BMJ open

The welfare burden of adolescent anxiety and depression: A prospective study of 7,500 young Norwegians and their families - the HUNT study

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2012-001942
Article Type:	Research
Date Submitted by the Author:	09-Aug-2012
Complete List of Authors:	Pape, Kristine; Norwegian University of Science and Technology, Department of Public Health and General Practice Bjorngaard, Johan; Norwegian University of Science and Technology, Department of Public Health and General Practice; St. Olav's University Hospital Trondheim, Forensic Department and Research Centre Bröset Holmen, Turid; Norwegian University of Science and Technology, HUNT research Center, Department of Public Health and General Practice Krokstad, Steinar; Norwegian University of Science and Technology, HUNT research Center, Department of Public Health and General Practice
Primary Subject Heading:	Public health
Secondary Subject Heading:	Epidemiology, Mental health
Keywords:	PUBLIC HEALTH, EPIDEMIOLOGY, Anxiety and depression, Adolescents, Social insurance, Family

TITLE PAGE

The welfare burden of adolescent anxiety and depression: A prospective study of 7,500 young Norwegians and their families - the HUNT study

Kristine Pape, Johan Håkon Bjørngaard, Turid Lingaas Holmen, Steinar Krokstad

Corresponding author:

Kristine Pape

Department of Public Health and General Practice,

Norwegian University of Science and Technology,

7491 Trondheim, Norway

E-mail: kristine.pape@ntnu.no

Telephone: private +47 95 11 79 20 work +47 73 59 88 76

Fax: +47 73 59 75 77

Co-authors:

Johan Håkon Bjørngaard

Department of Public Health and General Practice,

Norwegian University of Science and Technology,

Trondheim, Norway

St. Olav's University Hospital Trondheim,

Forensic Department and Research Centre Bröset,

Trondheim, Norway

Turid Lingaas Holmen

Steinar Krokstad

HUNT research Center,

Department of Public Health and General Practice,

Norwegian University of Science and Technology,

Levanger, Norway

Keywords: Adolescent, social security, longitudinal study, anxiety and depression, family, siblings

Word count: 3104

ABSTRACT

Objectives

To examine the association between anxiety and depression symptoms in adolescents and their families and later medical benefit reception in young adulthood.

Design

Prospective cohort study. Norwegian population study linked to national registers.

Participants

2

7,497 school-attending adolescents had information on their own (Hopkins Symptoms Checklist – SCL-5 score) and parental (Hospital Anxiety and Depression Scale – HADS score) anxiety and depression symptoms from the Nord-Trøndelag Health Study 1995-1997 (HUNT). There were 2,711 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 reception of medical benefits (main outcome) and unemployment benefits for comparison from ages 20–29.

Methods

We used logistic regression analysis to compare medical benefit reception risk both following own and parental anxiety and depression symptoms. In addition, we used sibling fixed-effect analysis to adjust for family-level confounders among siblings differentially exposed to anxiety and depression symptoms.

Results

Comparing siblings, a one-unit increase in the mean SCL-5 score was associated with a 65% increase in the odds of *medical* benefit reception from age 20-29 (adjusted OR, 1.65, 95% CI 1.10-2.48). Parental anxiety and depression symptom load was an indicator of their adolescent's future risk of medical benefit reception, and adolescents with both parents reporting high symptom loads seemed to be at a particularly high risk. The anxiety and depression symptom load was not, or at least only weakly, associated with *unemployment* benefit reception from age 20-29.

Conclusions

Adolescents in families hampered with anxiety and depression symptoms are at a substantial 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.

Keywords: adolescent, social security, longitudinal study, anxiety and depression, family, siblings

ARTICLE SUMMARY

Article focus

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

Key messages

- Adolescents with high levels of anxiety and depression symptoms had an increased risk of medical benefits from age 20-29.
- 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 reception from age 20-29 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 of global disability and disease burden among young people, while adolescents with symptoms of anxiety and depression are more likely to experience mental health problems in adulthood,[1-4] educational underachievement and periods of unemployment later in life.[3-5] However, research on anxiety and depression and later life outcomes related to working life has mostly been undertaken with adult working populations.[6, 7] 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.[8-12] 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.[13-15] 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.[16] Our first and main aim was to study the relationship between anxiety and depression symptoms in adolescence and later medical benefit reception 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 medical benefit reception in young adult offspring. For comparative purposes, we also wanted to explore these associations using unemployment benefit reception 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),[17] where 8,950 school-attending adolescents (90% of those invited) completed a questionnaire between 1995-1997 (the Young-HUNT Study). We linked the adolescent data to the National Education and National Insurance Administration Registers for information on demography and the

reception 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 within mothers. A total of 7,497 of the eligible adolescents had one or two parents who participated in the HUNT 2 survey (1995-97), and these were included in our study cohort. See Figure 1 for description of sample selection (2,711 adolescents had one or more siblings in the cohort sharing the same mother).

Figure 1: Flow chart displaying how the study cohort was derived

(Figure 1 here)

Ethics

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

Outcome measure − benefit reception

The main outcome variable was medical benefit reception from age 20–29. Medical benefits included social insurance benefits intended to replace income in the case of health problems, and which were received for more than 180 days during one calendar year. These benefits included sickness absence, rehabilitation or vocational rehabilitation benefit and disability pension (http://www.nordsoc.org/). Additionally, medical benefit

reception was recorded each calendar year and according to age from 20 to 29 years (starting registrations continuously from 1998, ending registration in 2008 or in the case of death). An additional outcome variable was unemployment benefit reception from age 20–29 (not including those who also received medical benefits), which included cases of unemployment if economic compensation was received 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).[18] 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”), and 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 to 4) was calculated for those who had answered at least three of the five questions. The adolescent symptom load was categorized as high or low according to established and recommended cut-off values of the SCL-5 scores.[18] 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. 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 both anxiety (HADS-A) and depression (HADS-

D).[19] Each item was scored on a four-point scale ranging from 0 to 3, and was added up to 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).[19] 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 categorized as 12-14 years, 15-17 years 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, asthma or 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). 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 to 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, categorized 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 teenagers when their 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 1,669 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 7,497 adolescents, including information on both parents. We used the chained equations option in the multiple imputation (mi) procedure in STATA statistical software, creating 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 reception by using both the continuous SCL-5 scale score and by a comparison of the groups according to symptom load (high vs. low). In the sibling subsample, we used a fixed-effect logistic regression model [20] to compare the anxiety and depression symptom level *within* sibling groups in order 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 reception 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, with these results 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, and 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), with the odds ratios from the fixed-effect logistic regression (sibling comparison) having a cluster-specific interpretation.[21] All of the analyses were reported with 95% confidence intervals (CI).

RESULTS

The data was available for 3,729 boys and 3,768 girls, with a mean age of 16.0 years (s.d. = 1.8) and a mean SCL-5 score of 1.45 (s.d. = 0.48, range 1-4). The median follow-up 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 reception are presented in Table 1 (table including unemployment benefits available as Table 3 in Appendix).

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

	No medical benefits (n=6,511)		Medical benefits (n=986)	
	n	%	*n*	%
Girls	3,163	48.6	605	61.4
Boys	3,348	51.4	381	38.6
Age 12-14	2,218	34.1	306	31.0
Age 15-17	3,154	48.4	533	54.1
Age 18-20	1,139	17.5	147	14.9
High anxiety and depression symptom load [a]	915	14.1	219	22.2
Chronic disease	1,375	21.1	311	31.5
Disability	368	5.7	122	12.4
Sibling in cohort	2375	36.5	336	34.1
Mother high anxiety and depression symptom load [ab]	1,218	20.4	229	26.2
Father high anxiety and depression symptom load [ab]	944	18.4	147	21.5
Mother tertiary education [b]	1,457	22.9	132	13.9
Mother secondary education [b]	4,073	63.9	623	65.4
Mother primary education [b]	840	13.2	198	20.8
Father tertiary education [b]	1,367	22.7	132	15.7
Father secondary education [b]	3,793	62.9	524	62.5
Father primary education [b]	868	14.4	183	21.8

Parents divorced	1,027	15.8	264	26.8
Single parent	533	8.2	113	11.5
Teenage parents	392	6.0	113	11.5
Adolescent living alone	364	5.6	73	7.4

[a] High anxiety and depression symptom loads defined by SCL-5 scale scores above 2.0 for adolescents and HADS scores above 8.0 (on the anxiety *or* depression subscale) for parents.
[b] 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 (1,669), mother's educational level (174), father's educational level (630).

