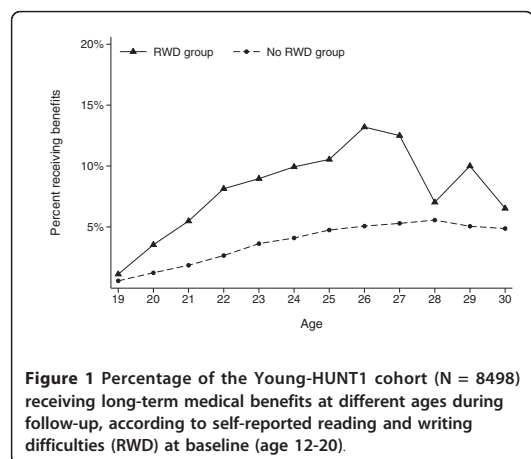
**Table 1 Participant characteristics according to self-reported reading and writing difficulties (RWD), percentages, means and standard deviations.**

Participant characteristics	RWD group (n = 725)	Non-RWD group (n = 7, 773)
Baseline 1995-1997		
Male sex (%)	63.0	48.8
Middle school attendees (%)	70.2	50.7
Drunk more than 10 times (%)	18.9	31.0
Living situation (%)		
Living with both parents	71.5	71.3
Living with one parent and new partner	5.3	7.0
Living with only mother or father	11.2	10.3
Living with other adults	5.7	3.7
Living alone	5.0	5.7
Living with a partner	1.4	2.0
Mother's educational level (%)		
Primary	17.9	13.7
Secondary	67.1	64.5
Tertiary	15.1	21.8
Father's educational level (%)		
Primary	21.9	14.9
Secondary	64.6	62.7
Tertiary	13.5	22.5
Having a sibling in cohort (%)	33.7	35.5
Complete cases (%)	87.2	92.4
Age - years	15.39 (1.79)	16.09 (1.79)
Somatic health - propensity score	0.10 (0.04)	0.09 (0.02)
Symptom index	0.22 (0.15)	0.22 (0.15)
Anxiety and depression - index	0.14 (0.17)	0.15 (0.16)
Conduct and attention problems - index	0.21 (0.14)	0.19 (0.12)
Status 2007		
Age - years	26.35 (1.77)	27.05 (1.85)
Follow-up time age 24-28 - years	3.13 (1.39)	3.66 (1.37)
Secondary education		
Not completed age 24 (%)	33.7	16.7
Received long-term medical benefits		
At end of follow-up (%)	18.8	11.3
At age 24-28 (%)	15.0	8.9
No secondary education age 24 (%)	57.8	35.5
Received any long-term social benefits		
At end of follow-up (%)	35.0	22.8
At age 24-28 (%)	22.8	15.6
No secondary education age 24 (%)	59.4	26.1

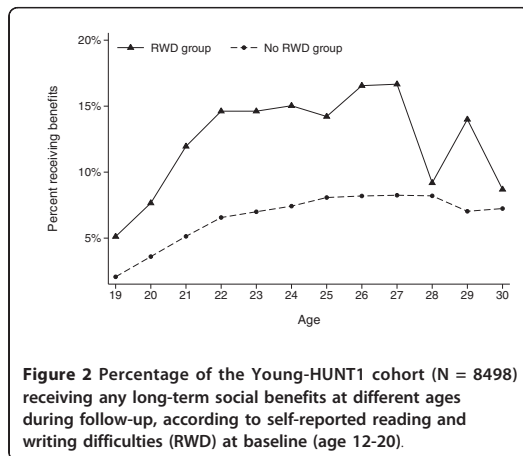
participants (268 girls and 457 boys) out of 8, 498 (8.5%) were included in our RWD group. Participants in this group were in general younger, had lower educated parents and more often reported conduct and attention

problems. At the end of follow-up 1012 participants (11.9%) had received medical benefits, and 2022 participants (23.8%) had received any social benefits. Figure 1 shows that participants in the RWD group (solid line) more often received medical benefits at all ages during the follow-up period, compared with those not reporting such problems (dashed line), except at ages 28-30, where the total numbers are small. Figure 2 shows the same for all social benefits.

In the crude age adjusted logistic regression model, the estimated 5-year risks for receiving medical benefits was higher in the RWD group compared with the non-RWD group both in girls (0.23 (CI 0.18-0.30) and 0.12 (CI 0.11-0.14) respectively) and boys (0.15 (CI 0.11-0.20) and 0.09 (CI 0.08-0.10) respectively). The adjustments for potential confounders in model 1 and 2 did not alter these results substantially (Table 2), indicating that the association between RWD and welfare dependence to a small extent could be accounted for by the variables we had included in our models. The same pattern was found in the analyses using all social benefits as the outcome (Table 3). There was no statistically significant effect-measure modification between RWD status and school level on benefit reception (p-value for the interaction term 0.63 (medical benefits) and 0.94 (all social benefits)). Longitudinal assessments of benefit reception each year during follow-up using GEE analyses revealed similar associations between RWD status and later benefit reception: Population-averaged estimates in the fully adjusted model (model 2 + time/years) reported as odds ratios (OR) were 2.06 (CI 1.56-2.72) for medical benefits and 1.84 (CI 1.51-2.23) for all social benefits. There was no statistically significant effect-measure modification between RWD status and time/years on benefit reception (p-value for the interaction term 0.34 (medical



**Figure 1** Percentage of the Young-HUNT1 cohort (N = 8498) receiving long-term medical benefits at different ages during follow-up, according to self-reported reading and writing difficulties (RWD) at baseline (age 12-20).



benefits) and 0.39 (all social benefits)), indicating a stable impact of RWD on benefit reception during the course of time in the follow-up period.

