



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

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4 **TITLE PAGE**  
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8 **The welfare burden of adolescent anxiety and depression: A prospective study of**  
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10 **7,500 young Norwegians and their families - the HUNT study**  
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31 family, siblings  
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## 40 41 **ABSTRACT**

### 42 43 **Objectives**

44  
45 To examine the association between anxiety and depression symptoms in adolescents and  
46  
47 their families and later medical benefit reception in young adulthood.  
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### 50 51 **Design**

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53 Prospective cohort study. Norwegian population study linked to national registers.  
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### 55 56 **Participants**

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3 7,497 school-attending adolescents had information on their own (Hopkins Symptoms  
4 Checklist – SCL-5 score) and parental (Hospital Anxiety and Depression Scale – HADS  
5 score) anxiety and depression symptoms from the Nord-Trøndelag Health Study 1995-  
6 1997 (HUNT). There were 2,711 adolescents with one or more siblings in the cohort.  
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### 10 11 12 **Outcome measures**

13  
14 Adolescents were followed for 10 years in national social security registers, identifying  
15 long-term reception of medical benefits (main outcome) and unemployment benefits for  
16 comparison from ages 20–29.  
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### 20 21 22 **Methods**

23  
24 We used logistic regression analysis to compare medical benefit reception risk both  
25 following own and parental anxiety and depression symptoms. In addition, we used  
26 sibling fixed-effect analysis to adjust for family-level confounders among siblings  
27 differentially exposed to anxiety and depression symptoms.  
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### 33 34 35 **Results**

36 Comparing siblings, a one-unit increase in the mean SCL-5 score was associated with a  
37 65% increase in the odds of *medical* benefit reception from age 20-29 (adjusted OR, 1.65,  
38 95% CI 1.10-2.48). Parental anxiety and depression symptom load was an indicator of  
39 their adolescent's future risk of medical benefit reception, and adolescents with both  
40 parents reporting high symptom loads seemed to be at a particularly high risk. The  
41 anxiety and depression symptom load was not, or at least only weakly, associated with  
42 *unemployment* benefit reception from age 20-29.  
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### 53 54 55 **Conclusions**

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3 Adolescents in families hampered with anxiety and depression symptoms are at a  
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5 substantial higher risk of medical welfare dependence in young adulthood. The  
6  
7 prevention and treatment of anxiety and depression in adolescence should be family-  
8  
9 oriented and aimed at ensuring work-life integration.  
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14  
15 Keywords: adolescent, social security, longitudinal study, anxiety and depression, family,  
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17 siblings  
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## 20 21 22 **ARTICLE SUMMARY** 23

### 24 25 26 **Article focus** 27

- 28  
29 • The influence of anxiety and depression symptoms in adolescence on work  
30  
31 integration in early adulthood, assessed by the reception of long-term medical  
32  
33 benefits from age 20-29.  
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- 36  
37 • The impact of parental anxiety and depression on adolescents' future risk of  
38  
39 medical benefit reception.  
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### 42 43 44 **Key messages** 45

- 46  
47 • Adolescents with high levels of anxiety and depression symptoms had an  
48  
49 increased risk of medical benefits from age 20-29.  
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- 52  
53 • Confounding from family factors was not a likely explanation as associations  
54  
55 were present among siblings differentially exposed to anxiety and depression.  
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- 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.

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3 Anxiety and depression in parents and their offspring are associated due to both heritage  
4 and influences on the parenting role and family environment.[8-12] Factors that are  
5  
6 and influences on the parenting role and family environment.[8-12] Factors that are  
7  
8 shared within families, such as socioeconomic status, marital conflict, parenting style and  
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10 stressful life events may confound associations between symptoms of anxiety and  
11  
12 depression and life outcomes in young people.[13-15] Therefore, a prospective design  
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14 comparing siblings with different symptom loads would be suitable, as it will in itself  
15  
16 control for shared factors that could have confounded the results of other studies.[16]  
17  
18 Our first and main aim was to study the relationship between anxiety and depression  
19  
20 symptoms in adolescence and later medical benefit reception in young adulthood. Our  
21  
22 second aim was to assess this relationship by comparing levels of anxiety and depression  
23  
24 symptoms within sibling groups, while our third aim was to study the relationship  
25  
26 between the combined anxiety and depression symptom loads of adolescents and parents  
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28 and later medical benefit reception in young adult offspring. For comparative purposes,  
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30 we also wanted to explore these associations using unemployment benefit reception as an  
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32 alternative outcome.  
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## 41 **METHODS**

### 42 **Data and linkages**

43  
44 We used data from the HUNT study, a Norwegian population study from Nord-  
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46 Trøndelag County (<http://www.ntnu.no/hunt/english>),[17] where 8,950 school-attending  
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48 adolescents (90% of those invited) completed a questionnaire between 1995-1997 (the  
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50 Young-HUNT Study). We linked the adolescent data to the National Education and  
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52 National Insurance Administration Registers for information on demography and the  
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3 reception of social benefits during follow-up from 1998 to 2008 (Statistics Norway,  
4 <http://www.ssb.no/en/>). Biological parents and siblings were identified through a linkage  
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6 to the Norwegian Family Register, using a unique parental identification number for  
7  
8 siblings within mothers. A total of 7,497 of the eligible adolescents had one or two  
9  
10 parents who participated in the HUNT 2 survey (1995-97), and these were included in our  
11  
12 study cohort. See Figure 1 for description of sample selection (2,711 adolescents had one  
13  
14 or more siblings in the cohort sharing the same mother).  
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22 Figure 1: Flow chart displaying how the study cohort was derived

23  
24 (Figure 1 here)  
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### 29 **Ethics**

30  
31 Each student signed a written consent form to participate in the study and parents or  
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33 guardians of students less than 16 years also gave their written consent. The study was  
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35 approved by the Regional Medicine Ethical Committee and the Norwegian Data  
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37 Inspectorate.  
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### 43 **Outcome measure – benefit reception**

44  
45 The main outcome variable was medical benefit reception from age 20–29. Medical  
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47 benefits included social insurance benefits intended to replace income in the case of  
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49 health problems, and which were received for more than 180 days during one calendar  
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51 year. These benefits included sickness absence, rehabilitation or vocational rehabilitation  
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53 benefit and disability pension (<http://www.nordsoc.org/>). Additionally, medical benefit  
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3 reception was recorded each calendar year and according to age from 20 to 29 years  
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5 (starting registrations continuously from 1998, ending registration in 2008 or in the case  
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7 of death). An additional outcome variable was unemployment benefit reception from age  
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9 20–29 (not including those who also received medical benefits), which included cases of  
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11 unemployment if economic compensation was received more than 180 days during one  
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13 calendar year.  
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### 20 **Anxiety and depression symptoms**

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22 Adolescent symptoms of anxiety and depression were assessed with the five-item  
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24 Hopkins Symptom Checklist (SCL-5).[18] In the SCL-5, the presence or absence of the  
25  
26 following five symptoms during the last 14 days was reported: feeling blue, feeling  
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28 fearful, feeling hopeless about the future, worrying too much about things and  
29  
30 experiencing nervousness or shakiness inside. A four-point scale was used, ranging from  
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32 1 (“not bothered”) to 4 (“very much bothered”), and we summed up the scale scores on  
33  
34 each item and then divided the total sum by the number of items answered. The average  
35  
36 SCL-5 scale score (range 1 to 4) was calculated for those who had answered at least three  
37  
38 of the five questions. The adolescent symptom load was categorized as high or low  
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40 according to established and recommended cut-off values of the SCL-5 scores.[18] The  
41  
42 high adolescent symptom load group included adolescents with SCL-5 scores of 2.0 or  
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44 above, whereas the low adolescent symptom load group included adolescents with SCL-5  
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46 scores below 2.0. Parental symptoms of anxiety and depression were assessed with the  
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48 Hospital Anxiety and Depression Scale (HADS), which is a validated 14-item scale that  
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50 consists of two 7-item scales covering both anxiety (HADS-A) and depression (HADS-  
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3 D).[19] Each item was scored on a four-point scale ranging from 0 to 3, and was added  
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5 up to a score between 0 and 21 for each subscale. A high parental symptom load was  
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7 defined as having a score of 8 or above (recommended cut-off value) on *at least one* of  
8  
9 the subscales (HADS-A and/or HADS-D).[19] Three groups were identified according to  
10  
11 whether no parent, one parent or both parents had a high anxiety or depression symptom  
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13 load.  
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### 20 **Baseline covariates**

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22 *Age* was used as continuous variable, but also categorized as 12-14 years, 15-17 years  
23  
24 and 18-20 years. *Somatic health* was assessed by the self-reported presence of chronic  
25  
26 disease (has a doctor ever diagnosed you with epilepsy, migraine, diabetes, asthma or had  
27  
28 another disease lasting more than three months) and disability (medium or much  
29  
30 impairment of hearing, movement or somatic illness or much impairment of vision).  
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32 Variables were included in the analyses as dichotomous measures. *Follow-up time* was  
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34 the number of years from 1998 to 2008 in which the participants were alive and aged 20  
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36 to 29, and thereby registered with benefit or no benefit. *Parental educational attainment*  
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38 was measured for both parents by the level of completed education in 1995, categorized  
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40 as primary education (compulsory school only) secondary education (completed high  
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42 school) and tertiary education (university degree). Family risk factors were assessed by  
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44 four dichotomous measures: *teenage parent* (families in which one or both parents were  
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46 teenagers when their adolescent study participant was born), *divorced* (families with  
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48 divorced parents), *single parent* (adolescent reporting living with only one parent), and  
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50 *living alone* (adolescent reporting living alone).  
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### 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.

