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# Risk of severe mood and anxiety disorders in the adult children of parents with alcohol use disorder: a nationwide cohort study

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## ABSTRACT

**Background** Growing up with parental alcohol use disorder (AUD) is a risk factor for psychiatric disorders. This study investigated the risk of mood disorders and of anxiety disorders in the adult children of parents with AUD, adjusted for sociodemographic factors.

**Methods** Individual-level register data on the total population were linked to follow children of parents with AUD from 1973 to 2018 to assess their risk of mood disorders and of anxiety disorders. AUD, mood disorders and anxiety disorders were defined with International Statistical Classification of Diseases and Related Health Problems codes from the National Patient Register. HRs of outcomes were calculated with Cox regression. Model 1 was adjusted for the child's sex, parental education and death of a parent. Model 2 was adjusted for those factors and parental diagnosis of mood or anxiety disorder.

**Results** Those with  $\geq 1$  parent with AUD (99 723 of 2 421 479 children) had a higher risk of mood disorder and of anxiety disorder than those whose parents did not have AUD (HR mood 2.32, 95% CI 2.26 to 2.39; HR anxiety 2.66, 95% CI 2.60 to 2.72). The risk remained elevated after adjustment for sociodemographic factors and parental psychiatric diagnosis (HR mood 1.67, 95% CI 1.63 to 1.72; HR anxiety 1.74, 95% CI 1.69 to 1.78). The highest risks were associated with AUD in both parents, followed by AUD in mothers and then in fathers.

**Conclusion** Adult children of parents with AUD have a raised risk of mood and anxiety disorders even after adjustment for sociodemographic factors and parental mood or anxiety disorder. These population-level findings can inform future policies and interventions.

## INTRODUCTION

Approximately 3%–23%<sup>1 2</sup> of children in western countries have at least one parent with alcohol problems. Growing up with parental alcohol use disorder (AUD) can expose children to adversity, ranging from disrupted family life and social isolation<sup>3</sup> to neglect and abuse.<sup>4</sup> Children of parents with AUD can be resilient.<sup>5</sup> However, parental AUD is associated with negative consequences, such as poor school performance,<sup>6</sup> low adult socioeconomic status,<sup>7</sup> premature mortality,<sup>8</sup> and a raised risk of somatic<sup>9</sup> and psychiatric<sup>10</sup> disorders.

Worldwide, the most prevalent psychiatric disorders are depressive and anxiety disorders.<sup>11</sup> Past studies have investigated the relationship between parental AUD and these disorders in offspring,

## WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Growing up with parental alcohol use disorder (AUD) is a risk factor for psychiatric disorders.
- ⇒ The long-term impact of parental AUD on adult children's risk of mood or anxiety disorders remains unclear.

## WHAT THIS STUDY ADDS

- ⇒ This four-decade follow-up of nearly 2.5 million children shows that adult children of parents with AUD have an elevated risk of mood and anxiety disorders.
- ⇒ Risk was higher when the child's mother had AUD than when their father had the disorder and highest when both parents had AUD.

## HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ The study provides public health professionals and policy-makers with new information on a risk factor that could be addressed to reduce the burden of mood and anxiety disorders in the community.

often finding a connection<sup>10 12–17</sup> but sometimes with mixed<sup>15 18</sup> or negative<sup>19</sup> results. A birth cohort study that used national register data to follow children born in Finland in 1997 through age 15 observed a connection between parental alcohol abuse and children's mood disorders, as well as between parental alcohol abuse and neurotic, stress-related and somatoform disorders.<sup>10</sup> The results of longitudinal studies of problematic parental drinking and depression or depressive symptoms in offspring have varied,<sup>15 16 18 19</sup> as have the results of longitudinal and repeated cross-sectional studies of anxiety.<sup>15 17 18</sup> Nationally representative surveys from the USA and Europe, however, have consistently observed associations between parental alcohol problems and offspring depression<sup>12 13</sup> or anxiety disorders.<sup>13 14</sup>

Many previous studies have been limited by small sample size and/or populations not representative of the general population. To the best of our knowledge, few previous studies have followed the children of parents with AUD from birth to middle age to assess their risk for mood or anxiety disorders. Sweden's national registers contain more than 40 years of individual-level data on psychiatric disorders, maternity and paternity, mortality, and sociodemographic factors in a national population.