Adolescent symptoms of anxiety and depression

Symptoms of anxiety and depression among the adolescents were associated with higher odds of receiving medical benefits during follow-up. The odds ratio of receiving medical benefits was 1.47 (95% CI 1.29-1.68) for a one-unit change on the SCL-5 scale score and 1.58 (95% CI 1.33-1.87) for adolescents in the high-symptom load group compared to the low-symptom load group (analyses adjusted for sex, age and follow-up time). An adjustment for somatic health lowered the estimates to 1.33 (95% CI 1.17-1.53) and 1.42 (95% CI 1.20-1.69), respectively. 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 odds ratio of receiving unemployment benefits was 0.99 (95% CI 0.83-1.17) for a one-unit change on the SCL-5 scale score and 1.13 (95% CI 0.91-1.40) for adolescents in the high-symptom load group compared to the low-symptom load group (analyses adjusted for sex, age and follow-up time).

Table 2: Logistic regression analyses associating family exposures of anxiety and depression symptoms in adolescence with reception of medical benefits from age 20–29.

	Medical benefits from age 20-29					
	Model 1[a]		Model 2[a]		Model 3[a]	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)

According to combinations of adolescent and parental symptom loads, n = 7,497						
Adolescent low, parents low	1.00	(ref)	1.00	(ref)	1.00	(ref)
Adolescent low, one parent high	1.31	(1.08-1.58)	1.29	(1.06-1.56)	1.16	(0.96-1.41)
Adolescent low, both parents high	1.92	(1.38-2.69)	1.88	(1.34-2.64)	1.56	(1.10-2.22)
Adolescent high, parents low	1.68	(1.33-2.13)	1.53	(1.21-1.94)	1.52	(1.20-1.93)
Adolescent high, one parent high	1.82	(1.34-2.49)	1.61	(1.18-2.21)	1.39	(1.01-1.92)
Adolescent high, both parents high	2.30	(1.40-3.77)	1.98	(1.19-3.27)	1.58	(0.95-2.65)
Comparison of siblings within families, n = 577 [b]						
SCL-5 scale score[c]	1.86	(1.25-2.76)	1.65	(1.10-2.48)		

[a] Model specification: 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: as Model 2, with additional adjustment for parental educational level and family risk factors
[b] Fixed-effect model (conditional logistic regression).
[c] Odds ratios of a one-unit increase in the SCL-5 score (range 1-4).

Sibling comparison

When comparing siblings, the impact of anxiety and depression symptoms on the odds of medical benefit reception was still pronounced, and the results are presented in the lower part of Table 2. A one-unit 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 reception 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 reception yielded an odds ratio of 1.11 (0.74-1.66) for a one-unit increase in the SCL-5 score in a model adjusted for age, sex and follow-up time (see Table 4 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 reception from age 20-29. Compared with adolescents having parents with low symptom loads, the odds ratio of receiving medical benefits was 1.28 (95% CI 1.08-1.52) if one parent had a high symptom load and 1.85 (95% CI 1.38-2.47) if both parents had high symptom loads (analyses adjusted for sex, age and follow-up time). The corresponding odds ratios of receiving unemployment benefits were 1.20 (95% CI 0.99-1.45) and 1.52 (95% CI 1.06-2.16). Adjustments for family characteristics (Model 3) attenuated all estimates, although the association between having two parents with a high symptom load and receiving medical benefit reception remained (OR 1.45 (95% CI 1.07-1.98)). In the upper part of Table 2, we can see that the odds of medical benefit reception were higher in all five groups, with an increased symptom load compared with the "low adolescent/low parental" symptom load group. The odds ratios attenuated a 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 Table 4 in the Appendix).

DISCUSSION

In our study, anxiety and depression symptoms in adolescence were associated with an increased susceptibility to 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 medical benefit reception, 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 reception of medical- than unemployment benefits.

Strengths and limitations

The originality and main contributions of our study are that it utilizes a unique data material consisting of both parental- and offspring health variables, as well as follow-up data from registers on later medical benefit reception in the offspring. Assessments of anxiety and depression were performed using validated questionnaires,[18, 19] but were only based on self-reported information on 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. Missing parental data was a potential source of selection bias, and we performed a multiple imputation procedure in order to obtain complete parental data to help minimize this bias. The adolescents initially excluded from the study cohort because they had no participating parents were included in a sensitivity analysis of the relationship between SCL-5 score and benefit reception for all 8,509 adolescents (including the group of 1,012 excluded adolescents). The estimates obtained from these analyses were comparable to our reported findings, although somewhat lower. As regards the generalizability of our findings to other countries and populations, we believe we have demonstrated a universal

vulnerability in adolescents regardless of context. Nevertheless, the consequences of mental disorders in adolescents and their parents in terms of work integration will of course depend on characteristics of the actual labour market and welfare regime.

Results compared to existing literature

Our study's results are in accordance with studies from New Zealand,[3-5, 22, 23] 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 18-19) and risk of disability pension both early and later in adulthood.[24, 25] 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 work and may not grasp the particular challenges of young people in the transition to adulthood.[6, 7] An American prospective study of siblings and parents reported that childhood depression was strongly related to income as an adult, also when comparing siblings.[26] 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,[2-4] which may be the direct cause of work impairment. It is also possible that the association may be explained by confounding individual and/or family factors that may increase both mental distress and the risk of medical benefit reception. However, despite the fact that family factors did seem to play a certain role, the association between adolescent symptom load and medical benefit reception remained even when all shared family factors were adjusted for in the sibling comparison. Other mental diseases and more general personal traits such as childhood temperament and intellectual abilities are individual factors that may be of importance,[25, 27] though these were not assessed in our study. Parental anxiety and depression symptom load were independently associated with medical benefit reception 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.[8, 9, 11, 14] Furthermore, parental anxiety and depression may also have consequences for their offspring's cognitive, emotional and social development from an early age.[10, 12] Hence, adolescent *and* parent symptoms of anxiety and depression may be regarded as risk measures of previous, existent and future mental health vulnerability for the

adolescents. Our findings suggest that parental and adolescent symptom loads assessed together could provide a more complete picture of the burden of anxiety and depression symptoms for adolescents as they enter in adulthood. Furthermore, our finding that anxiety and depression symptoms were more strongly related to medical benefit reception 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 demonstrated 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. This suggests that the family perspective may be of importance, and that 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.

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.

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.

CONFLICTS OF INTEREST

None

ETHICAL CONSIDERATIONS

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

CONTRIBUTORSHIP STATEMENT

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.

DATA SHARING STATEMENT

Data may be availabe from the HUNT study (http://www.ntnu.no/hunt/english) and Statistics Norway

REFERENCES

1 Copeland WE, Shanahan L, Costello EJ, *et al.* Childhood and Adolescent Psychiatric Disorders as Predictors of Young Adult Disorders. *Arch Gen Psychiatry* 2009;**66**:764-72.

2 Reef J, Diamantopoulou S, Van Meurs I, *et al.* Child to adult continuities of psychopathology: a 24-year follow-up. *Acta Psychiatrica Scandinavica* 2009;**120**:230-8.

3 Woodward LJ, Fergusson DM. Life Course Outcomes of Young People With Anxiety Disorders in Adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry* 2001;**40**:1086-93.

4 Fergusson DM, Woodward LJ. Mental Health, Educational, and Social Role Outcomes of Adolescents With Depression. *Arch Gen Psychiatry* 2002;**59**:225-31.

5 Gibb SJ, Fergusson DM, Horwood LJ. Burden of psychiatric disorder in young adulthood and life outcomes at age 30. *The British Journal of Psychiatry* 2010;**197**:122-7.

6 Moncrieff J, Pomerleau J. Trends in sickness benefits in Great Britain and the contribution of mental disorders. *J Public Health Med* 2000;**22**:59-67.

7 Mykletun A, Overland S, Dahl AA, *et al.* A Population-Based Cohort Study of the Effect of Common Mental Disorders on Disability Pension Awards. *Am J Psychiatry* 2006;**163**:1412-8.

8 Rice F. The genetics of depression in childhood and adolescence. *Curr Psychiatry Rep* 2009;**11**:167-73.

9 Kendler KS, Gardner CO, Lichtenstein P. A developmental twin study of symptoms of anxiety and depression: evidence for genetic innovation and attenuation. *Psychological Medicine* 2008;**38**:1567-75.

10 Mensah FK, Kiernan KE. Parents' mental health and children's cognitive and social development : Families in England in the Millennium Cohort Study. *Soc Psychiatry Psychiatr Epidemiol* 2009.

11 Hughes EK, Gullone E. Internalizing symptoms and disorders in families of adolescents: A review of family systems literature. *Clinical Psychology Review* 2008;**28**:92-117.