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3 We explored the relationship between adolescents' family symptom load and benefit  
4 reception by a comparison of the groups according to parental symptom load and  
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6 according to combinations of adolescent and parental symptom load. Six groups were  
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8 identified by combining the two adolescent symptom load groups (low and high) with the  
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10 three parental symptom load groups (low, one parent high and both parents high). In the  
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12 analysis, all five groups including high symptom loads were compared with the "low  
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14 adolescent and low parental" symptom load group (reference category).  
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20 All the analyses mentioned above were adjusted for sex, age and follow-up time, with  
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22 these results presented as "Model 1" in the text and tables. We adjusted for adolescent  
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24 somatic health in a separate model ("Model 2"), regarding health as a potentially  
25  
26 important confounder. "Model 3" (not included in the fixed-effect model) included an  
27  
28 additional adjustment for parental education and family risk factors. These family-related  
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30 factors were regarded as potential confounders and/or intermediate factors. A potential  
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32 effect measure modification by sex and age was explored by including interaction terms  
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34 between SCL-5 scale scores and sex and SCL-5 scale scores and age in the analyses, and  
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36 analyses were conducted using STATA 11 and STATA 12 software (StataCorp LP,  
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38 Texas, USA). The results from logistic regression analyses were presented as odds ratios  
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40 (OR), with the odds ratios from the fixed-effect logistic regression (sibling comparison)  
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42 having a cluster-specific interpretation.[21] All of the analyses were reported with 95%  
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44 confidence intervals (CI).  
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## 50 51 52 53 **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<br>(n=6,511) |      | Medical benefits<br>(n=986) |      |
|---|----------------------------------|------|-----------------------------|------|
|   | <i>n</i>                         | %    | <i>n</i>                    | %    |
| 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 <sup>a</sup>         | 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 <sup>ab</sup> | 1,218                            | 20.4 | 229                         | 26.2 |
| Father high anxiety and depression symptom load <sup>ab</sup> | 944                              | 18.4 | 147                         | 21.5 |
| Mother tertiary education <sup>b</sup>                        | 1,457                            | 22.9 | 132                         | 13.9 |
| Mother secondary education <sup>b</sup>                       | 4,073                            | 63.9 | 623                         | 65.4 |
| Mother primary education <sup>b</sup>                         | 840                              | 13.2 | 198                         | 20.8 |
| Father tertiary education <sup>b</sup>                        | 1,367                            | 22.7 | 132                         | 15.7 |
| Father secondary education <sup>b</sup>                       | 3,793                            | 62.9 | 524                         | 62.5 |
| Father primary education <sup>b</sup>                         | 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  |

<sup>a</sup> 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.

<sup>b</sup> 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.

| 13 | Medical benefits from age 20-29 |          |                      |          |                      |          |
|----|---------------------------------|----------|----------------------|----------|----------------------|----------|
|    | Model 1 <sup>a</sup>            |          | Model 2 <sup>a</sup> |          | Model 3 <sup>a</sup> |          |
|    | OR                              | (95% CI) | OR                   | (95% CI) | OR                   | (95% CI) |
|    |                                 |          |                      |          |                      |          |

According to combinations of adolescent and parental symptom loads, n = 7,497

|                                       |      |             |      |             |      |             |
|---------------------------------------|------|-------------|------|-------------|------|-------------|
| Adolescent low,<br>parents low        | 1.00 | (ref)       | 1.00 | (ref)       | 1.00 | (ref)       |
| Adolescent low,<br>one parent high    | 1.31 | (1.08-1.58) | 1.29 | (1.06-1.56) | 1.16 | (0.96-1.41) |
| Adolescent low,<br>both parents high  | 1.92 | (1.38-2.69) | 1.88 | (1.34-2.64) | 1.56 | (1.10-2.22) |
| Adolescent high,<br>parents low       | 1.68 | (1.33-2.13) | 1.53 | (1.21-1.94) | 1.52 | (1.20-1.93) |
| Adolescent high,<br>one parent high   | 1.82 | (1.34-2.49) | 1.61 | (1.18-2.21) | 1.39 | (1.01-1.92) |
| Adolescent high,<br>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<sup>b</sup>

|                                |      |             |      |             |
|--------------------------------|------|-------------|------|-------------|
| SCL-5 scale score <sup>c</sup> | 1.86 | (1.25-2.76) | 1.65 | (1.10-2.48) |
|--------------------------------|------|-------------|------|-------------|

<sup>a</sup> 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

<sup>b</sup> Fixed-effect model (conditional logistic regression).

<sup>c</sup> 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



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3 true when we adjusted for confounding factors at the family level by comparing symptom  
4 loads within sibling groups. Parental anxiety and depression symptom load was an  
5 indicator of their adolescent's future risk of medical benefit reception, and adolescents  
6 with both parents reporting high symptom loads seemed to be at a particularly high risk.  
7  
8 Moreover, anxiety and depression symptoms were more strongly related to later reception  
9 of medical- than unemployment benefits.  
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### 20 **Strengths and limitations**

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22 The originality and main contributions of our study are that it utilizes a unique data  
23 material consisting of both parental- and offspring health variables, as well as follow-up  
24 data from registers on later medical benefit reception in the offspring. Assessments of  
25 anxiety and depression were performed using validated questionnaires,[18, 19] but were  
26 only based on self-reported information on one occasion. Repeated measurements with  
27 structured diagnostic interviews may have provided more reliable information on anxiety  
28 and depression. However, such an approach is not feasible in a population study of this  
29 size. Missing parental data was a potential source of selection bias, and we performed a  
30 multiple imputation procedure in order to obtain complete parental data to help minimize  
31 this bias. The adolescents initially excluded from the study cohort because they had no  
32 participating parents were included in a sensitivity analysis of the relationship between  
33 SCL-5 score and benefit reception for all 8,509 adolescents (including the group of 1,012  
34 excluded adolescents). The estimates obtained from these analyses were comparable to  
35 our reported findings, although somewhat lower. As regards the generalizability of our  
36 findings to other countries and populations, we believe we have demonstrated a universal  
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3 vulnerability in adolescents regardless of context. Nevertheless, the consequences of  
4 mental disorders in adolescents and their parents in terms of work integration will of  
5 course depend on characteristics of the actual labour market and welfare regime.  
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### 11 12 **Results compared to existing literature**

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14 Our study's results are in accordance with studies from New Zealand,[3-5, 22, 23] where  
15 symptoms of adolescent anxiety and depression and other mental illnesses have been  
16 associated with lower educational attainment, lower workforce participation and  
17 increased welfare dependence. Additionally, two large prospective Scandinavian  
18 population studies have described an association between mental impairment/psychiatric  
19 diagnosis among young men (at conscript, age 18-19) and risk of disability pension both  
20 early and later in adulthood.[24, 25] Other prospective studies relating anxiety and  
21 depression to unemployment, sick leave and disability pension primarily include cohorts  
22 of working adults who have already succeeded in entering work and may not grasp the  
23 particular challenges of young people in the transition to adulthood.[6, 7] An American  
24 prospective study of siblings and parents reported that childhood depression was strongly  
25 related to income as an adult, also when comparing siblings.[26] This study represents  
26 one of the few that uses twin or sibling designs to study life outcomes following anxiety  
27 and depression in young people. Although there are many studies on the association  
28 between parental anxiety and depression and offspring mental health, the literature on the  
29 association between parental anxiety and depression and life outcomes in the offspring is  
30 scarce. Thus far, we have not found any studies that assess life outcomes for young  
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3 people according to a combination of parental and adolescent anxiety and depression  
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5 symptom load.  
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### 10 **Interpretation of findings**