These data make it possible to estimate the impact of parental AUD on the population-level risk of developing the two most common psychiatric disorders, information that can help form the basis of future policies and interventions.

### Aim

This national cohort study aimed to investigate the risk of mood and of anxiety disorders in the adult children of parents with AUD. The reference group was the adult children of parents without AUD.

## METHODS

### Study period, population and data sources

The study period began on 1 January 1973 and ended on 31 December 2018. An anonymised version of the Swedish personal identification number was used to link individual-level data from registers that cover the entire population of Sweden, including the Medical Birth, Patient and Total Population registers, held by the Swedish National Board of Health and Welfare and by Statistics Sweden, the Swedish national statistics agency. Anonymisation was performed by Statistics Sweden.

The study cohort was derived from the national registers and comprised the 2 421 479 children born in Sweden (live births) between 1 January 1973 and 31 December 1995, 100% of their biological mothers and 99% of their biological fathers ( $n=2\ 396\ 514$ ). Birth and maternity data were obtained from the Swedish Medical Birth Register, established in 1973. Children were followed up from birth to emigration, death or the end of the study. Paternity, emigration and mortality data came from the Total Population Register, established in 1968.

### Parental AUD

Information on parental AUD came from medical diagnoses in the form of diagnostic codes from the International Statistical Classification of Diseases and Related Health Problems (ICD) recorded in the Swedish National Patient Register. Since 1987, this register has covered hospital inpatient diagnoses nationwide, including alcohol detoxification at hospitals to prevent seizures and delirium tremens. Since 2001, it has also covered outpatient diagnoses from public and private specialised psychiatric care, including addiction care.

Parental AUD was defined as hospital diagnosis of an alcohol-related disorder from the 10th revision of the ICD (ICD-10), including codes E24.4, F10, G31.2, G62.1, G72.1, I42.6, K29.2, K70, K85.2, K86.0 and O35.4) and their ICD-9 and ICD-8 equivalents, as well as two codes unique to the Swedish ICD-8 that indicate AUD, 261 and 262 (online supplemental table 1). Children's diagnoses related to prenatal alcohol exposure were not included in the analyses. Parents' hospital diagnoses of AUD were followed up until the children turned 18 years (1 January 1973–31 December 2013).

Children were grouped into five categories: (1) no parental AUD, (2)  $\geq 1$  parent had AUD, (3) father had AUD, (4) mother had AUD and (5) both parents had the disorder. The 1% of children not linkable to their fathers were categorised as not having paternal AUD.

### Mood disorders and anxiety disorders

Mood disorders and anxiety disorders in children were the outcome variables in the study. The analyses were controlled for parental diagnosis of the same type of disorder as the child (mood or anxiety). Data on the disorders, from the National Patient Register, were followed up from 1 January 1973 to 31 December 2018. Mood

disorders were defined as ICD-10 codes F30–F39 (mood (affective) disorders) and their ICD-9 and ICD-8 equivalents (online supplemental table 2). Anxiety disorders were defined as ICD-10 codes F40–F48 (neurotic, stress-related and somatoform disorders) and their ICD-9 and ICD-8 equivalents (online supplemental table 3).

### Birth year and sex

Data on children's birth year (1973–1995) and sex (male or female) were obtained from the Medical Birth Register.

### Parental education

Data on the highest level of parental education attained by the mother or the father, used as a proxy for socioeconomic status, came from the Swedish census (1970, 1975, 1980, 1985 and 1990). This variable was categorised in accordance with the Swedish Educational Nomenclature (Svensk utbildningsnomenklatur), harmonised with the 1997 version of the International Standard Classification of Education. The categories were basic ( $\leq 9$  years), secondary (10–12 years), tertiary ( $\geq 13$  years) and missing.