12 Lewinsohn PM, Olino TM, Klein DN. Psychosocial impairment in offspring of depressed parents. *Psychological Medicine* 2005;**35**:1493-503.

13 Amone-P'Olak K, Burger H, Ormel J*, et al.* Socioeconomic position and mental health problems in pre- and early-adolescents: the TRAILS study. *Soc Psychiatry Psychiatr Epidemiol* 2009;**44**:231-8.

14 Amone-P'Olak K, Burger H, Huisman M*, et al.* Parental psychopathology and socioeconomic position predict adolescent offspring's mental health independently and do not interact: the TRAILS study. *J Epidemiol Community Health* 2011;**65**:57-63.

15 Dunn VJ, Abbott RA, Croudace TJ*, et al.* Profiles of family-focused adverse experiences through childhood and early adolescence: The ROOTS project a community investigation of adolescent mental health. *BMC Psychiatry* 2011;**11**:109.

16 Donovan SJ, Susser E. Commentary: Advent of sibling designs. *Int J Epidemiol* 2011;**40**:345-9.

17 Holmen J, Midthjell K, Krüger Ø*, et al.* The Nord-Trøndelag Health Study 1995-97 (HUNT 2): Objectives, contents, methods and participation. *Norsk epidemiologi* 2003;**13**:19-32.

18 Strand BH, Dalgard OS, Tambs K*, et al.* Measuring the mental health status of the Norwegian population: a comparison of the instruments SCL-25, SCL-10, SCL-5 and MHI-5 (SF-36). *Nord J Psychiatry* 2003;**57**:113-8.

19 Bjelland I, Dahl AA, Haug TT*, et al.* The validity of the hospital anxiety and depression scale. An updated literature review. *J Psychosom Res* 2002;**52**:69 - 77.

20 Kleinbaum DG, Klein M. *Logistic Regression. A Self-Learning Text*. New York Dordrecht Heidelberg London: Springer 2010.

21 Rabe-Hesketh S, Skrondal A. *Multilevel and Longitudinal Modeling using Stata*: Stata Press 2005.

22 Fergusson DM, Boden JM, Horwood LJ. Recurrence of major depression in adolescence and early adulthood, and later mental health, educational and economic outcomes. *The British Journal of Psychiatry* 2007;**191**:335-42.

23 Fergusson DM, Horwood LJ, Ridder EM*, et al.* Subthreshold Depression in Adolescence and Mental Health Outcomes in Adulthood. *Arch Gen Psychiatry* 2005;**62**:66-72.

24 Gravseth HM, Bjerkedal T, Irgens LM*, et al.* Influence of physical, mental and intellectual development on disability in young Norwegian men. *Eur J Public Health* 2008.

23

25 Johansson E, Leijon O, Falkstedt D*, et al.* Educational differences in disability pension among Swedish middle-aged men: role of factors in late adolescence and work characteristics in adulthood. *Journal of Epidemiology and Community Health* 2011.

26 Smith JP, Smith GC. Long-term economic costs of psychological problems during childhood. *Social Science & Medicine* 2010;**71**:110-5.

27 Henderson M, Hotopf M, Leon DA. Childhood temperament and long-term sickness absence in adult life. *Br J Psychiatry* 2009;**194**:220-3.

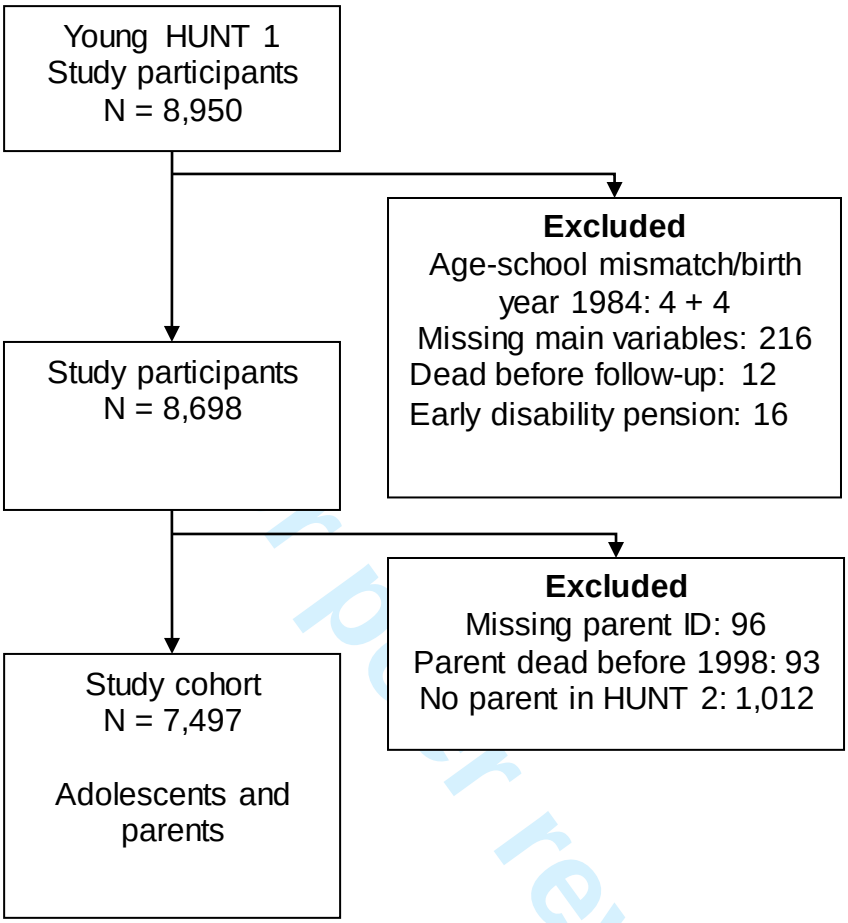


Table 3_appendix: Baseline characteristics (1995 – 1997) of the adolescents and their parents in the study cohort according to benefit reception from age 20-29

	No benefits (n=5835)		Medical benefits (n=986)		Unemployment benefits (n=676)	
	n	%	*n*	%	*n*	%
Girls	2853	48.9	605	61.4	310	45.9
Boys	2982	51.1	381	38.6	366	54.1
Age 12-14	2034	34.9	306	31.0	184	27.2
Age 15-17	2812	48.2	533	54.1	342	50.6
Age 18-20	989	17.0	147	14.9	150	22.2
High anxiety and depression symptom load [a]	802	13.7	219	22.2	113	16.7
Chronic disease	1235	21.2	311	31.5	140	21.7
Disability	331	5.7	122	12.4	37	5.5
Sibling in cohort	2149	36.8	337	34.2	229	33.9
Mother high anxiety and depression symptom load [ab]	1058	19.7	229	26.2	160	26.9
Father high anxiety and depression symptom load [ab]	844	18.2	147	21.5	100	20.1
Mother tertiary education [b]	1384	24.2	132	13.9	73	11.3
Mother secondary education [b]	3640	63.6	623	65.4	433	66.8
Mother primary education [b]	698	12.2	198	20.8	142	21.9
Father tertiary education [b]	1296	23.9	132	15.7	71	11.8
Father secondary education [b]	3382	62.3	524	62.5	411	68.3
Father primary education [b]	748	13.8	183	21.8	120	19.9
Parents divorced	866	14.8	264	26.8	161	23.8
Single parent	460	7.9	113	11.5	73	10.8
Teenage parents	326	5.6	113	11.5	66	9.8
Adolescent living alone	310	5.3	73	7.4	54	8.0

[a] high anxiety and depression symptom loads defined by SCL-5 scale scores above 2.0 for adolescents and HADS scores above 8.0 (on the anxiety *or* depression subscale) for parents

[b] variables with missing data, the number of missing observations indicated in paretheses; mother's anxiety and depression score (653), father's anxiety and depression score (1669), mother's educational level (174), father's educational level (630)

Table 4_appendix Logistic regression analyses associating family exposures to anxiety and depression symptoms in adolescence with reception of unemployment benefits from age 20 – 29.