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12 One plausible mechanism may be that adolescents with high anxiety and depression  
13 symptoms have an increased risk of experiencing mental illness later in life,[2-4] which  
14 may be the direct cause of work impairment. It is also possible that the association may  
15 be explained by confounding individual and/or family factors that may increase both  
16 mental distress and the risk of medical benefit reception. However, despite the fact that  
17 family factors did seem to play a certain role, the association between adolescent  
18 symptom load and medical benefit reception remained even when all shared family  
19 factors were adjusted for in the sibling comparison. Other mental diseases and more  
20 general personal traits such as childhood temperament and intellectual abilities are  
21 individual factors that may be of importance,[25, 27] though these were not assessed in  
22 our study. Parental anxiety and depression symptom load were independently associated  
23 with medical benefit reception in their offspring, which could be attributed to an  
24 increased vulnerability in the offspring related to increased mental health problems.  
25 Anxiety, depression and other mental illnesses are strongly associated in parents and  
26 offspring, both because of genetic and environmental influences.[8, 9, 11, 14]  
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28 Furthermore, parental anxiety and depression may also have consequences for their  
29 offspring's cognitive, emotional and social development from an early age.[10, 12]  
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31 Hence, adolescent *and* parent symptoms of anxiety and depression may be regarded as  
32 risk measures of previous, existent and future mental health vulnerability for the  
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3 adolescents. Our findings suggest that parental and adolescent symptom loads assessed  
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5 together could provide a more complete picture of the burden of anxiety and depression  
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7 symptoms for adolescents as they enter in adulthood. Furthermore, our finding that  
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9 anxiety and depression symptoms were more strongly related to medical benefit reception  
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11 than to unemployment indicates that the work exclusion associated with anxiety and  
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13 depression symptoms in the transition to young adulthood is primarily *health related*.  
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### 20 **Implications and conclusions**

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22 Our study demonstrated that high levels of anxiety and depression symptoms among  
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24 adolescents and their parents were associated with an increased risk of receiving medical  
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26 benefits as the adolescents entered adulthood. This suggests that the family perspective  
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28 may be of importance, and that treatment and interventions for young people with  
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30 symptoms of anxiety and depression should aim to stimulate education, increase work  
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32 integration and obtain economic independence. Moreover, preventive measures should be  
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34 taken to ensure better work-life integration for adolescents with anxiety and depression  
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36 since young people with mental problems may be particularly vulnerable when facing  
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38 today's labour market demands.  
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51  
52 Study) is a collaboration between the HUNT Research Centre (Faculty of Medicine,  
53  
54 Norwegian University of Science and Technology (NTNU)), the Nord-Trøndelag County  
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4  
5 Health.  
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14  
15 Gunnell for their useful comments on the manuscript.  
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## 20 **CONFLICTS OF INTEREST**

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22 None  
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## 29 **ETHICAL CONSIDERATIONS**

30  
31 Each student signed a written consent form to participate in the study and parents or  
32 guardians of students less than 16 years also gave their written consent. The study was  
33 approved by the Regional Medicine Ethical Committee and the Norwegian Data  
34  
35 Inspectorate.  
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## 40 **CONTRIBUTORSHIP STATEMENT**

41  
42 KP and JHB carried out the data processing, the epidemiological modelling and statistical  
43 analysis and wrote the manuscript. TLH and SK participated in the design of the study  
44 and helped to write the manuscript. All authors have read and approved the final version  
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46 of the manuscript.  
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## DATA SHARING STATEMENT

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

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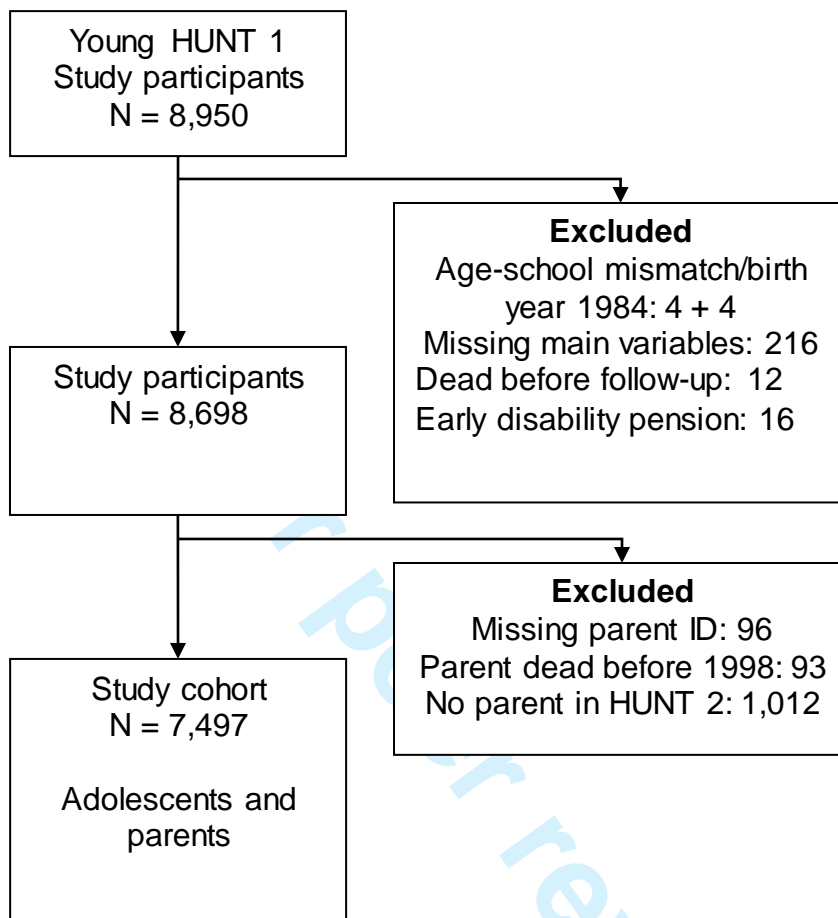


Table 3\_appendix: Baseline characteristics (1995 – 1997) of the adolescents and their parents in the study cohort according to benefit reception from age 20-29

|  | No benefits<br>(n=5835) |      | Medical benefits<br>(n=986) |      | Unemployment<br>benefits (n=676) |      |
|--|-------------------------|------|-----------------------------|------|----------------------------------|------|
|  | <i>n</i>                | %    | <i>n</i>                    | %    | <i>n</i>                         | %    |
| 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<br>symptom load <sup>a</sup>         | 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<br>depression symptom load <sup>ab</sup> | 1058                    | 19.7 | 229                         | 26.2 | 160                              | 26.9 |
| Father high anxiety and<br>depression symptom load <sup>ab</sup> | 844                     | 18.2 | 147                         | 21.5 | 100                              | 20.1 |
| Mother tertiary education <sup>b</sup>                           | 1384                    | 24.2 | 132                         | 13.9 | 73                               | 11.3 |
| Mother secondary education <sup>b</sup>                          | 3640                    | 63.6 | 623                         | 65.4 | 433                              | 66.8 |
| Mother primary education <sup>b</sup>                            | 698                     | 12.2 | 198                         | 20.8 | 142                              | 21.9 |
| Father tertiary education <sup>b</sup>                           | 1296                    | 23.9 | 132                         | 15.7 | 71                               | 11.8 |
| Father secondary education <sup>b</sup>                          | 3382                    | 62.3 | 524                         | 62.5 | 411                              | 68.3 |
| Father primary education <sup>b</sup>                            | 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  |

<sup>a</sup> 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

<sup>b</sup> 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), 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 <sup>a</sup>                 |             | Model 2 <sup>a</sup> |             | Model 3 <sup>a</sup> |             |
|   | 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 <sup>b</sup>                      |                                      |             |                      |             |                      |             |
| SCL-5 scale score <sup>a</sup>  | 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

<sup>a</sup>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 |
|------------------------------|---------|---|------------------|
| <b>Title and abstract</b>    | 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              |
| <b>Introduction</b>          |         |   |                  |
| 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                |
| <b>Methods</b>               |         |   |                  |
| 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/<br>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<br>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   |                  |
| <b>Results</b>               |         |   |                  |
| 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<br>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<br>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<br>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                  |
| <b>Discussion</b>        |     |  |                           |
| 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                        |
| <b>Other information</b> |     |  |                           |
| 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>.