### Death of a parent

Information on the death of a parent, obtained from the Total Population Register, was dichotomised as yes (child lost  $\geq 1$  parent before turning 18) or no.

### Statistical methods

Differences between those whose parents did and did not have AUD were tested with  $\chi^2$  and relative proportions tests. Cox regression models were used to compare outcomes in those whose parents did and did not have AUD. Crude and adjusted HRs with 95% CIs were calculated. Model 1 was adjusted for children's sex, the highest level of parental education and death of a parent. Model 2 was adjusted for children's sex, the highest level of parental education, death of a parent and parental diagnosis of the same type of psychiatric disorder (mood or anxiety) between 1973 and 2018. Analyses were stratified by children's sex. Absolute risks were calculated.

A supplementary analysis was carried out that excluded individuals who received their first diagnosis of mood or anxiety disorder before their mother or father received their AUD diagnosis. The analysis excluded 31 of the 76 476 children with paternal AUD (0.04%) and 22 of the 28 533 children with maternal AUD (0.08%). For anxiety disorders, the analysis excluded 26 of the 76 476 children with paternal AUD (0.03%) and 71 of the 28 533 children with maternal AUD (0.25%).

Data were analysed with SAS/STAT software, V.9.4 of the SAS System for Windows V.7 (SAS Institute) and STATA software, V.17.0 (StataCorp).

## RESULTS

### Characteristics of the study population

Of the 2 421 479 children in the study population, 99 723 (4.1%) had  $\geq 1$  parent with AUD (table 1). It was more common to have a father than a mother with AUD ( $n=76\ 476$  vs  $28\ 533$ ; 3.2% vs 1.2% of the study population;  $p<0.001$ ). Over 5000 children had two parents with AUD ( $n=5286$ ; 0.2% of the study population). A higher proportion of those whose parents had AUD experienced the death of a parent (14.5% vs 2.9%,  $p<0.001$ ).

A total of 76% of mothers with AUD and 81% of fathers with AUD received the diagnosis before the child turned 15 years (data are not shown). Parents with AUD were more likely to have a basic (31.8% vs 21.0%,  $p<0.001$ ) or secondary (34.3%

**Table 1** Characteristics of the study population of people born in Sweden from 1 January 1973 to 31 December 1995\*

	Total study population	No parental AUD	Parental AUD†			
			≥1 parent	Father	Mother	Father and mother
Number (% of total study population)	2 421 479 (100)	2 321 756 (95.9)	99 723 (4.1)	76 476 (3.2)	28 533 (1.2)	5 286 (0.2)
Sex, n (%)						
Male	1 244 135 (51.4)	1 192 970 (95.9)	51 165 (4.1)	39 183 (3.2)	14 676 (1.2)	2 694 (0.2)
Female	1 177 344 (48.6)	1 128 786 (95.9)	48 558 (4.1)	37 293 (3.2)	13 857 (1.2)	2 592 (0.2)
Highest level of parental education, n (%)						
Basic	520 057 (21.5)	488 309 (21.0)	31 748 (31.8)	25 110 (32.8)	8 605 (30.2)	1 967 (37.2)
Secondary	804 441 (33.2)	770 269 (33.2)	34 172 (34.3)	25 882 (33.8)	9 881 (34.6)	1 591 (30.1)
Tertiary	893 791 (36.9)	876 651 (37.8)	17 140 (17.2)	12 147 (15.9)	5 455 (19.1)	462 (8.7)
Missing	203 190 (8.4)	186 527 (8.0)	16 663 (16.7)	13 337 (17.4)	4 592 (16.1)	1 266 (24.0)
One or both parents died before the child turned 18 years, n (%)	82 122 (3.4)	67 638 (2.9)	14 484 (14.5)	11 883 (15.5)	4 033 (14.1)	1 432 (27.1)

\*Only live births were included.