#### Effect-measure modification by parental education

Parental education was highly associated with benefit reception in the cohort as a whole. In the RWD group, however, the risk of receiving benefits was more or less the same regardless of the level of parental education (p-value for the interaction term between RWD and maternal education in a fully adjusted model with medical benefits as the outcome 0.10).

#### Sibling comparison

A total of 244 siblings (98 girls and 146 boys) out of 3,000 (8.1%) were included in our RWD group. The cluster-specific RWD odds ratios on complete cases when comparing individuals with their siblings were

comparable to the odds ratios from the logistic regression models (table 2), but the estimates were more uncertain due to lower numbers. We also found increased differences between girls and boys in these analyses. For reception of medical benefits the RWD odds ratio was 2.38 (CI 0.87-6.45) for girls and 0.77 (CI 0.29-2.07) for boys. Corresponding estimates for all social benefits were OR 2.13 (CI 0.90-5.01) for girls and OR 1.09 (CI 0.49-2.44) for boys. We could also observe a higher risk of benefit reception in the families with adolescents reporting RWD.

#### Discussion

Adolescents reporting reading and writing difficulties (RWD) had an elevated risk of welfare dependence as young adults, also after adjustment for a variety of health issues at baseline. The effect was larger for girls. We found no additional protective effect of having highly educated parents for individuals with RWD. Adjusting for mental health in adolescence did not affect the association between RWD and welfare dependence in our data. Main findings did not differ substantially according to whether medical benefits only or all social benefits were used as the main outcome measure.

#### Strengths and limitations

This is a large longitudinal study with a high participation rate, relatively low levels of missing data and complete follow-up in registers. We were able to adjust for a range of possible confounding factors, as well as comparing the outcome of siblings with and without RWD. A limitation of the study could be our measure of RWD status, which was rough, containing no grading of problems and reliant on self-reported questionnaire data. Our results must be interpreted having this in mind. Our study might not always be comparable to other studies measuring reading skills or using a clinical

**Table 2** Logistic regression analyses\* of self-reported reading and writing difficulties (RWD) in adolescence (age 12-20) and reception of medical benefits at age 24-28.

	n	Model 1 <sup>a</sup>		Model 2 <sup>b</sup>	
		5-year risk (95% CI)	Odds Ratio (95% CI)	5-year risk (95% CI)	Odds Ratio (95% CI)
Girls not reporting RWD	3,699	0.11 (0.10, 0.13)	1 (ref)	0.11 (0.09, 0.12)	1 (ref)
Girls reporting RWD	233	0.21 (0.16, 0.28)	2.10 (1.46, 3.02)	0.20 (0.14, 0.26)	2.08 (1.44, 3.00)
Boys not reporting RWD	3,486	0.08 (0.07, 0.09)	1 (ref)	0.08 (0.07, 0.09)	1 (ref)
Boys reporting RWD	399	0.13 (0.10, 0.17)	1.69 (1.20, 2.39)	0.13 (0.09, 0.17)	1.66 (1.17, 2.34)

\*Results are reported as predicted 5-year risks and odds ratios. All analyses are performed on complete case data (n = 7,817) and include RWD-status and gender interaction.

<sup>a</sup>Adjusted for age, follow-up time, living situation, maternal education and somatic health.

<sup>b</sup>Adjusted for age, follow-up time, living situation, maternal education, somatic health and mental health issues



**Table 3 Logistic regression analyses\* of self-reported reading and writing difficulties (RWD) in adolescence (age 12-20) and reception of all social benefits at age 24-28.**

	n	Model 1 <sup>a</sup>		Model 2 <sup>b</sup>	
		5-year risk (95% CI)	Odds Ratio (95% CI)	5-year risk (95% CI)	Odds Ratio (95% CI)
Girls not reporting RWD	3, 699	0.20 (0.18, 0.22)	1 (ref)	0.19 (0.17, 0.21)	1 (ref)
Girls reporting RWD	233	0.35 (0.28, 0.42)	2.10 (1.53, 2.88)	0.33 (0.26, 0.40)	2.09 (1.52, 2.88)
Boys not reporting RWD	3, 486	0.16 (0.15, 0.18)	1 (ref)	0.16 (0.15, 0.18)	1 (ref)
Boys reporting RWD	399	0.23 (0.19, 0.29)	1.56 (1.18, 2.06)	0.23 (0.18, 0.28)	1.53 (1.15, 2.03)

\*Results are reported as predicted 5-year risks and odds ratios. All analyses are performed on complete case data (n = 7, 817) and include RWD-status and gender interaction.

<sup>a</sup>Adjusted for age, follow-up time, living situation, maternal education and somatic health. <sup>b</sup>Adjusted for age, follow-up time, living situation, maternal education, somatic health and mental health issues

diagnosis of dyslexia. We do however believe that our RWD group represents a group having RWD-related problems and that potential misclassification is non-differential - meaning that the associations we found in our study would be even stronger if our measure of RWD was better. The results of the current study apply to the school-attending adolescent population in Norway and the Norwegian welfare system. The major importance of reading and writing skills and the concerns for young people in the school to work transition are common features of many societies and across country borders. Our results may suggest a more general relationship between RWD related problems and work related life outcomes, but this needs to be tested in other contexts.