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

|                                 |   |
|---------------------------------|---|
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| <b>Primary Subject Heading</b>: | Public health   |
| Secondary Subject Heading:      | Epidemiology, Mental health   |
| Keywords:                       | PUBLIC HEALTH, EPIDEMIOLOGY, Anxiety and depression, Adolescents, Social insurance, Family  |
|                                 |   |

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

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28  
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31 family, siblings  
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## 40 41 **ABSTRACT**

### 42 43 **Objectives**

44  
45 To examine the association between anxiety and depression symptoms in adolescents and  
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47 their families and later medical benefit receipt in young adulthood.  
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### 50 51 **Design**

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53 Prospective cohort study. Norwegian population study linked to national registers.  
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### 55 56 **Participants**

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3 Data from the Nord-Trøndelag Health Study 1995-1997 (HUNT) gave information on  
4 anxiety and depression symptoms as self-reported by 7497 school-attending adolescents  
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6 (Hopkins Symptoms Checklist – SCL-5 score) and their parents (Hospital Anxiety and  
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8 Depression Scale – HADS score). There were 2711 adolescents with one or more siblings  
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10 in the cohort.  
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### 13 14 15 **Outcome measures**

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17 Adolescents were followed for 10 years in national social security registers, identifying  
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19 long-term receipt of medical benefits (main outcome) and unemployment benefits for  
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21 comparison from ages 20–29.  
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### 24 25 **Methods**

26  
27 We used logistic regression to estimate odds ratios of benefit receipt for groups according  
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29 to adolescent and parental anxiety and depression symptom load (high vs. low symptom  
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31 loads) and for a one point increase in the continuous SCL-5 score (range 1 – 4). We  
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33 adjusted for family-level confounders by comparing siblings differentially exposed to  
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35 anxiety and depression symptoms.  
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### 38 39 **Results**

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41 Comparing siblings, a one point increase in the mean SCL-5 score was associated with a  
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43 65% increase in the odds of *medical* benefit receipt from age 20-29 (adjusted OR, 1.65,  
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45 95% CI 1.10-2.48). Parental anxiety and depression symptom load was an indicator of  
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47 their adolescent's future risk of medical benefit receipt, and adolescents with both parents  
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49 reporting high symptom loads seemed to be at a particularly high risk. The anxiety and  
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51 depression symptom load was only weakly associated with *unemployment* benefits.  
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### 55 56 **Conclusions**

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3 Adolescents in families hampered by anxiety and depression symptoms are at a  
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5 substantially higher risk of medical welfare dependence in young adulthood. The  
6  
7 prevention and treatment of anxiety and depression in adolescence should be family-  
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9 oriented and aimed at ensuring work-life integration.  
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15 Keywords: adolescent, social security, longitudinal study, anxiety and depression, family,  
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17 siblings  
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## 20 21 22 **ARTICLE SUMMARY** 23

### 24 25 26 27 **Article focus**

- 28  
29 • The influence of anxiety and depression symptoms in adolescence on work  
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31 integration in early adulthood, assessed by the receipt of long-term medical  
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33 benefits from age 20-29.  
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- 36  
37 • The impact of parental anxiety and depression on adolescents' future risk of  
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39 medical benefit receipt.  
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### 42 43 44 **Key messages**

- 45  
46 • Adolescents with high levels of anxiety and depression symptoms had increased  
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48 risk of receiving medical benefits from age 20-29.  
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52 • Confounding from family factors was not a likely explanation as associations  
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54 were present among siblings differentially exposed to anxiety and depression.  
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- 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

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3 shared within families, such as socioeconomic status, marital conflict, parenting style and  
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5 stressful life events may confound associations between symptoms of anxiety and  
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7 depression and life outcomes in young people.[13-15] Therefore, a prospective design  
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9 comparing siblings with different symptom loads would be suitable, as it will in itself  
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11 control for shared factors that could have confounded the results of other studies.[16]  
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13 Our first and main aim was to study the relationship between anxiety and depression  
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15 symptoms in adolescence and later receipt of medical benefits in young adulthood. Our  
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17 second aim was to assess this relationship by comparing levels of anxiety and depression  
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19 symptoms within sibling groups, while our third aim was to study the relationship  
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21 between the combined anxiety and depression symptom loads of adolescents and parents  
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23 and later receipt of medical benefits in young adult offspring. For comparative purposes,  
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25 we also wanted to explore these associations using receipt of unemployment benefits as  
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27 an alternative outcome.  
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## 36 **METHODS**

### 37 **Data and linkages**

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39 We used data from the HUNT study, a Norwegian population study from Nord-  
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41 Trøndelag County (<http://www.ntnu.no/hunt/english>),[17] where 8950 school-attending  
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43 adolescents (90% of those invited) completed a questionnaire between 1995-1997 (the  
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45 Young-HUNT Study). We linked the adolescent data to the National Education and  
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47 National Insurance Administration Registers for information on demography and the  
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49 receipt of social benefits during follow-up from 1998 to 2008 (Statistics Norway,  
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51 <http://www.ssb.no/en/>). Biological parents and siblings were identified through a linkage  
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3 to the Norwegian Family Register using a unique parental identification number for  
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5 siblings. Included in our study cohort was the 7497 eligible adolescents with one or two  
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7 parents who had participated in the HUNT 2 survey (1995-97). See Figure 1 for  
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9 description of sample selection (2711 adolescents had one or more siblings in the cohort,  
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11 their mother being the common parent).  
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18 Figure 1: Flow chart displaying how the study cohort was derived

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20 (Please place Figure 1 here)  
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## 24 25 **Ethics**

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27 Each student signed a written consent form to participate in the study, and parents or  
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29 guardians of the students who were younger than 16 years old gave their written consent.  
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32 The study was approved by the Regional Medicine Ethical Committee and the Norwegian  
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34 Data Inspectorate.  
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## 38 39 **Outcome measure – benefit receipt**

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41 The main outcome variable was medical benefit receipt from age 20–29. Medical benefits  
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43 are defined as social insurance benefits received for more than 180 days during one  
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45 calendar year and are intended to replace income lost because of health problems. These  
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47 benefits included sickness absence, rehabilitation or vocational rehabilitation benefits and  
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49 disability pension (<http://www.nordsoc.org/>). Additionally, medical benefit receipt was  
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51 recorded each calendar year and according to age from 20 to 29 years (continuous  
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53 registration starting at the beginning of 1998, ending registration in 2008 or in the case of  
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3 death). An additional outcome variable was unemployment benefit receipt from age 20–  
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5 29 (not including those who also received medical benefits), which included cases of  
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7 unemployment if economic compensation was received for more than 180 days during  
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9 one calendar year.  
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### 12 13 14 15 **Anxiety and depression symptoms** 16

17 Adolescent symptoms of anxiety and depression were assessed with the five-item  
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19 Hopkins Symptom Checklist (SCL-5).[18] In the SCL-5, the presence or absence of the  
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21 following five symptoms during the last 14 days was reported: feeling blue, feeling  
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23 fearful, feeling hopeless about the future, worrying too much about things and  
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25 experiencing nervousness or shakiness inside. A four-point scale was used, ranging from  
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27 1 (“not bothered”) to 4 (“very much bothered”); we summed up the scale scores on each  
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29 item and then divided the total sum by the number of items answered. The average SCL-5  
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31 scale score (range 1 to 4) was calculated for those who had answered at least three of the  
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33 five questions. The adolescent symptom load was categorized as high or low according to  
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35 established and recommended cut-off values of the SCL-5 scores.[18] The high  
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37 adolescent symptom load group included adolescents with SCL-5 scores of 2.0 or above,  
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39 whereas the low adolescent symptom load group included adolescents with SCL-5 scores  
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41 below 2.0. Parental symptoms of anxiety and depression were assessed with the Hospital  
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43 Anxiety and Depression Scale (HADS), which is a validated 14-item scale that consists  
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45 of two 7-item scales covering anxiety (HADS-A) and depression (HADS-D).[19] Each  
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47 item was scored on a four-point scale ranging from 0 to 3, and was added up resulting in  
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49 a score between 0 and 21 for each subscale. A high parental symptom load was defined as  
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3 having a score of 8 or above (recommended cut-off value) on *at least one* of the subscales  
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5 (HADS-A and/or HADS-D).[19] Three groups were identified according to whether no  
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8 parent, one parent or both parents had a high anxiety or depression symptom load.  
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### 10 11 12 **Baseline covariates**

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

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3 The parental HADS scores were missing for 1669 fathers (22%) and 653 mothers (9%),  
4 while the educational level was missing for 630 fathers (8%) and 17 mothers (2%). We  
5 performed a multiple imputation of missing data in order to obtain complete datasets for  
6 the 7497 adolescents, including information on both parents. We conducted the  
7 procedure following recommendations in the current guidelines, [20] and using the  
8 chained equations option in the multiple imputation (mi) procedure in STATA statistical  
9 software to create 20 datasets. Extensive health measures from the HUNT surveys and  
10 information on demography and social insurance benefits for the adolescents, mothers  
11 and fathers were used as predictor variables (a total of more than 90 variables, details  
12 available upon request), so as to ensure the required assumption of “missing at random” .  
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### 29 **Statistical methods**