	Unemployment benefits from age 20-29					
	Model 1[a]		Model 2[a]		Model 3[a]	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
According to combinations of adolescent and parental symptom loads, n = 7,497						
Adolescent low, parents low	1.00	(ref)	1.00	(ref)	1.00	(ref)
Adolescent low, one parent high	1.15	(0.93-1.42)	1.15	(0.94-1.42)	1.04	(0.85-1.29)
Adolescent low, both parents high	1.43	(0.93-2.18)	1.44	(0.94-2.20)	1.22	(0.79-1.86)
Adolescent high, parents low	0.99	(0.72-1.34)	1.01	(0.74-1.38)	1.02	(0.74-1.39)
Adolescent high, one parent high	1.42	(0.97-2.07)	1.47	(1.00-2.16)	1.31	(0.89-1.93)
Adolescent high, both parents high	1.78	(0.95-3.34)	1.86	(0.99-3.52)	1.56	(0.82-2.94)
Comparing siblings within families, n = 425 [b]						
SCL-5 scale score[a]	1.11	(0.74-1.66)	1.22	(0.80-1.85)		

Model specification: 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: as model 2, with additional adjustment for parental educational level and family risk factors

[a] Odds ratios of a one unit increase in the SCL-5 score (range 1-4) in a fixed-effect model (conditional logistic regression)

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Page of document
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1,2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2,3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5,6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6,7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	7-8, Figure 1
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7,8,9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6,7,8,9*
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8,9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10,11
		(*b*) Describe any methods used to examine subgroups and interactions	11
		(*c*) Explain how missing data were addressed	10
		(*d*) If applicable, explain how loss to follow-up was addressed	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Figure 1
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	10 Table 1

		(c) Summarise follow-up time (eg, average and total amount)	12
Outcome data	15*	Report numbers of outcome events or summary measures over time	12 Table 1 and 3
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13,14,15 Table 2 and 4
		(*b*) Report category boundaries when continuous variables were categorized	8,9
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	13,14,15
Discussion			
Key results	18	Summarise key results with reference to study objectives	15,16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18 (19)
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	19

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

BMJ open

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

Journal:	*BMJ Open*
Manuscript ID:	bmjopen-2012-001942.R1
Article Type:	Research
Date Submitted by the Author:	05-Oct-2012
Complete List of Authors:	Pape, Kristine; Norwegian University of Science and Technology, Department of Public Health and General Practice Bjorngaard, Johan; Norwegian University of Science and Technology, Department of Public Health and General Practice; St. Olav's University Hospital Trondheim, Forensic Department and Research Centre Bröset Holmen, Turid; Norwegian University of Science and Technology, HUNT research Center, Department of Public Health and General Practice Krokstad, Steinar; Norwegian University of Science and Technology, HUNT research Center, Department of Public Health and General Practice
Primary Subject Heading:	Public health
Secondary Subject Heading:	Epidemiology, Mental health
Keywords:	PUBLIC HEALTH, EPIDEMIOLOGY, Anxiety and depression, Adolescents, Social insurance, Family

TITLE PAGE

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

Kristine Pape, Johan Håkon Bjørngaard, Turid Lingaas Holmen, Steinar Krokstad

Corresponding author:

Kristine Pape

Department of Public Health and General Practice,

Norwegian University of Science and Technology,

7491 Trondheim, Norway

E-mail: kristine.pape@ntnu.no

Telephone: private +47 95 11 79 20 work +47 73 59 88 76

Fax: +47 73 59 75 77

Co-authors:

Johan Håkon Bjørngaard

Department of Public Health and General Practice,

Norwegian University of Science and Technology,

Trondheim, Norway

St. Olav's University Hospital Trondheim,

Forensic Department and Research Centre Bröset,

Trondheim, Norway

Turid Lingaas Holmen

Steinar Krokstad

HUNT research Center,

Department of Public Health and General Practice,

Norwegian University of Science and Technology,

Levanger, Norway

Keywords: Adolescent, social security, longitudinal study, anxiety and depression, family, siblings

Word count: 3104

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

2

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 – HADS 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 odds ratios 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 1.10-2.48). 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.

Keywords: adolescent, social security, longitudinal study, anxiety and depression, family, siblings

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 20-29.
- 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 20-29.
- 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 20-29 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 while adolescents with symptoms of anxiety and depression are more likely to experience mental health problems in adulthood,[1-4] educational underachievement and periods of unemployment later in life.[3-5] However, research on anxiety and depression and later life outcomes related to working life has mostly been geared towards adult working populations.[6, 7] 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.[8-12] 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.[13-15] 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.[16] 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),[17] where 8950 school-attending adolescents (90% of those invited) completed a questionnaire between 1995-1997 (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 (1995-97). See Figure 1 for description of sample selection (2711 adolescents had one or more siblings in the cohort, their mother being the common parent).

Figure 1: Flow chart displaying how the study cohort was derived

(Please place Figure 1 here)

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 20–29. 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 20–29 (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).[18] 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 to 4) was calculated for those who had answered at least three of the five questions. The adolescent symptom load was categorized as high or low according to established and recommended cut-off values of the SCL-5 scores.[18] 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. 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).[19] 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).[19] 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 categorized as 12-14 years, 15-17 years 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 three 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 to 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, categorized 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, [20] and using the chained equations option in the multiple imputation (mi) procedure in STATA statistical software tocreate 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 odds ratio 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 [21] 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 odds ratios (OR), with the odds ratios from the fixed-effect logistic regression (sibling comparison) having a cluster-specific interpretation.[22] All of the analyses were reported with 95% confidence intervals (CI).

RESULTS

Data was available for 3729 boys and 3768 girls, with a mean age of 16.0 years (standard deviation (sd) = 1.8) and a mean SCL-5 score of 1.45 (sd = 0.48, range 1-4). The median follow-up 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 Table 3 in Appendix).

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	%	*n*	%
Adolescent anxiety and depression symptoms				
SCL-5 score, mean *sd*	1.43	*0.47*	1.56	*0.56*
High load [a]	915	14	219	22
Parental anxiety and depression symptoms [ab]				
Mother high load	1218	20	229	26
Father high load	944	18	147	22
Adolescent and parental symptom loads combined [ab]				
Adolescent low, parents low	2751	59	293	50
Adolescent low, one parent high	1094	24	144	25
Adolescent low, both parents high	177	4	34	6
Adolescent high, parents low	378	8	76	13
Adolescent high, one parent high	196	4	30	5
Adolescent high, 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 [b]	1457	23	132	14
Mother secondary education [b]	4073	64	623	65
Mother primary education [b]	840	13	198	21
Father tertiary education [b]	1367	23	132	16
Father secondary education [b]	3793	63	524	63
Father primary education [b]	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 2.0 or above for adolescents and HADS scores of 8.0 or above (on the anxiety *or* depression subscale) for parents.

[b] 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), father's educational level (630).

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% both following a one point increase in the SCL-5 scale score. Adolescents in the high-symptom load group had about 60% higher odds of receiving medical benefits (OR 1.58, 95% CI 1.33-1.87) compared to 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 odds ratio of receiving unemployment benefits was 0.99 (95% CI 0.83-1.17) for a one point increase in the SCL-5 scale score and 1.13 (95% CI 0.91-1.40) 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 recipt yielded an odds ratio 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 Table 4 in Appendix for details).

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

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

[a] 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: as Model 2, with additional adjustment for parental educational level and family risk factors

[b] Fixed-effect model (conditional logistic regression).

[c] Odds ratios of a one-point increase in the SCL-5 score (range 1-4).

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 20-29. Compared with adolescents who had parents with low symptom loads, the odds ratio of receiving medical benefits was 1.28 (95% CI 1.08-1.52) if one parent had a high symptom load and 1.85 (95% CI 1.38-2.47) if both parents had high symptom loads (analyses adjusted for sex, age and follow-up time). The corresponding odds ratios of receiving unemployment benefits were 1.20 (95% CI 0.99-1.45) and 1.52 (95% CI 1.06-2.16). 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 1.07-1.98)). 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 odds ratios attenuated a 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 Table 4 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 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 utilizes 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,[18, 19] 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 co-morbidity in our study, we were unable to formulate a more detailed and differentiated picture of the risk following mental health vulnerability.

Missing parental data was a potential source of selection bias, and we performed a multiple imputation procedure in order to obtain complete parental data to help minimize 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 integrationare 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,[3-5, 23, 24] 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 18-19) and risk of disability pension both early and later in adulthood.[25, 26] 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.[6, 7] An American prospective study of siblings and parents reported that childhood depression was strongly related to income as an adult, also when comparing siblings.[27] 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,[2-4] 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.[28] 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 benefitssuch as the various somatic and psychiatric conditions that are associated 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,[5] and that co-occurring mental disorders, to a small extent, influenced the consequences of anxiety and depression.[3, 4, 23] More general personal traits such as childhood temperament and intellectual abilities are other individual factors that may be of importance,[26, 29] but the effects of intellectual function and psychiatric disease seem independent of each other.[25]Our results indicated an influence of family factors, as indicated by the

attenuation of odds ratios 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.[8, 9, 11, 14] 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.[10, 12] Anxiety and depression in adults are associated with work exclusion,[6, 7] which could increase the strain on the children and adolescents in the family.[30]

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 emphasizes 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.

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.

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.

CONFLICTS OF INTEREST

None

ETHICAL CONSIDERATIONS

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.