†Parental AUD diagnoses were included if they were received before the child was born or until the child turned 18 (diagnoses received between 1 January 1973 and 31 December 2018). AUD, alcohol use disorder.

vs 33.2%,  $p < 0.001$ ) education or to be missing data on educational level (16.7% vs 8.0%,  $p < 0.001$ ).

### Number of children diagnosed with mood and anxiety disorders

The proportion diagnosed with mood disorders was significantly higher among those with  $\geq 1$  parent with AUD ( $n = 5982$ ; 6.0%) than those whose parents did not have the disorder ( $n = 60469$ ; 2.6%) ( $p < 0.001$ ) (table 2). The same was true of anxiety disorders: 7775 (7.8%) with  $\geq 1$  parent with AUD were diagnosed with an anxiety disorder, whereas 68617 (3.0%) with no parental AUD were diagnosed with such a disorder ( $p < 0.001$ ). In all groups, the number diagnosed with anxiety disorder was higher than the number diagnosed with mood disorder ( $p < 0.001$ ). Median age of children's first diagnosis with either mood or anxiety disorder was 25 years (mood: median 25 years, IQR 21–31 years; anxiety: median 25 years, IQR 20–31 years) (data are not shown). Of the children diagnosed with mood

disorders, 3.9% received the diagnosis before age 15 and 9.5% before age 18. Of the children diagnosed with anxiety disorders, 5.6% received the diagnosis before 15 and 13.4% before age 18 (data are not shown).

### HRs and absolute risk

Crude HRs of both disorders were significantly higher in those with  $\geq 1$  parent with AUD than in those whose parents did not have AUD (mood: HR 2.32, 95% CI 2.26 to 2.39; anxiety: HR 2.66, 95% CI 2.60 to 2.72) (table 3). The absolute risk was also higher in those with than without parental AUD (mood: 6 vs 3 per 100; anxiety: 8 vs 3 per 100).

HRs of both disorders declined after adjustment for sex, parents' highest level of education and death of a parent but remained elevated in the adult children of parents with AUD (mood: HR 2.05, 95% CI 1.99 to 2.10; anxiety: HR 2.27, 95% CI 2.21 to 2.32) (table 3, model 1). Absolute risk remained higher in the adult children of parents with AUD (mood: 5 vs 3

**Table 2** Number of children who received a diagnosis of a mood disorder and number who received a diagnosis of an anxiety disorder\* in the study population of people born in Sweden from 1 January 1973 to 31 December 1995†

	No parental AUD	Parental AUD‡			
		≥1 parent	Father	Mother	Father and mother
Number (% of total study population)	2 321 756 (95.9)	99 723 (4.1)	76 476 (3.2)	28 533 (1.2)	5 286 (0.2)
Number diagnosed					
Mood disorders	60 469	5 982	4 546	1 993	557
Anxiety disorders	68 617	7 775	5 892	2 579	696
Proportion diagnosed					
Mood disorders (%)	2.6	6.0	5.9	7.0	10.5
Anxiety disorders (%)	3.0	7.8	7.7	9.0	13.2

\*Mood and anxiety disorders were defined with ICD-10 codes and their historical equivalents: ICD-10 codes F30–F39, mood (affective) disorders and ICD-10 codes F40–F48, neurotic, stress-related and somatoform disorders. See online supplemental tables 2 and 3 for the ICD-9 and ICD-8 codes used in the study.

†Only live births were included.

‡Parents were diagnosed with AUD either before the child was born or until the child turned 18 (diagnosis received between 1 January 1973 and 31 December 2018). AUD, alcohol use disorder; ICD, International Statistical Classification of Diseases and Related Health Problems.