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31 We used logistic regression analyses to explore the associations between anxiety and  
32 depression symptom exposures in adolescence and medical benefit receipt in young  
33 adulthood. Additional analyses were performed with unemployment benefits as an  
34 alternative outcome, and we explored the relationship between adolescent symptom load  
35 and benefit receipt by using both the continuous SCL-5 scale score and by a comparison  
36 of the groups according to symptom load (high vs. low). For the continuous SCL-5 score  
37 we estimated the odds ratio associated with a one point (+1) increase in the scale score  
38 (range 1–4). In the sibling subsample, we used a fixed-effect logistic regression model  
39 [21] to compare the anxiety and depression symptom level (the continuous SCL-5 score)  
40 *within* sibling groups to control for factors that are shared by siblings such as parental  
41 health, family socioeconomic status, home environment, etc.  
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3 We explored the relationship between adolescents' family symptom load and benefit  
4 receipt by a comparison of the groups according to parental symptom load and according  
5 to combinations of adolescent and parental symptom load. Six groups were identified by  
6 combining the two adolescent symptom load groups (low and high) with the three  
7 parental symptom load groups (low, one parent high and both parents high). In the  
8 analysis, all five groups including high symptom loads were compared with the "low  
9 adolescent and low parental" symptom load group (reference category).  
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19 All the analyses mentioned above were adjusted for sex, age and follow-up time. The  
20 results are presented as "Model 1" in the text and tables. We adjusted for adolescent  
21 somatic health in a separate model, "Model 2", regarding health as a potentially important  
22 confounder. "Model 3" (not included in the fixed-effect model) included an additional  
23 adjustment for parental education and family risk factors. These family-related factors  
24 were regarded as potential confounders and/or intermediate factors. A potential effect  
25 measure modification by sex and age was explored by including interaction terms  
26 between SCL-5 scale scores and sex and SCL-5 scale scores and age in the analyses. The  
27 analyses were conducted using STATA 11 and STATA 12 software (StataCorp LP,  
28 Texas, USA). The results from logistic regression analyses were presented as odds ratios  
29 (OR), with the odds ratios from the fixed-effect logistic regression (sibling comparison)  
30 having a cluster-specific interpretation.[22] All of the analyses were reported with 95%  
31 confidence intervals (CI).  
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## 51 52 53 **RESULTS**

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3 Data was available for 3729 boys and 3768 girls, with a mean age of 16.0 years (standard  
4 deviation (sd) = 1.8) and a mean SCL-5 score of 1.45 (sd = 0.48, range 1-4). The median  
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8 follow-up time was 9 years (range 1-10), and medical benefits were received by 986  
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10 (13%) individuals and unemployment benefits by another 676 individuals (9%).

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12 Descriptive characteristics of the study cohort according to medical benefit receipt are  
13 presented in Table 1 (table including unemployment benefits available as Table 3 in  
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17 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<br>(n=6511) |      | Medical benefits<br>(n=986) |      |
|--|---------------------------------|------|-----------------------------|------|
|  | <i>n</i>                        | %    | <i>n</i>                    | %    |
| Adolescent anxiety and depression symptoms                   |                                 |      |                             |      |
| SCL-5 score, mean <i>sd</i>                                  | 1.43                            | 0.47 | 1.56                        | 0.56 |
| High load <sup>a</sup>                                       | 915                             | 14   | 219                         | 22   |
| Parental anxiety and depression symptoms <sup>ab</sup>       |                                 |      |                             |      |
| Mother high load   | 1218                            | 20   | 229                         | 26   |
| Father high load   | 944                             | 18   | 147                         | 22   |
| Adolescent and parental symptom loads combined <sup>ab</sup> |                                 |      |                             |      |
| 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 <sup>b</sup>                       | 1457                            | 23   | 132                         | 14   |
| Mother secondary education <sup>b</sup>                      | 4073                            | 64   | 623                         | 65   |
| Mother primary education <sup>b</sup>                        | 840                             | 13   | 198                         | 21   |
| Father tertiary education <sup>b</sup>                       | 1367                            | 23   | 132                         | 16   |
| Father secondary education <sup>b</sup>                      | 3793                            | 63   | 524                         | 63   |
| Father primary education <sup>b</sup>                        | 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.

<sup>b</sup> 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

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3 impact of the SCL-5 score on the odds of unemployment benefit receipt yielded an odds  
4 ratio of 1.11 (0.74-1.66) for a one point increase in the SCL-5 score in a model adjusted  
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8 for age, sex and follow-up time (see Table 4 in Appendix for details).  
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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 <sup>a</sup>            |             | Model 2 <sup>a</sup> |             | Model 3 <sup>a</sup> |             |
|   | OR                              | (95% CI)    | OR                   | (95% CI)    | OR                   | (95% CI)    |
| <b>According to adolescent and parental anxiety and depression symptoms, n = 7497</b> |                                 |             |                      |             |                      |             |
| Adolescent SCL-5 scale score <sup>bc</sup>  | 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) |
| <b>Comparison of siblings within families, n = 577<sup>c</sup></b>                    |                                 |             |                      |             |                      |             |
| SCL-5 scale score <sup>bc</sup>   | 1.86                            | (1.25-2.76) | 1.65                 | (1.10-2.48) |                      |             |

<sup>a</sup> 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

<sup>b</sup> Fixed-effect model (conditional logistic regression).

<sup>c</sup> 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

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3 In our study, anxiety and depression symptoms in adolescence were associated with an  
4 increased susceptibility to receive medical benefits in early adulthood, which was also  
5 true when we adjusted for confounding factors at the family level by comparing symptom  
6 loads within sibling groups. Parental anxiety and depression symptom load was an  
7 indicator of their adolescent's future risk of receiving medical benefits, and adolescents  
8 with both parents reporting high symptom loads seemed to be at a particularly high risk.  
9 Moreover, anxiety and depression symptoms were more strongly related to later receipt  
10 of medical than unemployment benefits.  
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### 25 **Strengths and limitations**

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27 The originality and main contributions of our study are that it utilizes a unique data  
28 material consisting of both parental- and offspring health variables, as well as follow-up  
29 data from registers on later medical benefit receipt in the offspring. Assessments of  
30 anxiety and depression were performed using validated questionnaires,[18, 19] but the  
31 self-reported information used in our study was only from one occasion. Repeated  
32 measurements with structured diagnostic interviews may have provided more reliable  
33 information on anxiety and depression. However, such an approach is not feasible in a  
34 population study of this size. Because we did not have good data on psychiatric co-  
35 morbidity in our study, we were unable to formulate a more detailed and differentiated  
36 picture of the risk following mental health vulnerability.  
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50 Missing parental data was a potential source of selection bias, and we performed a  
51 multiple imputation procedure in order to obtain complete parental data to help minimize  
52 this bias. The adolescents initially excluded from the study cohort (n = 1012) because  
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3 they had no participating parents were included in a sensitivity analysis of the  
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5 relationship between SCL-5 score and benefit receipt (n = 8509). The estimates obtained  
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7 from these analyses were comparable to our reported findings, although somewhat lower.  
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10 The consequences of mental disorders in adolescents and their parents on work  
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12 integration are largely dependent on characteristics of the context such as the labour  
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14 market and welfare regime. Our results should be interpreted with this in mind.  
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### 20 **Results compared to existing literature**

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22 Our study's results are in accordance with studies from New Zealand,[3-5, 23, 24] where  
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24 symptoms of adolescent anxiety and depression and other mental illnesses have been  
25  
26 associated with lower educational attainment, lower workforce participation and  
27  
28 increased welfare dependence. Additionally, two large prospective Scandinavian  
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30 population studies have described an association between mental impairment/psychiatric  
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32 diagnosis among young men (at conscript, age 18-19) and risk of disability pension both  
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34 early and later in adulthood.[25, 26] Other prospective studies relating anxiety and  
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36 depression to unemployment, sick leave and disability pension primarily include cohorts  
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38 of working adults who have already succeeded in entering the work force and may not  
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40 grasp the particular challenges of young people in the transition to adulthood.[6, 7] An  
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42 American prospective study of siblings and parents reported that childhood depression  
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44 was strongly related to income as an adult, also when comparing siblings.[27] This study  
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46 represents one of the few that uses twin or sibling designs to study life outcomes  
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48 following anxiety and depression in young people. Although there are many studies on  
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50 the association between parental anxiety and depression and offspring mental health, the  
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3 literature on the association between parental anxiety and depression and life outcomes in  
4 the offspring is scarce. Thus far, we have not found any studies that assess life outcomes  
5 for young people according to a combination of parental and adolescent anxiety and  
6 depression symptom load.  
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### 12 13 14 15 **Interpretation of findings**