CONTRIBUTORSHIP STATEMENT

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.

REFERENCES

1 Copeland WE, Shanahan L, Costello EJ, *et al.* Childhood and Adolescent Psychiatric Disorders as Predictors of Young Adult Disorders. *Arch Gen Psychiatry* 2009;**66**:764-72.

2 Reef J, Diamantopoulou S, Van Meurs I, *et al.* Child to adult continuities of psychopathology: a 24-year follow-up. *Acta Psychiatrica Scandinavica* 2009;**120**:230-8.

3 Woodward LJ, Fergusson DM. Life Course Outcomes of Young People With Anxiety Disorders in Adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry* 2001;**40**:1086-93.

4 Fergusson DM, Woodward LJ. Mental Health, Educational, and Social Role Outcomes of Adolescents With Depression. *Arch Gen Psychiatry* 2002;**59**:225-31.

5 Gibb SJ, Fergusson DM, Horwood LJ. Burden of psychiatric disorder in young adulthood and life outcomes at age 30. *The British Journal of Psychiatry* 2010;**197**:122-7.

6 Moncrieff J, Pomerleau J. Trends in sickness benefits in Great Britain and the contribution of mental disorders. *J Public Health Med* 2000;**22**:59-67.

7 Mykletun A, Overland S, Dahl AA, *et al.* A Population-Based Cohort Study of the Effect of Common Mental Disorders on Disability Pension Awards. *Am J Psychiatry* 2006;**163**:1412-8.

8 Rice F. The genetics of depression in childhood and adolescence. *Curr Psychiatry Rep* 2009;**11**:167-73.

9 Kendler KS, Gardner CO, Lichtenstein P. A developmental twin study of symptoms of anxiety and depression: evidence for genetic innovation and attenuation. *Psychological Medicine* 2008;**38**:1567-75.

10 Mensah FK, Kiernan KE. Parents' mental health and children's cognitive and social development : Families in England in the Millennium Cohort Study. *Soc Psychiatry Psychiatr Epidemiol* 2009.

11 Hughes EK, Gullone E. Internalizing symptoms and disorders in families of adolescents: A review of family systems literature. *Clinical Psychology Review* 2008;**28**:92-117.

12 Lewinsohn PM, Olino TM, Klein DN. Psychosocial impairment in offspring of depressed parents. *Psychological Medicine* 2005;**35**:1493-503.

13 Amone-P'Olak K, Burger H, Ormel J*, et al.* Socioeconomic position and mental health problems in pre- and early-adolescents: the TRAILS study. *Soc Psychiatry Psychiatr Epidemiol* 2009;**44**:231-8.

14 Amone-P'Olak K, Burger H, Huisman M*, et al.* Parental psychopathology and socioeconomic position predict adolescent offspring's mental health independently and do not interact: the TRAILS study. *J Epidemiol Community Health* 2011;**65**:57-63.

15 Dunn VJ, Abbott RA, Croudace TJ*, et al.* Profiles of family-focused adverse experiences through childhood and early adolescence: The ROOTS project a community investigation of adolescent mental health. *BMC Psychiatry* 2011;**11**:109.

16 Donovan SJ, Susser E. Commentary: Advent of sibling designs. *Int J Epidemiol* 2011;**40**:345-9.

17 Holmen J, Midthjell K, Krüger Ø*, et al.* The Nord-Trøndelag Health Study 1995-97 (HUNT 2): Objectives, contents, methods and participation. *Norsk epidemiologi* 2003;**13**:19-32.

18 Strand BH, Dalgard OS, Tambs K, *et al.* Measuring the mental health status of the Norwegian population: a comparison of the instruments SCL-25, SCL-10, SCL-5 and MHI-5 (SF-36). *Nord J Psychiatry* 2003;**57**:113-8.

19 Bjelland I, Dahl AA, Haug TT, *et al.* The validity of the hospital anxiety and depression scale. An updated literature review. *J Psychosom Res* 2002;**52**:69 - 77.

20 Sterne JAC, White IR, Carlin JB, *et al.* Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. *BMJ* 2009;**338**.

21 Kleinbaum DG, Klein M. *Logistic Regression. A Self-Learning Text*. New York Dordrecht Heidelberg London: Springer 2010.

22 Rabe-Hesketh S, Skrondal A. *Multilevel and Longitudinal Modeling using Stata*: Stata Press 2005.

23 Fergusson DM, Boden JM, Horwood LJ. Recurrence of major depression in adolescence and early adulthood, and later mental health, educational and economic outcomes. *The British Journal of Psychiatry* 2007;**191**:335-42.

24 Fergusson DM, Horwood LJ, Ridder EM, *et al.* Subthreshold Depression in Adolescence and Mental Health Outcomes in Adulthood. *Arch Gen Psychiatry* 2005;**62**:66-72.

25 Gravseth HM, Bjerkedal T, Irgens LM, *et al.* Influence of physical, mental and intellectual development on disability in young Norwegian men. *Eur J Public Health* 2008.

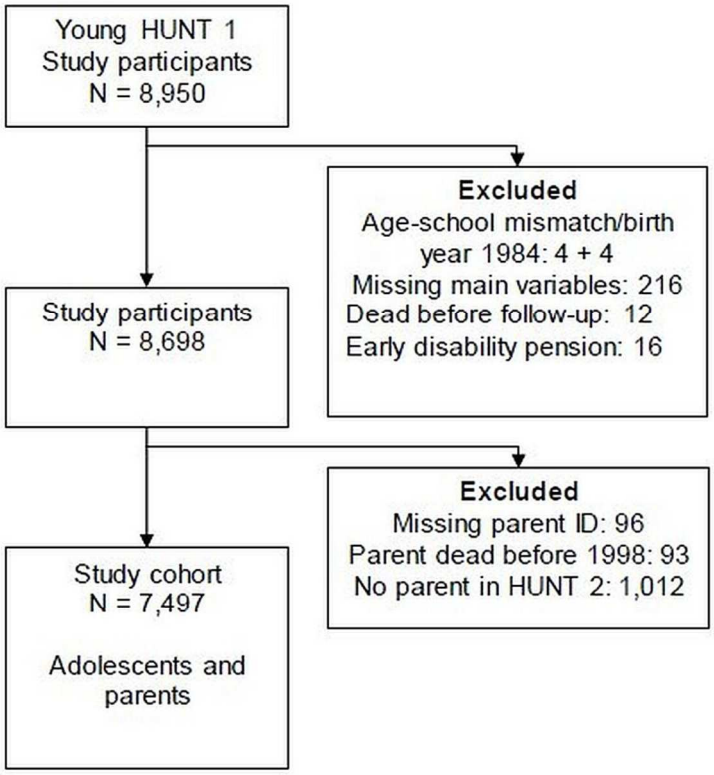
26 Johansson E, Leijon O, Falkstedt D, *et al.* Educational differences in disability pension among Swedish middle-aged men: role of factors in late adolescence and work characteristics in adulthood. *Journal of Epidemiology and Community Health* 2011.

27 Smith JP, Smith GC. Long-term economic costs of psychological problems during childhood. *Social Science & Medicine* 2010;**71**:110-5.

28 De Ridder KA, Pape K, Johnsen R, *et al.* 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.

29 Henderson M, Hotopf M, Leon DA. Childhood temperament and long-term sickness absence in adult life. *Br J Psychiatry* 2009;**194**:220-3.

30 Reinhardt Pedersen C, Madsen M. Parents' labour market participation as a predictor of children's health and wellbeing: a comparative study in five Nordic countries. *Journal of Epidemiology and Community Health* 2002;**56**:861-7.