#### Long-term consequences of RWD

Our study used population data and a modern social epidemiological approach to show that self-reported RWD in adolescence was associated with welfare dependence in young adulthood. Welfare dependence in this age group is an important indicator of failure in the work integration process and also of increased risk of future and permanent work exclusion [18,32,33]. Our findings concur with studies that have followed young dyslectics or learning disabled into adulthood (although only in small cohorts) and reported high levels of unemployment [17]. Low literacy proficiency in adult population samples has been associated with higher levels of unemployment [34] and risk of receiving a disability pension [35] in cross-sectional studies. A comparable study conducted in an urban US population with a cohort representing lower socioeconomic status, did however not find a strong association between RWD and various outcomes at ages 21 and 24 [36]. Interpreted in light of our own findings, we might suspect a socioeconomic gradient in the impact of RWD on life

outcomes. Moreover, the US study compared to our study illustrate that results always must be seen in the proper context - especially when studying social conditions.

Our study suggests that RWD might have different implications for girls and boys. This was most attenuated when comparing girls and boys with their siblings. One possible explanation is that girls reporting RWD were more different from their peers (and siblings), than the boys—nuances not possible to register in our dichotomous RWD measure. Girls generally read better and more than boys [37], and they more often attain higher education [38]. RWD might have a greater impact on girls in terms of self-esteem, mental health and academic and occupational choices, and could possibly explain their increased vulnerability. The increased risk of receiving social benefits due to RWD for boys was marginal when adjusting for all the family properties in the sibling analysis. This could imply that boys are more unaffected by reading and writing skills when entering adulthood. However, there is a possibility that siblings of boys with RWD have more RWD-related problems. Also, there was an increased risk at the family level, and this could be equally related to RWD or any other psychosocial factors.

#### Future challenges: finding causal pathways

Our study shows that RWD in adolescence are important vulnerabilities that may impact on future work-life. The mechanisms behind this are not well understood, since general work ability normally should not be impaired by RWD alone. Furthermore, RWD are not valid diagnoses qualifying for medical benefits and it is unlikely that RWD should be the direct cause of somatic health problems, leading to health related work exclusion. We discuss two pathways to be explored in the future, when trying to explain why RWD increase the

risk of welfare dependence; negative effects on mental health and problems regarding school or education. Previous research has described consequences of RWD on mental health, which could be a possible pathway to welfare dependence and early work exclusion [9-11]. However, adjustment for mental health problems did not substantially influence the results in our study. This interpretation is of course limited by our self-reported measures and the fact that RWD and mental health were measured at the same time, rather than allowing the effects of RWD on mental health issues to develop fully. On the other hand, depressive symptoms have been found to appear shortly after manifestation of RWD and not worsen over time [9].

RWD are known to interfere with academic attainment and occupational choices. The percentage of benefit receivers at age 24 - 28 in our data who had not completed secondary education at age 24 was nearly 60% for those reporting RWD, compared to 25 - 35% for those not reporting RWD (Table 1) - suggesting that educational attainment can be a substantial mediating factor of the effect of RWD on benefit reception. Other studies following young cohorts of dyslectics or learning disabled into adulthood have reported low educational aspirations and a high proportion of people in blue-collar or unskilled work [39-41], known to imply on unemployment and work exclusion. On the other hand, a Norwegian cohort of dyslectics showed only slightly lower educational attainment levels at age 23 compared with a representative population sample [42]. These issues should be more extensively explored in order to plan general and individual measures in the schools and in the health services aimed at minimizing the negative consequences of RWD. Targeted interventions have been shown to be effective in adults [43].

## Conclusions

Our study advocates paying increasing attention to the impact of RWD on welfare dependence and future work participation. The increased vulnerability in young individuals with RWD should be acknowledged by teachers, health personnel and others dealing directly with these young people, but also by public health institutions and politicians. More knowledge is needed on the mechanisms that make young people with RWD vulnerable in order to plan preventive actions and interventions.

## Acknowledgements and funding

We would like to thank all members of our research network HealthWIN, for inspiration and useful discussions, and in particular professor Roar Johnsen. This work was supported by the Norwegian University of Science and Technology and by the Norwegian Research Council. The Nord-Trøndelag Health Study (The HUNT Study) is a collaboration between HUNT Research Centre (Faculty of Medicine, Norwegian University of Science and

Technology NTNU), Nord-Trøndelag County Council, Central Norway Health Authority, and the Norwegian Institute of Public Health.

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## Authors' contributions

KP carried out the data processing, the epidemiological modelling and statistical analysis and wrote the manuscript. JHB contributed to the statistical analysis, data interpretation and drafting of the manuscript. TLH is the PI of the Young-HUNT Study and together with SK and SW participated in the design of the study and helped to write the manuscript. All authors have read and approved the final version of the manuscript.

## Competing interests

The authors declare that they have no competing interests.

Received: 7 February 2011 Accepted: 23 September 2011

Published: 23 September 2011

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#### Pre-publication history

The pre-publication history for this paper can be accessed here:  
http://www.biomedcentral.com/1471-2458/11/718/prepub

doi:10.1186/1471-2458-11-718

**Cite this article as:** Pape et al.: Reading and writing difficulties in adolescence and later risk of welfare dependence. A ten year follow-up, the HUNT Study, Norway. *BMC Public Health* 2011 **11**:718.

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# Paper II

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# Paper III





# The welfare burden of adolescent anxiety and depression: a prospective study of 7500 young Norwegians and their families: the HUNT study

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**To cite:** Pape K, Bjørngaard JH, Holmen TL, *et al*. The welfare burden of adolescent anxiety and depression: a prospective study of 7500 young Norwegians and their families: the HUNT study. *BMJ Open* 2012;**2**:e001942. doi:10.1136/bmjopen-2012-001942

► Prepublication history and additional material for this paper are available online. To view these files please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2012-001942>).