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17 One plausible mechanism may be that adolescents with high anxiety and depression  
18 symptoms have an increased risk of experiencing mental illness later in life,[2-4] which  
19 may be the direct cause of work impairment. Also, anxiety and depression may impair  
20 adolescents' ability to learn and thereby increase their risk of low educational attainment  
21 and school drop-out, which in turn are known to lower work participation and increase  
22 welfare dependence.[28] The association between adolescent anxiety and depression  
23 symptoms and benefit receipt in young adulthood may also be influenced by factors that  
24 may increase both mental distress and the risk of receiving medical benefits such as the  
25 various somatic and psychiatric conditions that are associated with anxiety and depression. We  
26 were able to adjust for somatic conditions in our study, but we did not have good data on  
27 psychiatric comorbidity. Other studies have shown that the number of psychiatric  
28 disorders a person has is related to life outcomes in young adulthood,[5] and that co-  
29 occurring mental disorders, to a small extent, influenced the consequences of anxiety and  
30 depression.[3, 4, 23] More general personal traits such as childhood temperament and  
31 intellectual abilities are other individual factors that may be of importance,[26, 29] but  
32 the effects of intellectual function and psychiatric disease seem independent of each  
33 other.[25] Our results indicated an influence of family factors, as indicated by the  
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3 attenuation of odds ratios in model 3. However, the association between adolescent  
4 symptom load and medical benefit receipt remained, even when all shared family factors  
5 were adjusted for in the sibling comparison.  
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12 Parental anxiety and depression symptom load were independently associated with  
13 medical benefit receipt in their offspring, which could be attributed to an increased  
14 vulnerability in the offspring related to increased mental health problems. Anxiety,  
15 depression and other mental illnesses are strongly associated in parents and offspring,  
16 both because of genetic and environmental influences.[8, 9, 11, 14] Parental anxiety and  
17 depression may have negative influence on the family, with consequences for offspring's  
18 cognitive, emotional and social development from an early age.[10, 12] Anxiety and  
19 depression in adults are associated with work exclusion,[6, 7] which could increase the  
20 strain on the children and adolescents in the family.[30]  
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34 Our finding that anxiety and depression symptoms were more strongly related to medical  
35 benefit receipt than to unemployment indicates that the work exclusion associated with  
36 anxiety and depression symptoms in the transition to young adulthood is primarily *health*  
37 *related*.  
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### 46 **Implications and conclusions**

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48 Our study demonstrates that high levels of anxiety and depression symptoms among  
49 adolescents and their parents were associated with an increased risk of receiving medical  
50 benefits as the adolescents entered adulthood. Our findings suggest that assessing  
51 parental and adolescent symptom loads together could provide a more complete picture  
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3 of the burden of anxiety and depression symptoms on adolescents as they enter into  
4 adulthood. Furthermore, adolescent *and* parental symptoms of anxiety and depression  
5 may be regarded as risk measures of previous, existent and future mental health  
6 vulnerability for the adolescents. This emphasizes the importance of a family-oriented  
7 approach in mental health, not only in the assessment and treatment of anxiety and  
8 depression, but also in preventive public health strategies. Treatment and interventions  
9 for young people with symptoms of anxiety and depression should aim to stimulate  
10 education, increase work integration and obtain economic independence. Moreover,  
11 preventive measures should be taken to ensure better work-life integration for adolescents  
12 with anxiety and depression since young people with mental problems may be  
13 particularly vulnerable when facing today's labour market demands.  
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33  
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37 Norwegian University of Science and Technology (NTNU)), the Nord-Trøndelag County  
38 Council, the Central Norway Health Authority and the Norwegian Institute of Public  
39 Health.  
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4 and useful comments on the manuscript, and Nils Kristian Skjærvold and professor David  
5  
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7  
8 Gunnell for their useful comments on the manuscript.  
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### 10 11 12 **CONFLICTS OF INTEREST**

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15 None  
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### 18 19 20 **ETHICAL CONSIDERATIONS**

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22 Each student signed a written consent form to participate in the study, and parents or  
23 guardians of students younger than 16 years old also gave their written consent. The  
24  
25 study was approved by the Regional Medicine Ethical Committee and the Norwegian  
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27 Data Inspectorate.  
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### 35 36 **CONTRIBUTORSHIP STATEMENT**

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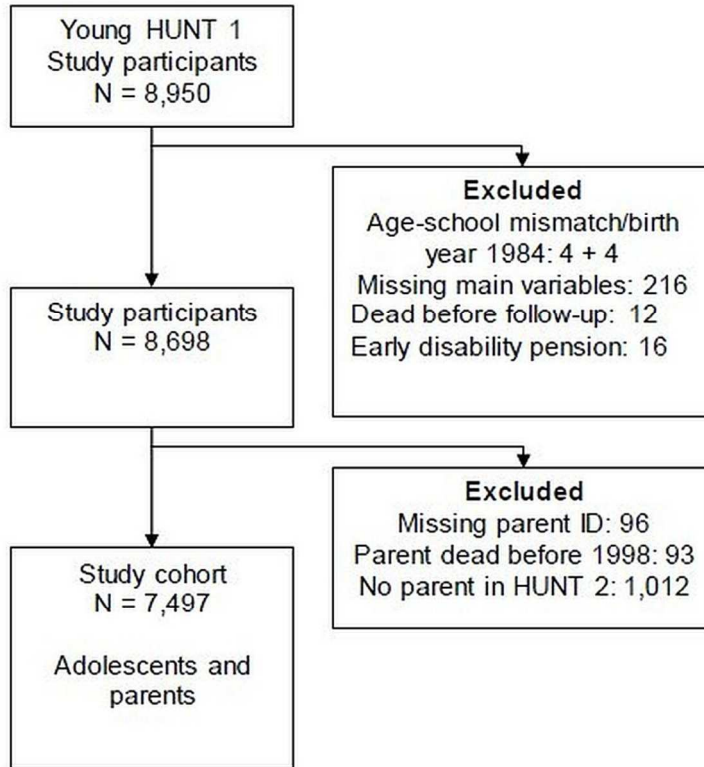
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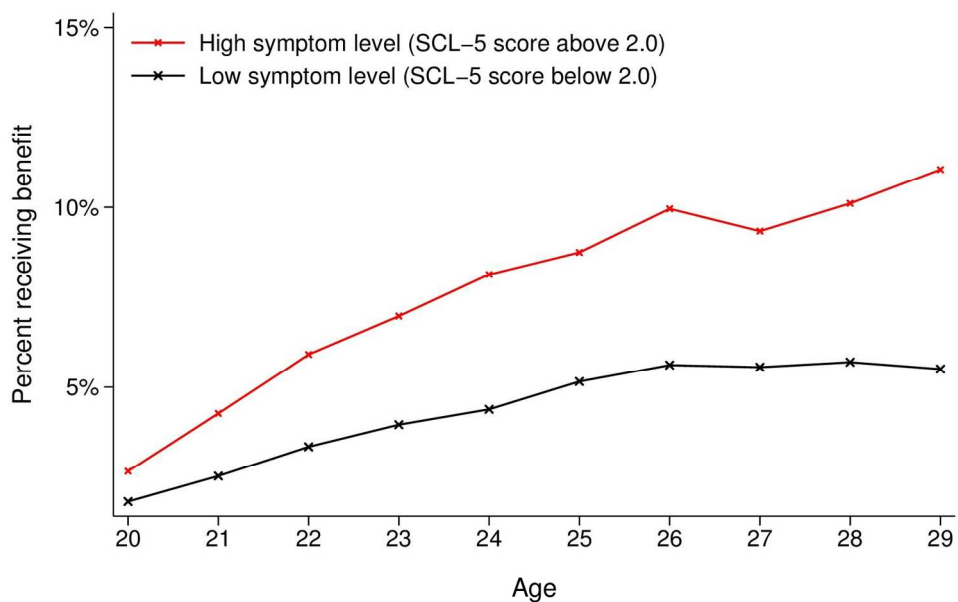


Figure 2: Percentage of the Young-HUNT cohort (n = 7497) in receipt of long-term medical benefits at different ages during follow-up according to self-reported anxiety and depression symptom level at baseline  
152x101mm (300 x 300 DPI)