91x90mm (300 x 300 DPI)

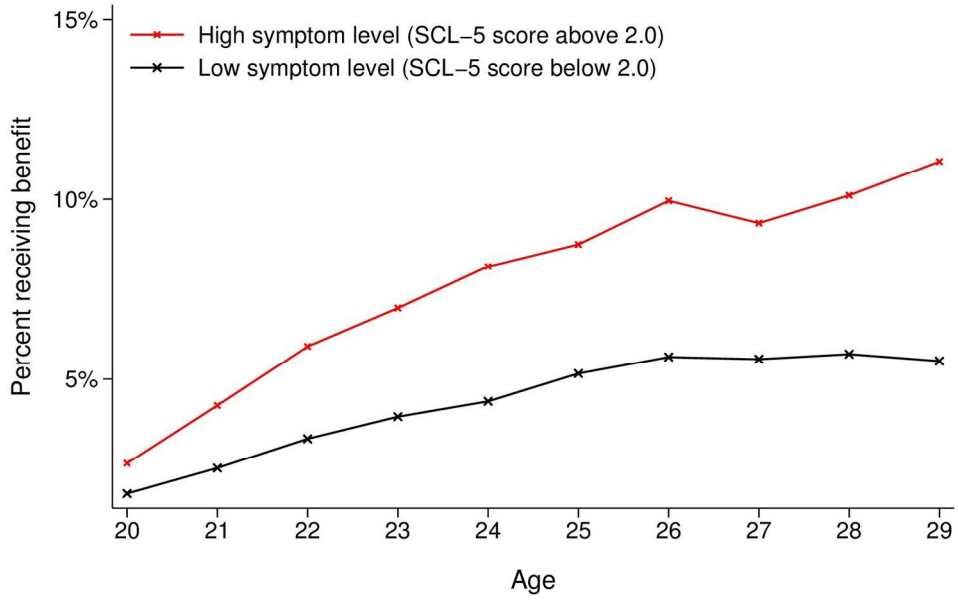


Figure 2: Percentage of the Young-HUNT cohort (n = 7497) in receipt of long-term medical benefits at different ages during follow-up according to self-reported anxiety and depression symptom level at baseline
152x101mm (300 x 300 DPI)

Table 3_appendix: Baseline characteristics (1995 – 1997) of the adolescents and their parents in the study cohort according to the receipt of benefits from age 20-29

	No benefits (n=5835)		Medical benefits (n=986)		Unemployment benefits (n=676)	
	n	%	*n*	%	*n*	%
Adolescent anxiety and depression symptoms						
SCL-5 score, mean *sd*	1.43	*0.47*	1.56	*0.56*	1.45	*0.48*
High load [a]	802	14	219	22	113	17
Parental anxiety and depression symptoms [ab]						
Mother high load	1058	20	229	26	160	27
Father high load	844	18	147	22	100	20
Adolescent and parental symptom loads combined [ab]						
Adolescent low, parents low	2518	60	293	50	233	55
Adolescent low, one parent high	994	24	144	25	100	24
Adolescent low, both parents high	157	4	34	6	20	5
Adolescent high, parents low	345	8	76	13	33	8
Adolescent high, one parent high	167	4	30	5	29	7
Adolescent high, both parents high	41	1	10	2	10	2
Girls	2853	49	605	61	310	46
Age 12-14	2034	35	306	31	184	27
Age 15-17	2812	48	533	54	342	51
Age 18-20	989	17	147	15	150	22
Chronic disease	1235	21	311	32	140	21
Disability	331	6	122	12	37	5
Sibling in cohort	2149	37	337	34	229	34
Mother tertiary education [b]	1384	24	132	14	73	11
Mother secondary education [b]	3640	64	623	65	433	67
Mother primary education [b]	698	12	198	21	142	22
Father tertiary education [b]	1296	24	132	16	71	12
Father secondary education [b]	3382	62	524	62	411	68
Father primary education [b]	748	14	183	22	120	20
Parents divorced	866	15	264	27	161	24
Single parent	460	8	113	11	73	11
Teenage parents	326	6	113	11	66	10
Adolescent living alone	310	5	73	7	54	8

[a] High anxiety and depression symptom loads defined by SCL-5 scale scores of 2.0 or above for adolescents and HADS scores of 8.0 or above (on the anxiety *or* depression subscale) for parents.
[b] 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), father's educational level (630).

Table 4_appendix Logistic regression analyses associating family exposures to anxiety and depression symptoms in adolescence with receipt of unemployment benefits from age 20 – 29, imputed data

	Unemployment benefits from age 20-29					
	Model 1[a]		Model 2[a]		Model 3[a]	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
According to adolescent and parental anxiety and depression symptoms, n = 7497						
Adolescent SCL-5 scale score [bc]	0.99	(0.84-1.17)	1.01	(0.85-1.21)	1.00	(0.84-1.19)
Adolescent low symptom load	1.00	(ref)	1.00	(ref)	1.00	(ref)
Adolescent high symptom load	1.13	(0.91-1-40)	1.16	(0.93-1.44)	1.14	(0.92-1.42)
Adolescent low, parents low	1.00	(ref)	1.00	(ref)	1.00	(ref)
Adolescent low, one parent high	1.15	(0.93-1.42)	1.15	(0.94-1.42)	1.04	(0.85-1.29)
Adolescent low, both parents high	1.43	(0.93-2.18)	1.44	(0.94-2.20)	1.22	(0.79-1.86)
Adolescent high, parents low	0.99	(0.72-1.34)	1.01	(0.74-1.38)	1.02	(0.74-1.39)
Adolescent high, one parent high	1.42	(0.97-2.07)	1.47	(1.00-2.16)	1.31	(0.89-1.93)
Adolescent high, both parents high	1.78	(0.95-3.34)	1.86	(0.99-3.52)	1.56	(0.82-2.94)
Comparison of siblings within families, n = 577 [c]						
SCL-5 scale score[a]	1.11	(0.74-1.66)	1.22	(0.80-1.85)		

[a] 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: as Model 2, with additional adjustment for parental educational level and family risk factors

[b] Fixed-effect model (conditional logistic regression).

[c] Odds ratios of a one-point increase in the SCL-5 score (range 1-4).

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Page of document
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1,2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2,3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5,6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6,7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	7-8, Figure 1
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7,8,9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6,7,8,9*
Bias	9	Describe any efforts to address potential sources of bias	10
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8,9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10,11
		(*b*) Describe any methods used to examine subgroups and interactions	11
		(*c*) Explain how missing data were addressed	10
		(*d*) If applicable, explain how loss to follow-up was addressed	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Figure 1
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Table 1
		(b) Indicate number of participants with missing data for each variable of interest	10 Table 1

		(c) Summarise follow-up time (eg, average and total amount)	12
Outcome data	15*	Report numbers of outcome events or summary measures over time	12 Table 1 and 3
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13,14,15 Table 2 and 4
		(*b*) Report category boundaries when continuous variables were categorized	8,9
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	13,14,15
Discussion			
Key results	18	Summarise key results with reference to study objectives	15,16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18 (19)
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	19

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

TITLE PAGE

The welfare burden of adolescent anxiety and depression: A prospective study of 7,500 young Norwegians and their families - the HUNT study

Kristine Pape, Johan Håkon Bjørngaard, Turid Lingaas Holmen, Steinar Krokstad

Corresponding author:

Kristine Pape

Department of Public Health and General Practice,

Norwegian University of Science and Technology,

7491 Trondheim, Norway

E-mail: kristine.pape@ntnu.no

Telephone: private +47 95 11 79 20 work +47 73 59 88 76

Fax: +47 73 59 75 77

Co-authors:

Johan Håkon Bjørngaard

Department of Public Health and General Practice,

Norwegian University of Science and Technology,

Trondheim, Norway

St. Olav's University Hospital Trondheim,

Forensic Department and Research Centre Bröset,

Trondheim, Norway

Turid Lingaas Holmen

Steinar Krokstad

HUNT research Center,

Department of Public Health and General Practice,

Norwegian University of Science and Technology,

Levanger, Norway

Keywords: Adolescent, social security, longitudinal study, anxiety and depression, family, siblings

Word count: 3104

ABSTRACT

Objectives

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

Design

Prospective cohort study. Norwegian population study linked to national registers.

Participants

2

~~7,497 school-attending adolescents had information on their own (Hopkins Symptoms Checklist – SCL-5 score) and parental (Hospital Anxiety and Depression Scale – HADS score) anxiety and depression symptoms from the Nord-Trøndelag Health Study 1995-1997 (HUNT).~~ 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 – HADS score). There were 2~~,~~711 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 ~~reception~~ receipt of medical benefits (main outcome) and unemployment benefits for comparison from ages 20–29.

Methods

We used logistic regression to estimate ~~analysis to compare medical benefit reception risk both following own and parental anxiety and depression symptoms.~~ odds ratios 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). ~~In addition, we used sibling fixed-effect analysis to~~ We adjusted for family-level confounders by comparing ~~among~~ siblings differentially exposed to anxiety and depression symptoms.

Results

Comparing siblings, a one ~~unit~~point increase in the mean SCL-5 score was associated with a 65% increase in the odds of *medical* benefit receiptption from age 20-29 (adjusted

3

OR, 1.65, 95% CI 1.10-2.48). Parental anxiety and depression symptom load was an indicator of their adolescent's future risk of medical benefit receiptption, and adolescents with both parents reporting high symptom loads seemed to be at a particularly high risk. The anxiety and depression symptom load was not, or at least only weakly, associated with *unemployment* benefits. reception from age 20-29.

Conclusions

Adolescents in families hampered bywith 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.