Received 9 August 2012  
Accepted 5 October 2012

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## ABSTRACT

**Objectives:** To examine the association between anxiety and depression symptoms in adolescents and their families and later medical benefit receipt in young adulthood.

**Design:** Prospective cohort study. Norwegian population study linked to national registers.

**Participants:** Data from the Nord-Trøndelag Health Study 1995–1997 (HUNT) gave information on anxiety and depression symptoms as self-reported by 7497 school-attending adolescents (Hopkins Symptoms Checklist—SCL-5 score) and their parents (Hospital Anxiety and Depression Scale score). There were 2711 adolescents with one or more siblings in the cohort.

**Outcome measures:** Adolescents were followed for 10 years in national social security registers, identifying long-term receipt of medical benefits (main outcome) and unemployment benefits for comparison from ages 20–29.

**Methods:** We used logistic regression to estimate OR of benefit receipt for groups according to adolescent and parental anxiety and depression symptom load (high vs low symptom loads) and for a one point increase in the continuous SCL-5 score (range 1–4). We adjusted for family-level confounders by comparing siblings differentially exposed to anxiety and depression symptoms.

**Results:** Comparing siblings, a one point increase in the mean SCL-5 score was associated with a 65% increase in the odds of *medical* benefit receipt from age 20–29 (adjusted OR, 1.65, 95% CI 1.10 to 2.48). Parental anxiety and depression symptom load was an indicator of their adolescent's future risk of medical benefit receipt, and adolescents with both parents reporting high symptom loads seemed to be at a particularly high risk. The anxiety and depression symptom load was only weakly associated with *unemployment* benefits.

**Conclusions:** Adolescents in families hampered by anxiety and depression symptoms are at a substantially higher risk of medical welfare dependence in young adulthood. The prevention and treatment of anxiety and depression in adolescence should be family-oriented and aimed at ensuring work-life integration.

## ARTICLE SUMMARY

### Article focus

- The influence of anxiety and depression symptoms in adolescence on work integration in early adulthood, assessed by the receipt of long-term medical benefits from age 20 to 29.
- The impact of parental anxiety and depression on adolescents' future risk of medical benefit receipt.

### Key messages

- Adolescents with high levels of anxiety and depression symptoms had increased risk of receiving medical benefits from age 20 to 29.
- Confounding from family factors was not a likely explanation as associations were present among siblings differentially exposed to anxiety and depression.
- High parental levels of anxiety and depression symptoms were associated with an increased risk of medical benefit receipt from age 20 to 29 in adolescent offspring.

### Strengths and limitations of this study

- Large data material consisting of both adolescent and parental health variables combined with almost complete information on outcome measures from National registers.
- Self-reported data only.
- Results could be dependent on characteristics of the labour market and welfare regime.

## INTRODUCTION

Anxiety and depression are leading contributors to global disability and disease burden among young people, and adolescents with symptoms of anxiety and depression are more likely to experience mental health problems in adulthood,<sup>1–4</sup> educational underachievement and periods of unemployment later in life.<sup>3–5</sup> However, research on anxiety and depression and later life outcomes related to working life has mostly been geared towards adult working

## The welfare burden of adolescent anxiety and depression

populations.<sup>6 7</sup> Furthermore, such studies have not considered life course and family perspectives.

Anxiety and depression in parents and their offspring are associated due to both heritage and influences on the parenting role and family environment.<sup>8–12</sup> Factors that are shared within families, such as socioeconomic status, marital conflict, parenting style and stressful life events may confound associations between symptoms of anxiety and depression and life outcomes in young people.<sup>13–15</sup> Therefore, a prospective design comparing siblings with different symptom loads would be suitable, as it will in itself control for shared factors that could have confounded the results of other studies.<sup>16</sup>

Our first and main aim was to study the relationship between anxiety and depression symptoms in adolescence and later receipt of medical benefits in young adulthood. Our second aim was to assess this relationship by comparing levels of anxiety and depression symptoms within sibling groups, while our third aim was to study the relationship between the combined anxiety and depression symptom loads of adolescents and parents and later receipt of medical benefits in young adult offspring. For comparative purposes, we also wanted to explore these associations using receipt of unemployment benefits as an alternative outcome.

### METHODS

#### Data and linkages

We used data from the HUNT study, a Norwegian population study from Nord-Trøndelag County (<http://www.ntnu.no/hunt/english>),<sup>17</sup> where 8950 school-attending adolescents (90% of those invited) completed a

questionnaire between 1995 and 1997 (the Young-HUNT Study). We linked the adolescent data to the National Education and National Insurance Administration Registers for information on demography and the receipt of social benefits during follow-up from 1998 to 2008 (Statistics Norway, <http://www.ssb.no/en/>). Biological parents and siblings were identified through a linkage to the Norwegian Family Register using a unique parental identification number for siblings. Included in our study cohort was the 7497 eligible adolescents with one or two parents who had participated in the HUNT 2 survey (1995–1997). See [figure 1](#) for description of sample selection (2711 adolescents had one or more siblings in the cohort, their mother being the common parent).

#### Ethics

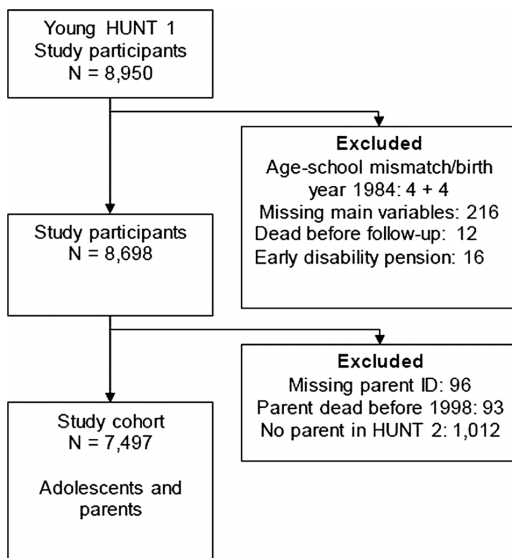
Each student signed a written consent form to participate in the study, and parents or guardians of the students who were younger than 16 years old gave their written consent. The study was approved by the Regional Medicine Ethical Committee and the Norwegian Data Inspectorate.