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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<br>(n=5835) |      | Medical<br>benefits<br>(n=986) |      | Unemployment<br>benefits<br>(n=676) |      |
|--|-------------------------|------|--------------------------------|------|-------------------------------------|------|
|  | <i>n</i>                | %    | <i>n</i>                       | %    | <i>n</i>                            | %    |
| Adolescent anxiety and depression symptoms                   |                         |      |                                |      |                                     |      |
| SCL-5 score, mean <i>sd</i>                                  | 1.43                    | 0.47 | 1.56                           | 0.56 | 1.45                                | 0.48 |
| High load <sup>a</sup>                                       | 802                     | 14   | 219                            | 22   | 113                                 | 17   |
| Parental anxiety and depression symptoms <sup>ab</sup>       |                         |      |                                |      |                                     |      |
| Mother high load   | 1058                    | 20   | 229                            | 26   | 160                                 | 27   |
| Father high load   | 844                     | 18   | 147                            | 22   | 100                                 | 20   |
| Adolescent and parental symptom loads combined <sup>ab</sup> |                         |      |                                |      |                                     |      |
| 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  |                         |      |                                |      |                                     |      |
| 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  |                         |      |                                |      |                                     |      |
| Disability   | 1235                    | 21   | 311                            | 32   | 140                                 | 21   |
| Sibling in cohort  | 331                     | 6    | 122                            | 12   | 37                                  | 5    |
| Mother tertiary education <sup>b</sup>                       |                         |      |                                |      |                                     |      |
| Mother secondary education <sup>b</sup>                      | 2149                    | 37   | 337                            | 34   | 229                                 | 34   |
| Mother primary education <sup>b</sup>                        | 1384                    | 24   | 132                            | 14   | 73                                  | 11   |
| Father tertiary education <sup>b</sup>                       |                         |      |                                |      |                                     |      |
| Father secondary education <sup>b</sup>                      | 3640                    | 64   | 623                            | 65   | 433                                 | 67   |
| Father primary education <sup>b</sup>                        | 698                     | 12   | 198                            | 21   | 142                                 | 22   |
| Parents divorced   |                         |      |                                |      |                                     |      |
| Single parent  | 1296                    | 24   | 132                            | 16   | 71                                  | 12   |
| Teenage parents  | 3382                    | 62   | 524                            | 62   | 411                                 | 68   |
| Adolescent living alone                                      | 748                     | 14   | 183                            | 22   | 120                                 | 20   |
| Parents divorced   |                         |      |                                |      |                                     |      |
| Single parent  | 866                     | 15   | 264                            | 27   | 161                                 | 24   |
| Teenage parents  | 460                     | 8    | 113                            | 11   | 73                                  | 11   |
| Adolescent living alone                                      | 326                     | 6    | 113                            | 11   | 66                                  | 10   |
|  | 310                     | 5    | 73                             | 7    | 54                                  | 8    |

<sup>a</sup> 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.

<sup>b</sup> 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).

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For peer review only

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 <sup>a</sup>                 |             | Model 2 <sup>a</sup> |             | Model 3 <sup>a</sup> |             |
|   | OR                                   | (95% CI)    | OR                   | (95% CI)    | OR                   | (95% CI)    |
| <b>According to adolescent and parental anxiety and depression symptoms, n = 7497</b> |                                      |             |                      |             |                      |             |
| Adolescent SCL-5 scale score <sup>bc</sup>  | 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) |
| <b>Comparison of siblings within families, n = 577<sup>c</sup></b>                    |                                      |             |                      |             |                      |             |
| SCL-5 scale score <sup>a</sup>  | 1.11                                 | (0.74-1.66) | 1.22                 | (0.80-1.85) |                      |             |

<sup>a</sup> 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

<sup>b</sup> Fixed-effect model (conditional logistic regression).

<sup>c</sup> 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 |
|------------------------------|---------|---|------------------|
| <b>Title and abstract</b>    | 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              |
| <b>Introduction</b>          |         |   |                  |
| 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                |
| <b>Methods</b>               |         |   |                  |
| 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/<br>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<br>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   |                  |
| <b>Results</b>               |         |   |                  |
| 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<br>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<br>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<br>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                  |
| <b>Discussion</b>        |     |  |                           |
| 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                        |
| <b>Other information</b> |     |  |                           |
| 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>.

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9 **TITLE PAGE**

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11 **The welfare burden of adolescent anxiety and depression: A prospective study of**  
12  
13 **7,500 young Norwegians and their families - the HUNT study**

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

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26 Levanger, Norway  
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29  
30 Keywords: Adolescent, social security, longitudinal study, anxiety and depression,  
31 family, siblings  
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33 Word count: 3104  
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## 39 **ABSTRACT**

### 40 **Objectives**

41  
42 To examine the association between anxiety and depression symptoms in adolescents and  
43 their families and later medical benefit ~~receipt~~ ~~reception~~ in young adulthood.  
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### 46 **Design**

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48 Prospective cohort study. Norwegian population study linked to national registers.  
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### 50 **Participants**

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~~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 recei*~~ption~~ 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 benefits*, ~~reception from age 20-29~~.

### Conclusions

Adolescents in families hampered ~~by~~with 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 ~~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 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 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 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

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8 anxiety and depression and later life outcomes related to working life has mostly been  
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10 ~~undertaken with~~ geared towards adult working populations.[6, 7] Furthermore, such  
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12 studies have not considered life course and family perspectives.  
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16 Anxiety and depression in parents and their offspring are associated due to both heritage  
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18 and influences on the parenting role and family environment.[8-12] Factors that are  
19  
20 shared within families, such as socioeconomic status, marital conflict, parenting style and  
21  
22 stressful life events may confound associations between symptoms of anxiety and  
23  
24 depression and life outcomes in young people.[13-15] Therefore, a prospective design  
25  
26 comparing siblings with different symptom loads would be suitable, as it will in itself  
27  
28 control for shared factors that could have confounded the results of other studies.[16]  
29  
30 Our first and main aim was to study the relationship between anxiety and depression  
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32 symptoms in adolescence and later ~~receipt of~~ medical benefits ~~reception~~ in young  
33  
34 adulthood. Our second aim was to assess this relationship by comparing levels of anxiety  
35  
36 and depression symptoms within sibling groups, while our third aim was to study the  
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38 relationship between the combined anxiety and depression symptom loads of adolescents  
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40 and parents and later ~~receipt of~~ medical benefits ~~reception~~ in young adult offspring. For  
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42 comparative purposes, we also wanted to explore these associations using ~~receipt of~~  
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44 unemployment benefit ~~receptions~~ as an alternative outcome.  
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## 46 METHODS

### 47 Data and linkages

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8 We used data from the HUNT study, a Norwegian population study from Nord-  
9 Trøndelag County (<http://www.ntnu.no/hunt/english>),[17] where 8,950 school-attending  
10 adolescents (90% of those invited) completed a questionnaire between 1995-1997 (the  
11 Young-HUNT Study). We linked the adolescent data to the National Education and  
12 National Insurance Administration Registers for information on demography and the  
13 receipt of social benefits during follow-up from 1998 to 2008 (Statistics Norway,  
14 <http://www.ssb.no/en/>). Biological parents and siblings were identified through a linkage  
15 to the Norwegian Family Register, using a unique parental identification number for  
16 siblings ~~within mothers. A total of 7,497 of the eligible adolescents had one or two~~  
17 ~~parents who participated in the HUNT 2 survey (1995-97), and these were included in our~~  
18 ~~study cohort. Included in our study cohort was the 7497 eligible adolescents with one or~~  
19 ~~two parents who had participated in the HUNT 2 survey (1995-97).~~ See Figure 1 for  
20 description of sample selection (2,711 adolescents had one or more siblings in the cohort,  
21 ~~their mother being the common parent-sharing the same mother~~).  
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37 Figure 1: Flow chart displaying how the study cohort was derived

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39 (~~Please place~~ Figure 1 here)  
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### 43 Ethics

44 Each student signed a written consent form to participate in the study, and parents or  
45 guardians of ~~the students who were younger~~ less than 16 years ~~old also~~ gave their written  
46 consent. The study was approved by the Regional Medicine Ethical Committee and the  
47 Norwegian Data Inspectorate.  
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### Outcome measure – benefit receipt

The main outcome variable was medical benefit receipt 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 receipt was recorded each calendar year and according to age from 20 to 29 years (~~starting registrations continuously~~ registration starting at the beginning of 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

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8 SCL-5 scale score (range 1 to 4) was calculated for those who had answered at least three  
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10 of the five questions. The adolescent symptom load was categorized as high or low  
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12 according to established and recommended cut-off values of the SCL-5 scores.[18] The  
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14 high adolescent symptom load group included adolescents with SCL-5 scores of 2.0 or  
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16 above, whereas the low adolescent symptom load group included adolescents with SCL-5  
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18 scores below 2.0. Parental symptoms of anxiety and depression were assessed with the  
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20 Hospital Anxiety and Depression Scale (HADS), which is a validated 14-item scale that  
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22 consists of two 7-item scales covering ~~both~~ anxiety (HADS-A) and depression (HADS-  
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24 D).[19] Each item was scored on a four-point scale ranging from 0 to 3, and was added  
25  
26 up ~~resulting into~~ a score between 0 and 21 for each subscale. A high parental symptom  
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28 load was defined as having a score of 8 or above (recommended cut-off value) on *at least*  
29  
30 *one* of the subscales (HADS-A and/or HADS-D).[19] Three groups were identified  
31  
32 according to whether no parent, one parent or both parents had a high anxiety or  
33  
34 depression symptom load.