Keywords: adolescent, social security, longitudinal study, anxiety and depression, family, siblings

ARTICLE SUMMARY

Article focus

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

Key messages

- Adolescents with high levels of anxiety and depression symptoms had ~~an~~ increased risk of receiving medical benefits from age 20-29.
- 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 receiptption from age 20-29 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 ~~of~~ global disability and disease burden among young people, and while adolescents with symptoms of anxiety and depression are more likely to experience mental health problems in adulthood,[1-4] educational underachievement and periods of unemployment later in life.[3-5] However, research on

anxiety and depression and later life outcomes related to working life has mostly been ~~undertaken with~~geared towards adult working populations.[6, 7] 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.[8-12] 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.[13-15] 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.[16] Our first and main aim was to study the relationship between anxiety and depression symptoms in adolescence and later receipt of medical benefits ~~reception~~ 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 ~~reception~~ in young adult offspring. For comparative purposes, we also wanted to explore these associations using receipt of unemployment benefit ~~reception~~s 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),[17] where 8,950 school-attending adolescents (90% of those invited) completed a questionnaire between 1995-1997 (the Young-HUNT Study). We linked the adolescent data to the National Education and National Insurance Administration Registers for information on demography and the receiptption 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 within mothers. A total of 7,497 of the eligible adolescents had one or two parents who participated in the HUNT 2 survey (1995-97), and these were included in our study cohort.Included in our study cohort was the 7497 eligible adolescents with one or two parents who had participated in the HUNT 2 survey (1995-97). See Figure 1 for description of sample selection (2,711 adolescents had one or more siblings in the cohort, their mother being the common parent sharing the same mother).

Figure 1: Flow chart displaying how the study cohort was derived

(Please place Figure 1 here)

Ethics

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

Outcome measure − benefit receiptption

The main outcome variable was medical benefit receiptption from age 20–29. Medical benefits ~~included~~ are defined as social insurance benefits received for more than 180 days during one calendar year and are intended to replace income ~~in the case~~lost because of health problems., ~~and which were received for more than 180 days during one calendar year.~~ These benefits included sickness absence, rehabilitation or vocational rehabilitation benefits and disability pension (http://www.nordsoc.org/). Additionally, medical benefit receiptption was recorded each calendar year and according to age from 20 to 29 years (~~starting registrations~~ continuous~~ly~~ registration starting at the beginning of ~~from~~ 1998, ending registration in 2008 or in the case of death). ~~-~~An additional outcome variable was unemployment benefit ~~reception~~ receipt from age 20–29 (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).[18] 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"), ~~and~~ ; 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 to 4) was calculated for those who had answered at least three of the five questions. The adolescent symptom load was categorized as high or low according to established and recommended cut-off values of the SCL-5 scores.[18] 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. 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 ~~both~~ anxiety (HADS-A) and depression (HADS-D).[19] Each item was scored on a four-point scale ranging from 0 to 3, and was added up resulting in~~to~~ 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).[19] 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 categorized as 12-14 years, 15-17 years 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 three 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 to 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, categorized 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 teenagers 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 1,669 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 7,497 adolescents, including information on both parents. We conducted the procedure following recommendations in the current guidelines, [20] used and using the chained equations option in the multiple imputation (mi) procedure in STATA statistical software to, creating 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

10

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 ~~reception~~ 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 odds ratio 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 [21] to compare the anxiety and depression symptom level (the continuous SCL-5 score) *within* sibling groups ~~in order~~ 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~~reception~~ 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 ~~;~~ ~~with these~~ 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. ~~ors.~~ 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. ~~, and~~ 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), with the odds ratios from the fixed-effect logistic regression (sibling comparison) having a cluster-specific interpretation.[22] All of the analyses were reported with 95% confidence intervals (CI).

RESULTS

D~~The d~~ata was available for 3~~,~~729 boys and 3~~,~~768 girls, with a mean age of 16.0 years (~~s.d~~standard deviation (sd) ~~.~~= 1.8) and a mean SCL-5 score of 1.45 (sd~~.d.~~ = 0.48, range 1-4). The median follow-up 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 ~~reception~~ receipt are presented in Table 1 (table including unemployment benefits available as Table 3 in Appendix).

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	%	*n*	%
Adolescent anxiety and depression symptoms				
SCL-5 score, mean *sd*	1.43	*0.47*	1.56	*0.56*
High load [a]	915	14	219	22
Parental anxiety and depression symptoms [ab]				
Mother high load	1218	20	229	26
Father high load	944	18	147	22
Adolescent and parental symptom loads combined [ab]				
Adolescent low, parents low	2751	59	293	50
Adolescent low, one parent high	1094	24	144	25
Adolescent low, both parents high	177	4	34	6
Adolescent high, parents low	378	8	76	13
Adolescent high, one parent high	196	4	30	5
Adolescent high, 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 [b]	1457	23	132	14
Mother secondary education [b]	4073	64	623	65
Mother primary education [b]	840	13	198	21
Father tertiary education [b]	1367	23	132	16
Father secondary education [b]	3793	63	524	63
Father primary education [b]	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

[a] High anxiety and depression symptom loads defined by SCL-5 scale scores of 2.0 or above for adolescents and HADS scores of 8.0 or above (on the anxiety *or* depression subscale) for parents.

[b] 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), father's educational level (630).

Formatted Table

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 ~~ratio~~ of receiving medical benefits ~~was 1.47 (95% CI 1.29-1.68)~~increased by 50% both following ~~for~~ a one ~~unit~~point ~~change~~ increase in~~on~~ the SCL-5 scale score. ~~and 1.58 (95% CI 1.33-1.87) for~~ Aadolescents in the high-symptom load group had about 60% higher odds of receiving medical benefits (OR 1.58, 95% CI 1.33-1.87) compared to the low-symptom load group (analyses adjusted for sex, age and follow-up time). An adjustment for somatic health ~~lowered~~ somewhat attenuated the estimates ~~to 1.33 (95% CI 1.17-1.53) and 1.42 (95% CI 1.20-1.69), respectively~~. 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 odds ratio of receiving unemployment benefits was 0.99 (95% CI 0.83-1.17) for a one ~~unit~~point ~~change~~ increase in~~on~~ the SCL-5 scale score and 1.13 (95% CI 0.91-1.40) 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 receiptption was still pronounced, and the results are presented in the

lower part of Table 2. A one ~~unit~~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 ~~reception~~ 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 ~~reception~~ recipt yielded an odds ratio of 1.11 (0.74-1.66) for a one ~~unit~~point increase in the SCL-5 score in a model adjusted for age, sex and follow-up time (see Table 4 in Appendix for details).

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

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

[a] 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: as Model 2, with additional adjustment for parental educational level and family risk factors

[b] Fixed-effect model (conditional logistic regression).

[c] Odds ratios of a one-point increase in the SCL-5 score (range 1-4).

Family symptoms of anxiety and depression

Having parents with a high anxiety and depression symptom load was independently associated with medical benefit ~~reception~~ receipt from age 20-29. Compared with adolescents ~~having~~ who had parents with low symptom loads, the odds ratio of receiving medical benefits was 1.28 (95% CI 1.08-1.52) if one parent had a high symptom load and 1.85 (95% CI 1.38-2.47) if both parents had high symptom loads (analyses adjusted for sex, age and follow-up time). The corresponding odds ratios of receiving unemployment benefits were 1.20 (95% CI 0.99-1.45) and 1.52 (95% CI 1.06-2.16). 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 ~~reception~~ remained (OR 1.45 (95% CI 1.07-1.98)). In the upper part of Table 2, we can see that the odds of medical benefit ~~reception~~ receipt were higher in all five groups~~,~~ with an increased symptom load, compared with the "low adolescent/low parental" symptom load group. The odds ratios attenuated a 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 Table 4 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 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 ~~reception~~, 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 ~~reception~~ receipt of medical~~-~~ than unemployment benefits.

Strengths and limitations

The originality and main contributions of our study are that it utilizes a unique data material consisting of both parental- and offspring health variables, as well as follow-up data from registers on later medical benefit ~~reception~~ receipt in the offspring. Assessments of anxiety and depression were performed using validated questionnaires,[18, 19] but ~~were only based on~~the self-reported information used in our study was only from~~on~~ 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 co-morbidity in our study, we were unable to formulate a more detailed and differentiated picture of the risk following mental health vulnerability.

Missing parental data was a potential source of selection bias, and we performed a multiple imputation procedure in order to obtain complete parental data to help minimize 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 ~~reception~~ receipt (n = 8509)~~for all 8,509 adolescents (including the group of 1,012 excluded adolescents)~~. The estimates obtained from these analyses were comparable to our reported findings, although somewhat lower.