#### Outcome measure—benefit receipt

The main outcome variable was medical benefit receipt from age 20 to 29. Medical benefits are defined as social insurance benefits received for more than 180 days during one calendar year and are intended to replace income lost because of health problems. These benefits included sickness absence, rehabilitation or vocational rehabilitation benefits and disability pension (<http://www.nordsoc.org/>). Additionally, medical benefit receipt was recorded each calendar year and according to age from 20 to 29 years (continuous registration starting at the beginning of 1998, ending registration in 2008 or in the case of death). An additional outcome variable was unemployment benefit receipt from age 20 to 29 (not including those who also received medical benefits), which included cases of unemployment if economic compensation was received for more than 180 days during one calendar year.

#### Anxiety and depression symptoms

Adolescent symptoms of anxiety and depression were assessed with the five-item Hopkins Symptom Checklist (SCL-5).<sup>18</sup> In the SCL-5, the presence or absence of the following five symptoms during the last 14 days was reported: feeling blue, feeling fearful, feeling hopeless about the future, worrying too much about things and experiencing nervousness or shakiness inside. A four-point scale was used, ranging from 1 ('not bothered') to 4 ('very much bothered'); we summed up the scale scores on each item and then divided the total sum by the number of items answered. The average SCL-5 scale score (range 1–4) was calculated for those who had answered at least three of the five questions. The adolescent symptom load was categorised as high or low according to established and recommended cut-off



**Figure 1** Flow chart displaying how the study cohort was derived.

values of the SCL-5 scores.<sup>18</sup> The high adolescent symptom load group included adolescents with SCL-5 scores of 2 or above, whereas the low adolescent symptom load group included adolescents with SCL-5 scores below 2. Parental symptoms of anxiety and depression were assessed with the Hospital Anxiety and Depression Scale (HADS), which is a validated 14-item scale that consists of two 7-item scales covering anxiety (HADS-A) and depression (HADS-D).<sup>19</sup> Each item was scored on a four-point scale ranging from 0 to 3, and was added up resulting in a score between 0 and 21 for each subscale. A high parental symptom load was defined as having a score of 8 or above (recommended cut-off value) on *at least one* of the subscales (HADS-A and/or HADS-D).<sup>19</sup> Three groups were identified according to whether no parent, one parent or both parents had a high anxiety or depression symptom load.

### Baseline covariates

Age was used as continuous variable, but also categorised as 12–14, 15–17 and 18–20 years. *Somatic health* was assessed by the self-reported presence of chronic disease (has a doctor ever diagnosed you with epilepsy, migraine, diabetes or asthma or have you had another disease lasting more than 3 months) and disability (medium or much impairment of hearing, movement or somatic illness or much impairment of vision). Variables were included in the analyses as dichotomous measures. *Follow-up time* was the number of years from 1998 to 2008 in which the participants were alive and aged 20–29, and thereby registered with benefit or no benefit. *Parental educational attainment* was measured for both parents by the level of completed education in 1995, categorised as primary education (compulsory school only), secondary education (completed high school) and tertiary education (university degree). Family risk factors were assessed by four dichotomous measures: *teenage parent* (families in which one or both parents were a teenager when the adolescent study participant was born), *divorced* (families with divorced parents), *single parent* (adolescent reporting living with only one parent) and *living alone* (adolescent reporting living alone).

### Missing parental information and selection bias

The parental HADS scores were missing for 1669 fathers (22%) and 653 mothers (9%), while the educational level was missing for 630 fathers (8%) and 17 mothers (2%). We performed a multiple imputation of missing data in order to obtain complete datasets for the 7497 adolescents, including information on both parents. We conducted the procedure following recommendations in the current guidelines,<sup>20</sup> and using the chained equations option in the multiple imputation (mi) procedure in STATA statistical software to create 20 datasets. Extensive health measures from the HUNT surveys and information on demography and social insurance benefits for the adolescents, mothers and fathers were used

as predictor variables (a total of more than 90 variables, details available upon request), so as to ensure the required assumption of ‘missing at random’.

### Statistical methods

We used logistic regression analyses to explore the associations between anxiety and depression symptom exposures in adolescence and medical benefit receipt in young adulthood. Additional analyses were performed with unemployment benefits as an alternative outcome, and we explored the relationship between adolescent symptom load and benefit receipt by using both the continuous SCL-5 scale score and by a comparison of the groups according to symptom load (high vs low). For the continuous SCL-5 score we estimated the OR associated with a one point (+1) increase in the scale score (range 1–4). In the sibling subsample, we used a fixed-effect logistic regression model<sup>21</sup> to compare the anxiety and depression symptom level (the continuous SCL-5 score) *within* sibling groups to control for factors that are shared by siblings such as parental health, family socioeconomic status, home environment, etc.

We explored the relationship between adolescents’ family symptom load and benefit receipt by a comparison of the groups according to parental symptom load and according to combinations of adolescent and parental symptom load. Six groups were identified by combining the two adolescent symptom load groups (low and high) with the three parental symptom load groups (low, one parent high and both parents high). In the analysis, all five groups including high symptom loads were compared with the ‘low adolescent and low parental’ symptom load group (reference category).