**Table 3** Crude and adjusted HRs and absolute risks per 100 for mood and anxiety disorders\* in the study population of people born in Sweden from 1 January 1973 to 31 December 1995†

	Parental AUD‡				
	No parental AUD	≥1 parent	Father	Mother	Father and mother
Number (% of total study population)	2321 756 (95.9)	99723 (4.1)	76 476 (3.2)	28 533 (1.2)	5286 (0.2)
Crude HR (95% CI) Absolute risk per 100					
Mood disorders	1.00 2.60	2.32 (2.26 to 2.39) 6.04	2.21 (2.14 to 2.28) 5.75	2.83 (2.71 to 2.96) 7.37	3.91 (3.60 to 4.25) 10.18
Anxiety disorders	1.00 2.96	2.66 (2.60 to 2.72) 7.86	2.51 (2.45 to 2.58) 7.42	3.20 (3.08 to 3.33) 9.46	4.26 (3.95 to 4.59) 12.59
Model 1: adjusted HR (95% CI)§ absolute risk per 100					
Mood disorders	1.00 2.60	2.05 (1.99 to 2.10) 5.34	1.91 (1.85 to 1.97) 4.97	2.48 (2.37 to 2.60) 6.46	3.06 (2.81 to 3.33) 7.97
Anxiety disorders	1.00 2.96	2.27 (2.21 to 2.32) 6.71	2.10 (2.04 to 2.16) 6.21	2.71 (2.61 to 2.82) 8.01	3.15 (2.93 to 3.40) 9.31
Model 2: adjusted HR (95% CI)¶ absolute risk per 100					
Mood disorders	1.00 2.60	1.67 (1.63 to 1.72) 4.35	1.61 (1.56 to 1.66) 4.19	1.82 (1.74 to 1.91) 4.74	2.07 (1.90 to 2.26) 5.39
Anxiety disorders	1.00 2.96	1.74 (1.69 to 1.78) 5.14	1.66 (1.61 to 1.71) 4.91	1.80 (1.73 to 1.87) 5.32	1.87 (1.73 to 2.01) 5.53

\*Mood and anxiety disorders were defined with ICD-10 codes and their historical equivalents: ICD-10 codes F30–F39, mood (affective) disorders and ICD-10 codes F40–F48, neurotic, stress-related and somatoform disorders. See online supplemental tables 2 and 3 for the ICD-9 and ICD-8 codes used in the study.  
†Only live births were included.  
‡Parents were diagnosed with AUD either before the child was born or until the child turned 18 (diagnosis received between 1 January 1973 and 31 December 2018).  
§Adjusted for sex, parents' highest level of education and death of one or both parents before the child turned 18 years.  
¶Adjusted for sex, parents' highest level of education, death of one or both parents before the child turned 18 years, and parental diagnosis of the disorder analysed.  
AUD, alcohol use disorder; ICD, International Statistical Classification of Diseases and Related Health Problems.

per 100; anxiety: 7 vs 3 per 100). In model 1, for both disorders, excess risk was reduced the most for those who had two parents with AUD, followed by those whose fathers had AUD and those whose mothers had the disorder (eg, decline in excess risk, mood: father and mother –29%, father –25%, mother –19%) (tables 4 and 5, model 1).

Adjustment for parental diagnosis of the same psychiatric disorder further reduced the risk of both disorders (mood: HR 1.67, 95% CI 1.63 to 1.72; anxiety: HR 1.74, 95% CI 1.69 to 1.78) (table 3, model 2). Absolute risk remained higher in the adult children of parents with AUD (mood: 4 vs 3 per 100; anxiety: 5 vs 3 per 100). In model 2, for both mood and anxiety disorders, the excess risk was reduced the most for those who had two parents with AUD, followed by those whose mothers had

AUD and those whose fathers had the disorder (eg, mood: father and mother –48%, mother –45%, father –33%) (tables 4 and 5, model 2).