### 35 36 37 **Baseline covariates**

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39 *Age* was used as continuous variable, but also categorized as 12-14 years, 15-17 years  
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41 and 18-20 years. *Somatic health* was assessed by the self-reported presence of chronic  
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43 disease (has a doctor ever diagnosed you with epilepsy, migraine, diabetes ~~or~~; asthma or  
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45 ~~have you~~ had another disease lasting more than three months) and disability (medium or  
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47 much impairment of hearing, movement or somatic illness or much impairment of  
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49 vision). Variables were included in the analyses as dichotomous measures. *Follow-up*  
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51 *time* was the number of years from 1998 to 2008 in which the participants were alive and  
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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 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 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

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

20 We explored the relationship between adolescents' family symptom load and benefit  
21 ~~reception~~ by a comparison of the groups according to parental symptom load and  
22 according to combinations of adolescent and parental symptom load. Six groups were  
23 identified by combining the two adolescent symptom load groups (low and high) with the  
24 three parental symptom load groups (low, one parent high and both parents high). In the  
25 analysis, all five groups including high symptom loads were compared with the "low  
26 adolescent and low parental" symptom load group (reference category).

27 All the analyses mentioned above were adjusted for sex, age and follow-up time. The  
28 ~~with these~~ results are presented as "Model 1" in the text and tables. We adjusted for  
29 adolescent somatic health in a separate model, ("Model 2"), regarding health as a  
30 potentially important confounder. "Model 3" (not included in the fixed-effect model)

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8 included an additional adjustment for parental education and family risk factors. These  
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10 family-related factors were regarded as potential confounders and/or intermediate factors.  
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12 ~~ers.~~ A potential effect measure modification by sex and age was explored by including  
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14 interaction terms between SCL-5 scale scores and sex and SCL-5 scale scores and age in  
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16 the analyses. ~~and~~ The analyses were conducted using STATA 11 and STATA 12  
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18 software (StataCorp LP, Texas, USA). The results from logistic regression analyses were  
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20 presented as odds ratios (OR), with the odds ratios from the fixed-effect logistic  
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22 regression (sibling comparison) having a cluster-specific interpretation.[22] All of the  
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24 analyses were reported with 95% confidence intervals (CI).  
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## 28 RESULTS

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30 ~~The~~ data was available for 3,729 boys and 3,768 girls, with a mean age of 16.0 years  
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32 (~~s-~~ standard deviation (sd) = 1.8) and a mean SCL-5 score of 1.45 (~~s-~~ d = 0.48, range  
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34 1-4). The median follow-up time was 9 years (range 1-10), and medical benefits were  
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36 received by 986 (13%) individuals and unemployment benefits by another 676  
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38 individuals (9%). Descriptive characteristics of the study cohort according to medical  
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40 benefit ~~reception-~~ receipt are presented in Table 1 (table including unemployment benefits  
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42 available as Table 3 in Appendix).  
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**Table 1: Baseline characteristics (1995–1997) of the adolescents and their parents in the study cohort according to medical benefit receipt age 20-29, the HUNT study, Norway**

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

<sup>a</sup> 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.

<sup>b</sup> 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 the SCL-5 scale score, and 1.58 (95% CI 1.33-1.87) for 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 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 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

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8 lower part of Table 2. A one -unitpoint increase in the SCL-5 score compared with the  
9 symptom level of their sibling(s) was associated with a 65% increase in the odds of  
10 medical benefit reception-receipt when adjusting for sex, age, follow-up time and somatic  
11 health (Model 2). The impact of the SCL-5 score on the odds of unemployment benefit  
12 reception-receipt yielded an odds ratio of 1.11 (0.74-1.66) for a one -unitpoint increase in  
13 the SCL-5 score in a model adjusted for age, sex and follow-up time (see Table 4 in  
14 Appendix for details).  
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**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.**

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

<sup>a</sup> 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

<sup>b</sup> Fixed-effect model (conditional logistic regression).

<sup>c</sup> 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.

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## 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 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.

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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

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8 of working adults who have already succeeded in entering the work force and may not  
9 grasp the particular challenges of young people in the transition to adulthood.[6, 7] An  
10 American prospective study of siblings and parents reported that childhood depression  
11 was strongly related to income as an adult, also when comparing siblings.[27] This study  
12 represents one of the few that uses twin or sibling designs to study life outcomes  
13 following anxiety and depression in young people. Although there are many studies on  
14 the association between parental anxiety and depression and offspring mental health, the  
15 literature on the association between parental anxiety and depression and life outcomes in  
16 the offspring is scarce. Thus far, we have not found any studies that assess life outcomes  
17 for young people according to a combination of parental and adolescent anxiety and  
18 depression symptom load.  
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### 31 **Interpretation of findings**

32 One plausible mechanism may be that adolescents with high anxiety and depression  
33 symptoms have an increased risk of experiencing mental illness later in life,[2-4] which  
34 may be the direct cause of work impairment. Also, anxiety and depression may impair  
35 adolescents' ability to learn and thereby increase their risk of low educational attainment  
36 and school drop-out, which in turn are known to lower work participation and increase  
37 welfare dependence.[28] ~~It is also possible that~~ the association between adolescent  
38 anxiety and depression symptoms and benefit receipt in young adulthood may also be  
39 explained-influenced by confounding individual and/or family factors that may increase  
40 both mental distress and the risk of receiving medical benefits ~~reception~~ such as the  
41 various somatic and psychiatric conditions that are associated anxiety and depression. We  
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9 were able to adjust for somatic conditions in our study, but we did not have good data on  
10 psychiatric comorbidity. Other studies have shown that the number of psychiatric  
11 disorders a person has is related to life outcomes in young adulthood,[5] and that co-  
12 occurring mental disorders, to a small extent, influenced the consequences of anxiety and  
13 depression.[3, 4, 23] More general personal traits such as childhood temperament and  
14 intellectual abilities are other individual factors that may be of importance.[26, 29] but  
15 the effects of intellectual function and psychiatric disease seem independent of each  
16 other.[25] However, despite the fact that ~~Our results indicated an influence of family~~  
17 factors ~~did seem to play a certain role, as indicated by the attenuation of odds ratios in~~  
18 model 3. However, the association between adolescent symptom load and medical benefit  
19 reception-receipt remained, even when all shared family factors were adjusted for in the  
20 sibling comparison. ~~Other mental diseases and more general personal traits such as~~  
21 ~~childhood temperament and intellectual abilities are individual factors that may be of~~  
22 ~~importance,[27, 31] though these were not assessed in our study.~~  
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37 Parental anxiety and depression symptom load were independently associated with  
38 medical benefit reception-receipt in their offspring, which could be attributed to an  
39 increased vulnerability in the offspring related to increased mental health problems.  
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42 Anxiety, depression and other mental illnesses are strongly associated in parents and  
43 offspring, both because of genetic and environmental influences.[8, 9, 11, 14]  
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45 ~~Furthermore, p~~Parental anxiety and depression may have negative influence on the  
46 family, with ~~also have~~ consequences for ~~their~~ offspring's cognitive, emotional and social  
47 development from an early age.[10, 12] Anxiety and depression in adults are associated  
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8 with work exclusion,[6, 7] which could increase the strain on the children and adolescents  
9 in the family.[30]

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11 Hence, adolescent *and* parent symptoms of anxiety and depression may be regarded as  
12 risk measures of previous, existent and future mental health vulnerability for the  
13 adolescents. Our findings suggest that parental and adolescent symptom loads assessed  
14 together could provide a more complete picture of the burden of anxiety and depression  
15 symptoms for adolescents as they enter in adulthood. Furthermore, e  
16 Our finding that  
17 anxiety and depression symptoms were more strongly related to medical benefit ~~reception~~  
18 receipt than to unemployment indicates that the work exclusion associated with anxiety  
19 and depression symptoms in the transition to young adulthood is primarily *health related*.  
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### 30 **Implications and conclusions**

31 Our study demonstratesed that high levels of anxiety and depression symptoms among  
32 adolescents and their parents were associated with an increased risk of receiving medical  
33 benefits as the adolescents entered adulthood. Our findings suggest that assessing  
34 parental and adolescent symptom loads together could provide a more complete picture  
35 of the burden of anxiety and depression symptoms on adolescents as they enter into  
36 adulthood. Furthermore, adolescent *and* parental symptoms of anxiety and depression  
37 may be regarded as risk measures of previous, existent and future mental health  
38 vulnerability for the adolescents. This emphasizes the importance of a family-oriented  
39 approach in mental health, not only in the assessment and treatment of anxiety and  
40 depression, but also in preventive public health strategies, suggests that the family  
41 perspective may be of importance, and that T  
42 treatment and interventions for young  
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8 people with symptoms of anxiety and depression should aim to stimulate education,  
9 increase work integration and obtain economic independence. Moreover, preventive  
10 measures should be taken to ensure better work-life integration for adolescents with  
11 anxiety and depression since young people with mental problems may be particularly  
12 vulnerable when facing today's labour market demands.  
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## 45 **CONFLICTS OF INTEREST**

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## 50 **ETHICAL CONSIDERATIONS**

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

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