All the analyses mentioned above were adjusted for sex, age and follow-up time. The results are presented as ‘Model 1’ in the text and tables. We adjusted for adolescent somatic health in a separate model, ‘Model 2’, regarding health as a potentially important confounder. ‘Model 3’ (not included in the fixed-effect model) included an additional adjustment for parental education and family risk factors. These family-related factors were regarded as potential confounders and/or intermediate factors. A potential effect measure modification by sex and age was explored by including interaction terms between SCL-5 scale scores and sex and SCL-5 scale scores and age in the analyses. The analyses were conducted using STATA 11 and STATA 12 software (StataCorp LP, Texas, USA). The results from logistic regression analyses were presented as OR, with the OR from the fixed-effect logistic regression (sibling comparison) having a cluster-specific interpretation.<sup>22</sup> All the analyses were reported with 95% CI.

### RESULTS

Data were available for 3729 boys and 3768 girls, with a mean age of 16 years (SD=1.8) and a mean SCL-5 score of 1.45 (SD=0.48, range 1–4). The median follow-up

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**Table 1** Baseline characteristics (1995–1997) of the adolescents and their parents in the study cohort according to medical benefit receipt age 20–29, the HUNT study, Norway

	No medical benefits (n=6511)		Medical benefits (n=986)	
	n	Per cent	n	Per cent
Adolescent anxiety and depression symptoms				
SCL-5 score, mean SD	1.43	0.47	1.56	0.56
High load*	915	14	219	22
Parental anxiety and depression symptoms*†				
Mother high load	1218	20	229	26
Father high load	944	18	147	22
Adolescent and parental symptom loads combined*†				
Adolescent low and parents low	2751	59	293	50
Adolescent low and one parent high	1094	24	144	25
Adolescent low and both parents high	177	4	34	6
Adolescent high and parents low	378	8	76	13
Adolescent high and one parent high	196	4	30	5
Adolescent high and both parents high	51	1	10	2
Girls	3163	49	605	61
Age 12–14	2218	34	306	31
Age 15–17	3154	48	533	54
Age 18–20	1139	17	147	15
Chronic disease	1375	21	311	32
Disability	368	6	122	12
Sibling in cohort	2375	36	336	34
Mother tertiary education†	1457	23	132	14
Mother secondary education†	4073	64	623	65
Mother primary education†	840	13	198	21
Father tertiary education†	1367	23	132	16
Father secondary education†	3793	63	524	63
Father primary education†	868	14	183	22
Parents divorced	1027	16	264	27
Single parent	533	8	113	11
Teenage parents	392	6	113	11
Adolescent living alone	364	6	73	7

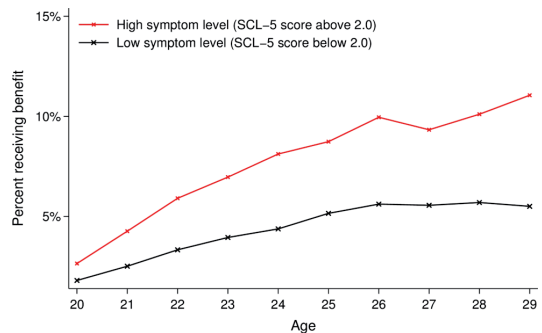
\*High anxiety and depression symptom loads defined by SCL-5 scale scores of 2 or above for adolescents and Hospital Anxiety and Depression Scale scores of 8 or above (on the anxiety or depression subscale) for parents.

†Variables with missing data, the number of missing observations indicated in parentheses; mother's anxiety and depression score (653), father's anxiety and depression score (1669), parental anxiety and depression (2263) mother's educational level (174) and father's educational level (630).

time was 9 years (range 1–10), and medical benefits were received by 986 (13%) individuals and unemployment benefits by another 676 individuals (9%). Descriptive characteristics of the study cohort according to medical benefit receipt are presented in [table 1](#) (table including unemployment benefits available as online supplementary table S3 in Appendix).

### Adolescent symptoms of anxiety and depression

[Figure 2](#) shows the percentage of adolescents who were in receipt of benefits at different ages during follow-up according to their SCL-5 score level. Symptoms of anxiety and depression among the adolescents were associated with higher odds of receiving medical benefits during follow-up (see [table 2](#)). The odds of receiving medical benefits increased by 50% following a one-point increase in the SCL-5 scale score. Adolescents in the



**Figure 2** Percentage of the Young-HUNT cohort (n=7497) in receipt of long-term medical benefits at different ages during follow-up according to self-reported anxiety and depression symptom level at baseline.

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high-symptom load group had about 60% higher odds of receiving medical benefits (OR 1.58, 95% CI 1.33 to 1.87) compared with the low-symptom load group (analyses adjusted for sex, age and follow-up time). An adjustment for somatic health somewhat attenuated the estimates. There were no important differences in the estimates for boys and girls ( $p$  of interaction term between SCL-5 score and sex=0.58) and no statistically significant interaction term between SCL-5 score and age ( $p$  interaction=0.25). The OR of receiving unemployment benefits was 0.99 (95% CI 0.83 to 1.17) for a one-point increase in the SCL-5 scale score and 1.13 (95% CI 0.91 to 1.40) for adolescents in the high-symptom load group compared to the low-symptom load group (analyses adjusted for sex, age and follow-up time).