In all models, for both mood and anxiety disorders, the proportion of children diagnosed with mood or anxiety disorder, HRs and absolute risks were highest when both parents had AUD, next highest when the mother had AUD and third highest when the father had AUD (tables 2 and 3). There was a significant interaction by sex. Men had a lower risk of mood disorders and of anxiety disorders that was consistent in both models and all groups (eg, men, model 1, mood: HR 0.56, 95% CI 0.55 to 0.56; anxiety: HR 0.53, 95% CI 0.52 to 0.54) (data are not shown).

Results remained the same after a supplementary analysis that excluded children who received their first mood or anxiety

**Table 4** Decline in HRs of mood (affective) disorders\* in the study population of people born in Sweden from 1 January 1973 to 31 December 1995† after adjustment

	Parental AUD‡				
	No parental AUD	≥1 parent	Father	Mother	Father and mother
Number (% of total study population)	2321 756 (95.9)	99723 (4.1)	76 476 (3.2)	28 533 (1.2)	5286 (0.2)
Crude HR (95% CI)	1.00	2.32 (2.26 to 2.39)	2.21 (2.14 to 2.28)	2.83 (2.71 to 2.96)	3.91 (3.60 to 4.25)
Model 1: adjusted HR (95% CI)§	1.00	2.05 (1.99 to 2.10)	1.91 (1.85 to 1.97)	2.48 (2.37 to 2.60)	3.06 (2.81 to 3.33)
Explained difference (%)		20.5	24.8	19.1	29.2
Model 2: adjusted HR (95% CI)¶	1.00	1.67 (1.63 to 1.72)	1.61 (1.56 to 1.66)	1.82 (1.74 to 1.91)	2.07 (1.90 to 2.26)
Explained difference (%)		36.2	33.0	44.6	48.1
Total explained difference (%)		49.2	49.6	55.2	63.2

\*Mood disorders were defined with ICD-10 codes and their historical equivalents: ICD-10 codes F30–F39, mood (affective) disorders. See online supplemental table 2 for the ICD-9 and ICD-8 codes used in the study.  
†Only live births were included.  
‡Parents were diagnosed with AUD either before the child was born or until the child turned 18 (diagnosis received between 1 January 1973 and 31 December 2018).  
§Adjusted for sex, parents' highest level of education and death of one or both parents before the child turned 18 years.  
¶Adjusted for sex, parents' highest level of education, death of one or both parents before the child turned 18 years and parental diagnosis of the disorder analysed.  
AUD, alcohol use disorder; ICD, International Statistical Classification of Diseases and Related Health Problems.

**Table 5** Decline in HRs for anxiety disorders\* in the study population of people born in Sweden from 1 January 1973 to 31 December 1995† after adjustment

	No parental AUD	Parental AUD‡			
		≥1 parent	Father	Mother	Father and mother
Number (% of total study population)	2 321 756 (95.9)	99 723 (4.1)	76 476 (3.2)	28 533 (1.2)	5286 (0.2)
Crude HR (95% CI)	1.00	2.66 (2.60 to 2.72)	2.51 (2.45 to 2.58)	3.20 (3.08 to 3.33)	4.26 (3.95 to 4.59)
Model 1: adjusted HR (95% CI)§	1.00	2.27 (2.21 to 2.32)	2.10 (2.04 to 2.16)	2.71 (2.61 to 2.82)	3.15 (2.93 to 3.40)
Explained difference (%)		23.5	27.2	22.3	34.0
Model 2: adjusted HR (95% CI)¶	1.00	1.74 (1.69 to 1.78)	1.66 (1.61 to 1.71)	1.80 (1.73 to 1.87)	1.87 (1.73 to 2.01)
Explained difference (%)		41.7	40.0	53.2	59.5
Total explained difference (%)		55.4	56.3	63.6	73.3

\*Anxiety disorders were defined with ICD-10 codes and their historical equivalents: ICD-10 codes F40–F48, neurotic, stress-related and somatoform disorders. See online supplemental tables 2 and 3 for the ICD-9 and ICD-8 codes used in the study.  
†Only live births were included.  
‡Parents were diagnosed with AUD either before the child was born or until the child turned 18 (diagnosis received between 1 January 1973 and 31 December 2018).  
§Adjusted for sex, parents' highest level of education and death of one or both parents before the child turned 18 years.  
¶Adjusted for sex, parents' highest level of education, death of one or both parents before the child turned 18 years and parental diagnosis of the disorder analysed.  
AUD, alcohol use disorder; ICD, International Statistical Classification of Diseases and Related Health Problems.

disorder diagnosis prior to their mother's or father's diagnosis of AUD (data are not shown).