~~As regards the generalizability of our findings to other countries and populations, we believe we have demonstrated a universal vulnerability in adolescents regardless of context. Nevertheless, the~~ The consequences of mental disorders in adolescents and their parents ~~in terms of~~on work integration ~~will of course~~ are largely dependent on characteristics of the context such as ~~of~~ the ~~actual~~ 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,[3-5, 23, 24] 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 18-19) and risk of disability pension both early and later in adulthood.[25, 26] Other prospective studies relating anxiety and depression to unemployment, sick leave and disability pension primarily include cohorts

19

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.[6, 7] An American prospective study of siblings and parents reported that childhood depression was strongly related to income as an adult, also when comparing siblings.[27] 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,[2-4] 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.[28] ~~It is also possible that~~ T~~t~~he association between adolescent anxiety and depression symptoms and benefit receipt in young adulthood may also be ~~explained~~ influenced by ~~confounding individual and/or family~~ factors that may increase both mental distress and the risk of receiving medical benefits ~~reception.~~ such as the various somatic and psychiatric conditions that are associated 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,[5] and that co-occurring mental disorders, to a small extent, influenced the consequences of anxiety and depression.[3, 4, 23] More general personal traits such as childhood temperament and intellectual abilities are other individual factors that may be of importance,[26, 29] but the effects of intellectual function and psychiatric disease seem independent of each other.[25] ~~However, despite the fact that f~~Our results indicated an influence of family factors ~~did seem to play a certain role~~, as indicated by the attenuation of odds ratios in model 3. However, the association between adolescent symptom load and medical benefit ~~reception~~ receipt remained, even when all shared family factors were adjusted for in the sibling comparison. ~~Other mental diseases and more general personal traits such as childhood temperament and intellectual abilities are individual factors that may be of importance,[27, 31] though these were not assessed in our study.~~

Parental anxiety and depression symptom load were independently associated with medical benefit ~~reception~~ 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.[8, 9, 11, 14] ~~Furthermore, p~~Parental anxiety and depression may have negative influence on the family, with ~~also have~~ consequences for ~~their~~ offspring's cognitive, emotional and social development from an early age.[10, 12] Anxiety and depression in adults are associated

with work exclusion,[6, 7] which could increase the strain on the children and adolescents in the family.[30]

~~Hence, adolescent *and* parent symptoms of anxiety and depression may be regarded as risk measures of previous, existent and future mental health vulnerability for the adolescents. Our findings suggest that parental and adolescent symptom loads assessed together could provide a more complete picture of the burden of anxiety and depression symptoms for adolescents as they enter in adulthood. Furthermore, o~~Our finding that anxiety and depression symptoms were more strongly related to medical benefit ~~reception~~ 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 demonstrat~~ed~~es 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 emphasizes 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.~~suggests that the family perspective may be of importance, and that~~ T~~t~~reatment 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.

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.

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.

CONFLICTS OF INTEREST

None

ETHICAL CONSIDERATIONS

23

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

CONTRIBUTORSHIP STATEMENT

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.

REFERENCES

1 Copeland WE, Shanahan L, Costello EJ, *et al.* Childhood and Adolescent Psychiatric Disorders as Predictors of Young Adult Disorders. *Arch Gen Psychiatry* 2009;**66**:764-72.

2 Reef J, Diamantopoulou S, Van Meurs I, *et al.* Child to adult continuities of psychopathology: a 24-year follow-up. *Acta Psychiatrica Scandinavica* 2009;**120**:230-8.

3 Woodward LJ, Fergusson DM. Life Course Outcomes of Young People With Anxiety Disorders in Adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry* 2001;**40**:1086-93.

4 Fergusson DM, Woodward LJ. Mental Health, Educational, and Social Role Outcomes of Adolescents With Depression. *Arch Gen Psychiatry* 2002;**59**:225-31.

5 Gibb SJ, Fergusson DM, Horwood LJ. Burden of psychiatric disorder in young adulthood and life outcomes at age 30. *The British Journal of Psychiatry* 2010;**197**:122-7.

6 Moncrieff J, Pomerleau J. Trends in sickness benefits in Great Britain and the contribution of mental disorders. *J Public Health Med* 2000;**22**:59-67.

7 Mykletun A, Overland S, Dahl AA*, et al.* A Population-Based Cohort Study of the Effect of Common Mental Disorders on Disability Pension Awards. *Am J Psychiatry* 2006;**163**:1412-8.

8 Rice F. The genetics of depression in childhood and adolescence. *Curr Psychiatry Rep* 2009;**11**:167-73.

9 Kendler KS, Gardner CO, Lichtenstein P. A developmental twin study of symptoms of anxiety and depression: evidence for genetic innovation and attenuation. *Psychological Medicine* 2008;**38**:1567-75.

10 Mensah FK, Kiernan KE. Parents' mental health and children's cognitive and social development : Families in England in the Millennium Cohort Study. *Soc Psychiatry Psychiatr Epidemiol* 2009.

11 Hughes EK, Gullone E. Internalizing symptoms and disorders in families of adolescents: A review of family systems literature. *Clinical Psychology Review* 2008;**28**:92-117.

12 Lewinsohn PM, Olino TM, Klein DN. Psychosocial impairment in offspring of depressed parents. *Psychological Medicine* 2005;**35**:1493-503.

25

13 Amone-P'Olak K, Burger H, Ormel J*, et al.* Socioeconomic position and mental health problems in pre- and early-adolescents: the TRAILS study. *Soc Psychiatry Psychiatr Epidemiol* 2009;**44**:231-8.

14 Amone-P'Olak K, Burger H, Huisman M*, et al.* Parental psychopathology and socioeconomic position predict adolescent offspring's mental health independently and do not interact: the TRAILS study. *J Epidemiol Community Health* 2011;**65**:57-63.

15 Dunn VJ, Abbott RA, Croudace TJ*, et al.* Profiles of family-focused adverse experiences through childhood and early adolescence: The ROOTS project a community investigation of adolescent mental health. *BMC Psychiatry* 2011;**11**:109.

16 Donovan SJ, Susser E. Commentary: Advent of sibling designs. *Int J Epidemiol* 2011;**40**:345-9.

17 Holmen J, Midthjell K, Krüger Ø*, et al.* The Nord-Trøndelag Health Study 1995-97 (HUNT 2): Objectives, contents, methods and participation. *Norsk epidemiologi* 2003;**13**:19-32.

18 Strand BH, Dalgard OS, Tambs K*, et al.* Measuring the mental health status of the Norwegian population: a comparison of the instruments SCL-25, SCL-10, SCL-5 and MHI-5 (SF-36). *Nord J Psychiatry* 2003;**57**:113-8.

19 Bjelland I, Dahl AA, Haug TT*, et al.* The validity of the hospital anxiety and depression scale. An updated literature review. *J Psychosom Res* 2002;**52**:69 - 77.

20 Sterne JAC, White IR, Carlin JB*, et al.* Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. *BMJ* 2009;**338**.

21 Kleinbaum DG, Klein M. *Logistic Regression. A Self-Learning Text*. New York Dordrecht Heidelberg London: Springer 2010.

26

22 Rabe-Hesketh S, Skrondal A. *Multilevel and Longitudinal Modeling using Stata*: Stata Press 2005.

23 Fergusson DM, Boden JM, Horwood LJ. Recurrence of major depression in adolescence and early adulthood, and later mental health, educational and economic outcomes. *The British Journal of Psychiatry* 2007;**191**:335-42.

24 Fergusson DM, Horwood LJ, Ridder EM*, et al.* Subthreshold Depression in Adolescence and Mental Health Outcomes in Adulthood. *Arch Gen Psychiatry* 2005;**62**:66-72.

25 Gravseth HM, Bjerkedal T, Irgens LM*, et al.* Influence of physical, mental and intellectual development on disability in young Norwegian men. *Eur J Public Health* 2008.

26 Johansson E, Leijon O, Falkstedt D*, et al.* Educational differences in disability pension among Swedish middle-aged men: role of factors in late adolescence and work characteristics in adulthood. *Journal of Epidemiology and Community Health* 2011.

27 Smith JP, Smith GC. Long-term economic costs of psychological problems during childhood. *Social Science & Medicine* 2010;**71**:110-5.

28 De Ridder KA, Pape K, Johnsen R*, et al.* 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.

29 Henderson M, Hotopf M, Leon DA. Childhood temperament and long-term sickness absence in adult life. *Br J Psychiatry* 2009;**194**:220-3.

30 Reinhardt Pedersen C, Madsen M. Parents' labour market participation as a predictor of children's health and wellbeing: a comparative study in five Nordic countries. *Journal of Epidemiology and Community Health* 2002;**56**:861-7.