### Sibling comparison

When comparing siblings, the impact of anxiety and depression symptoms on the odds of medical benefit receipt was still pronounced, and the results are presented in the lower part of [table 2](#). A one point increase in the SCL-5 score compared with the symptom level of their sibling(s) was associated with a 65% increase in the odds of medical benefit receipt when adjusting for sex, age, follow-up time and somatic health (Model 2). The impact of the SCL-5 score on the odds of unemployment benefit receipt yielded an OR of 1.11 (0.74–1.66) for a one point increase in the SCL-5 score in a model adjusted for age, sex and follow-up time (see online supplementary table S4 in appendix for details).

### Family symptoms of anxiety and depression

Having parents with a high anxiety and depression symptom load was independently associated with

medical benefit receipt from age 20 to 29. Compared with adolescents who had parents with low symptom loads, the OR of receiving medical benefits was 1.28 (95% CI 1.08 to 1.52) if one parent had a high symptom load and 1.85 (95% CI 1.38 to 2.47) if both parents had high symptom loads (analyses adjusted for sex, age and follow-up time). The corresponding OR of receiving unemployment benefits were 1.20 (95% CI 0.99 to 1.45) and 1.52 (95% CI 1.06 to 2.16). Adjustments for family characteristics (Model 3) attenuated all estimates, although the association between having two parents with a high symptom load and receiving medical benefits remained (OR 1.45 (95% CI 1.07 to 1.98)). In the upper part of [table 2](#), we can see that the odds of medical benefit receipt were higher in all five groups with an increased symptom load, compared with the 'low adolescent/low parental' symptom load group. The OR attenuated following adjustment for adolescent somatic health (Model 2) and parental education and family risk factors (Model 3). The associations between different combinations of adolescent and parental symptom load and unemployment benefits in the offspring were weaker than for medical benefits, and were removed to a large extent after introducing family factors in Model 3 (results for unemployment are displayed in online supplementary table S4 in the appendix). Main results in the imputed data-set did not differ substantially from analyses on complete-case data ( $n=5186$ ), but the strength of the associations between anxiety and depression symptom exposures and benefit receipt were somewhat stronger in the imputed data-set.

### DISCUSSION

In our study, anxiety and depression symptoms in adolescence were associated with an increased susceptibility to

**Table 2** Logistic regression analyses associating family exposures of anxiety and depression symptoms in adolescence with receipt of medical benefits from age 20 to 29, imputed data

	Medical benefits from age 20 to 29					
	Model 1*		Model 2*		Model 3*	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Adolescent anxiety and depression symptoms, n=7497						
SCL-5 scale score†	1.47	(1.29 to 1.68)	1.33	(1.17 to 1.53)	1.29	(1.12 to 1.48)
Low symptom load	1.00	(ref)	1.00	(ref)	1.00	(ref)
High symptom load	1.58	(1.33 to 1.87)	1.42	(1.20 to 1.69)	1.37	(1.15 to 1.64)
Adolescent and parental anxiety and depression symptoms, n=7497						
Adolescent low and parents low	1.00	(ref)	1.00	(ref)	1.00	(ref)
Adolescent low and one parent high	1.31	(1.08 to 1.58)	1.29	(1.06 to 1.56)	1.16	(0.96 to 1.41)
Adolescent low and both parents high	1.92	(1.38 to 2.69)	1.88	(1.34 to 2.64)	1.56	(1.10 to 2.22)
Adolescent high and parents low	1.68	(1.33 to 2.13)	1.53	(1.21 to 1.94)	1.52	(1.20 to 1.93)
Adolescent high and one parent high	1.82	(1.34 to 2.49)	1.61	(1.18 to 2.21)	1.39	(1.01 to 1.92)
Adolescent high and both parents high	2.30	(1.40 to 3.77)	1.98	(1.19 to 3.27)	1.58	(0.95 to 2.65)
Comparison of siblings within families, n=577‡						
SCL-5 scale score†	1.86	(1.25 to 2.76)	1.65	(1.10 to 2.48)		

\*Model 1: adjusted for age, sex and follow-up time; Model 2: adjusted for age, sex, follow-up time and adolescent somatic health; Model 3: Model 2, with additional adjustment for parental educational level and family risk factors.

†OR of a one point increase in the SCL-5 score (range1–4).

‡Fixed-effect model (conditional logistic regression).

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receive medical benefits in early adulthood, which was also true when we adjusted for confounding factors at the family level by comparing symptom loads within sibling groups. Parental anxiety and depression symptom load was an indicator of their adolescent's future risk of receiving medical benefits, and adolescents with both parents reporting high symptom loads seemed to be at a particularly high risk. Moreover, anxiety and depression symptoms were more strongly related to later receipt of medical than unemployment benefits.

### Strengths and limitations

The originality and main contributions of our study are that it utilises a unique data material consisting of both parental and offspring health variables, as well as follow-up data from registers on later medical benefit receipt in the offspring. Assessments of anxiety and depression were performed using validated questionnaires,<sup>18 19</sup> but the self-reported information used in our study was only from one occasion. Repeated measurements with structured diagnostic interviews may have provided more reliable information on anxiety and depression. However, such an approach is not feasible in a population study of this size. Because we did not have good data on psychiatric comorbidity in our study, we were unable to formulate a more detailed and differentiated picture of the risk following mental health vulnerability.

Missing parental data were a potential source of selection bias, and we performed a multiple imputation procedure in order to obtain complete parental data to help minimise this bias. The adolescents initially excluded from the study cohort (n=1012) because they had no participating parents were included in a sensitivity analysis of the relationship between SCL-5 score and benefit receipt (n=8509). The estimates obtained from these analyses were comparable to our reported findings, although somewhat lower. The consequences of mental disorders in adolescents and their parents on work integration are largely dependent on characteristics of the context such as the labour market and welfare regime. Our results should be interpreted with this in mind.