## DISCUSSION

Risk of mood disorders and of anxiety disorders was higher in adult children of parents with than without AUD. Those whose mothers had AUD had a higher risk of anxiety and mood disorders than those whose fathers had AUD. Risk was raised the most when both parents had AUD. Sociodemographic factors explained more of the risk associated with fathers' than mothers' AUD, whereas parental diagnosis of the same disorder explained more of the risk associated with mothers' than fathers' AUD.

A strength of the study was the use of Swedish national registers. These highly complete resources,<sup>20</sup> which contain population data linkable at the individual level, enabled us to study the association between parental AUD and psychiatric outcomes in nearly 2.5 million individuals over more than 40 years.

The study also had limitations. The results, like those of other cohort and register studies, can form the basis of hypotheses about causality but should not be used to infer it. Specific limitations common to register studies also characterise this study. For instance, data in the national registers were not collected for the study, so information on several covariates is missing. Although we controlled for parental mortality, data were not available on other types of separation from parents. Information on other adverse childhood experiences, potential protective factors and the child's living situation (with whom the child lived) was also unavailable. Information on parental education was used as a proxy of socioeconomic status. It would have been ideal to include data on income, wealth and occupation, but such information was not available in the current study. The data in the study covered children born in Sweden, so children who immigrated after birth were not included. Outside Sweden, the findings are likely most generalisable to places that have similar sociodemographic and socioeconomic characteristics, healthcare systems and alcohol use patterns. Generalisability likely declines the more a place differs from Sweden in such factors.

The National Patient Register has several limitations. It does not include psychiatric diagnoses prior to 1973. The register achieved coverage of all counties in Sweden in 1987.<sup>20</sup> Before that date, it lacked diagnoses from the few hospitals that did not yet contribute to the register. A review study has found that the validity of

inpatient diagnoses in the register varies between approximately 85% and 95%.<sup>20</sup> The register does not include information on prescriptions, which could have been used as a proxy for the disorders in the study, and prescription information was not gathered on a national basis until 2005, decades after the start of the study period. An additional limitation of the National Patient Register is that it does not include information on the severity of disorders. However, diagnoses in the study reflect disorders severe enough to require hospitalisation. Sweden does not have a national register of primary care diagnoses, so information was not available on AUD diagnosed in primary care and for which parents only received help outside hospitals and specialised care, such as from primary care, 12-step programmes or social services. The study, therefore, underestimates the number of exposed children but may overestimate the risk associated with parental AUD if our data only include the most severe cases.

Underdiagnosis of AUD, common in general, is more common in women than men.<sup>21</sup> AUD during pregnancy<sup>22</sup> and fetal alcohol spectrum disorders (FASDs)<sup>23</sup> are underdiagnosed. Excluding children's hospital diagnoses related to prenatal alcohol exposure added to this limitation, whereas including maternal care for (suspected) damage to the fetus from alcohol reduced it to some degree.

In the current study, 4.1% of children had ≥1 parent with AUD, a proportion similar to that observed in other Nordic national register studies.<sup>8, 24</sup> However, nationally representative US surveys have resulted in estimates as high as 10.5%–22%,<sup>25, 26</sup> and Polish data suggest a range of 17%–23%.<sup>2</sup> Some differences in estimates can be attributed to methodological variation (eg, in criteria used to define alcohol problems), but alcohol consumption and the number of people with AUD also differ by place and time.

The raised risks of mood and anxiety disorders observed in the present study are in keeping with the findings of a study that used national register data to investigate the risk of mental disorders in children born in Finland in 1997.<sup>10</sup> Like the present study, the Finnish study found an elevated risk of mood disorders and of neurotic, stress-related and somatoform disorders in the children of parents with alcohol problems. The risks observed in the current study were slightly higher and the CIs were narrower, possibly because the study population was larger and the follow-up longer.

The association between parental AUD and mood disorders in the present study is also consistent with the association observed in nationally representative surveys, including but not limited to surveys of youths 15 and 16 years in Sweden<sup>27</sup> and youths in Denmark.<sup>12</sup> Similarly, national surveys have found a higher prevalence of anxiety disorders<sup>13 14</sup> or medication for problems associated with anxiety<sup>27</sup> in people who report parental alcohol problems. However, some longitudinal studies that investigated depression, depressive symptoms or anxiety in the offspring of parents with AUD have had mixed<sup>15 18</sup> or negative findings.<sup>19</sup>

In the current study, the greatest risk of mood and anxiety disorders was seen in those who had two parents with AUD. To the best of our knowledge, few if any prior studies have investigated the association between the number of parents with AUD and mood or anxiety disorders in the next generation. However, studies of other outcomes such as AUD,<sup>26</sup> substance use disorder<sup>28</sup> and externalising disorders<sup>29</sup> have found that it is more impactful to have two parents with AUD than one parent with the disorder.

Maternal AUD was associated with a higher risk of mood and anxiety disorders than paternal AUD. This pattern is consistent with some<sup>10 17</sup> but not all<sup>10 14</sup> findings from similar studies. For instance, the study of children born in Finland in 1997 generally found a higher risk of mood or anxiety disorders in children when mothers rather than fathers abused alcohol.<sup>10</sup> The exception was the father's less severe alcohol abuse, which was associated with a higher risk of mood disorders in children than mother's less severe alcohol abuse.

Women's traditional role as the primary childcare provider may help explain the higher risks observed for maternal than paternal AUD in the present study. Gender equality is a policy priority in Sweden, and in 2022, the country had the highest overall Gender Equality Index score in the European Union.<sup>30</sup> Nevertheless, women in Sweden still spend more time than men supervising and caring for children,<sup>31</sup> and more mothers than fathers with substance abuse share a home with their children.<sup>1</sup>

Prenatal alcohol exposure may also lie behind part of the raised risk of psychiatric disorders associated with maternal AUD. Even small amounts of alcohol during pregnancy may impact offspring psychiatric outcomes,<sup>32</sup> and drinking while pregnant can lead to FASDs. FASDs are linked to increased rates of disorders investigated in the current study, including depression, bipolar disorder and anxiety.<sup>33</sup>

Following adjustment for sociodemographic factors in the first model, we observed a greater decline in excess risk associated with paternal than maternal AUD. Men's larger contributions to family socioeconomic status during the study period may help explain this finding. The gender gap in income has declined in Sweden since the 1960s, but among cohabiting adults, men's median income is still higher than women's.<sup>31</sup>

Additional factors not included in the study likely contributed to the elevated risk of mood and anxiety disorders in the adult children of parents with AUD. Parental alcohol problems frequently co-occur with other adversities, such as other parental mental health problems,<sup>34</sup> a need for social assistance,<sup>35</sup> family separation<sup>24</sup> and childhood abuse.<sup>36</sup> Such adversities can negatively affect later mental health.<sup>37</sup> Additionally, problematic alcohol use has genetic correlations with numerous psychiatric outcomes<sup>38</sup> that could also help explain the raised risk of mood and anxiety disorders in the current study.

## Conclusions

This 46-year follow-up of a nationwide cohort shows that growing up with parental AUD is associated with a raised risk of mood or anxiety disorders. The risk is most severe for those whose mothers have AUD and whose parents both have the disorder. These population-level findings can inform future policies and interventions, including preventive interventions.

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