### Results compared to existing literature

Our study's results are in accordance with studies from New Zealand,<sup>3-5 23 24</sup> where symptoms of adolescent anxiety and depression and other mental illnesses have been associated with lower educational attainment, lower workforce participation and increased welfare dependence. Additionally, two large prospective Scandinavian population studies have described an association between mental impairment/psychiatric diagnosis among young men (at conscript, age 18 and 19) and risk of disability pension both early and later in adulthood.<sup>25 26</sup> Other prospective studies relating anxiety and depression to unemployment, sick leave and disability pension primarily include cohorts of working adults who

have already succeeded in entering the work force and may not grasp the particular challenges of young people in the transition to adulthood.<sup>6 7</sup> An American prospective study of siblings and parents reported that childhood depression was strongly related to income as an adult, also when comparing siblings.<sup>27</sup> This study represents one of the few that uses twin or sibling designs to study life outcomes following anxiety and depression in young people. Although there are many studies on the association between parental anxiety and depression and offspring mental health, the literature on the association between parental anxiety and depression and life outcomes in the offspring is scarce. Thus far, we have not found any studies that assess life outcomes for young people according to a combination of parental and adolescent anxiety and depression symptom load.

### Interpretation of findings

One plausible mechanism may be that adolescents with high anxiety and depression symptoms have an increased risk of experiencing mental illness later in life,<sup>2-4</sup> which may be the direct cause of work impairment. Also, anxiety and depression may impair adolescents' ability to learn and thereby increase their risk of low educational attainment and school drop-out, which in turn are known to lower work participation and increase welfare dependence.<sup>28</sup> The association between adolescent anxiety and depression symptoms and benefit receipt in young adulthood may also be influenced by factors that may increase both mental distress and the risk of receiving medical benefits such as the various somatic and psychiatric conditions that are associated with anxiety and depression. We were able to adjust for somatic conditions in our study, but we did not have good data on psychiatric comorbidity. Other studies have shown that the number of psychiatric disorders a person has is related to life outcomes in young adulthood,<sup>5</sup> and that co-occurring mental disorders, to a small extent, influenced the consequences of anxiety and depression.<sup>3 4 23</sup> More general personal traits such as childhood temperament and intellectual abilities are other individual factors that may be of importance,<sup>26 29</sup> but the effects of intellectual function and psychiatric disease seem independent of each other.<sup>25</sup> Our results indicated an influence of family factors, as indicated by the attenuation of OR in model 3. However, the association between adolescent symptom load and medical benefit receipt remained, even when all shared family factors were adjusted for in the sibling comparison.

Parental anxiety and depression symptom load were independently associated with medical benefit receipt in their offspring, which could be attributed to an increased vulnerability in the offspring related to increased mental health problems. Anxiety, depression and other mental illnesses are strongly associated in parents and offspring, both because of genetic and environmental influences.<sup>8 9 11 14</sup> Parental anxiety and depression may have negative influence on the family,

with consequences for offspring's cognitive, emotional and social development from an early age.<sup>10 12</sup> Anxiety and depression in adults are associated with work exclusion,<sup>6 7</sup> which could increase the strain on the children and adolescents in the family.<sup>30</sup>

Our finding that anxiety and depression symptoms were more strongly related to medical benefit receipt than to unemployment indicates that the work exclusion associated with anxiety and depression symptoms in the transition to young adulthood is primarily *health related*.

### Implications and conclusions

Our study demonstrates that high levels of anxiety and depression symptoms among adolescents and their parents were associated with an increased risk of receiving medical benefits as the adolescents entered adulthood. Our findings suggest that assessing parental and adolescent symptom loads together could provide a more complete picture of the burden of anxiety and depression symptoms on adolescents as they enter into adulthood. Furthermore, adolescent *and* parental symptoms of anxiety and depression may be regarded as risk measures of previous, existent and future mental health vulnerability for the adolescents. This emphasises the importance of a family-oriented approach in mental health, not only in the assessment and treatment of anxiety and depression, but also in preventive public health strategies. Treatment and interventions for young people with symptoms of anxiety and depression should aim to stimulate education, increase work integration and obtain economic independence. Moreover, preventive measures should be taken to ensure better work-life integration for adolescents with anxiety and depression since young people with mental problems may be particularly vulnerable when facing today's labour market demands.

**Acknowledgements** We would like to thank Professors Steinar Westin and Roar Johnsen for their inspiration and useful comments on the manuscript, and Nils Kristian Skjærvold and Professor David Gunnell for their useful comments on the manuscript.

**Contributors** KP and JHB carried out the data processing, the epidemiological modelling and statistical analysis and wrote the manuscript. TLH and SK participated in the design of the study and helped to write the manuscript. All authors have read and approved the final version of the manuscript.

**Funding** This work was supported by the Norwegian University of Science and Technology and by the Research Council of Norway. The Nord-Trøndelag Health Study (the HUNT Study) is a collaboration between the HUNT Research Centre (Faculty of Medicine, Norwegian University of Science and Technology (NTNU)), the Nord-Trøndelag County Council, the Central Norway Health Authority and the Norwegian Institute of Public Health.

**Competing interests** None.

**Ethics approval** Each student signed a written consent form to participate in the study, and parents or guardians of students younger than 16 years old also gave their written consent. The study was approved by the Regional Medicine Ethical Committee and the Norwegian Data Inspectorate.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data sharing statement** Data are available from the HUNT study (<http://www.ntnu.no/hunt/english>) and Statistics Norway.

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# The welfare burden of adolescent anxiety and depression: a prospective study of 7500 young Norwegians and their families: the HUNT study

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*BMJ Open* 2012 2:

doi: 10.1136/bmjopen-2012-001942

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