Prevalence of parental mental illness and association with socioeconomic adversity among children in Sweden between 2006 and 2016: a population-based cohort study

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Summary

Background Children of parents with mental illness are a vulnerable group, but their numbers and their exposure to adversity have rarely been examined. We examined the prevalence of children with parents with mental illness in Sweden, trends in prevalence from 2006 to 2016, and these children's exposure to socioeconomic adversity.

Methods We did a population-based cohort study among all children (aged <18 years) born in Sweden between Jan 1, 1991, and Dec 31, 2011, and their parents, followed up between Jan 1, 2006, and Dec 31, 2016. We included children who were identified in the Total Population Register and linked to their birth parents, excluding adopted children and those with missing information on both birth parents. We used a comprehensive register linkage, Psychiatry Sweden, to follow up for indicators of parental mental illness and socioeconomic adversity. Marginal predictions from a standard logistic regression model were used to estimate age-specific, 3-year period prevalence of parental mental illness and trends in prevalence for 2006–16. Using cross-sectional data on each child, indicators of socioeconomic adversity were compared between children with and without concurrent parental mental illness using logistic regression.

Findings Of 2 198 289 children born in Sweden between Jan 1, 1991, and Dec 31, 2011, we analysed 2 110 988 children (96·03% of the total population). The overall prevalence of children with diagnosed parental mental illness between 2006 and 2016 was 9·53% (95% CI 9·50–9·57). This prevalence increased with age of the child, from 6·72% (6·65–6·78) of the youngest children (0 to <3 years) to 10·80% (10·73–10·89) in the oldest (15 to <18 years). The prevalence of diagnosed parental mental illness increased from 8·62% (8·54–8·69) in 2006–09 up to 10·95% (10·86–11·03) in 2013–16. Children with any type of parental mental illness had markedly higher risk of socioeconomic adversity, such as living in poorer households or living separately from their parents.

Interpretation Currently, 11% of all Swedish children have a parent with a mental illness treated within secondary care. These children have markedly higher risk of broad socioeconomic adversity than do other children. There is a need to understand how socioeconomic adversity and parental mental illness influence vulnerability to poor life outcomes in these children.

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Introduction

Children of parents with mental illness are more likely to experience multiple challenges throughout infancy, childhood, and adolescence than are other children. Existing evidence suggests that these children are exposed to an excess of obstetric complications,[1] developmental impairment,[1] premature mortality,[2] and long-term mental ill-health[3] and physical morbidity.[4] In addition to their health risks, these children might have higher rates of negative social outcomes, such as school dropout,[5] delinquency,[6] and teenage pregnancy.[7] Appropriate planning of services requires up-to-date information on the numbers and ages of these children, and knowing how to shape research and interventions requires information on the extent that parental mental illness co-exists with other adversities.

Although the genetic dependence of mental illness is well known,[8] parental mental illness might have important impacts on family socioeconomic disadvantage,[6] maternal mortality,[9] separation of children from parents,[10] and less sensitive parenting,[11] which could affect these children's wellbeing. However, to our knowledge, no population-based study from recent years has comprehensively described the concurrent socioeconomic conditions and adversities of children with parents with mental illness. This is unfortunate for many reasons.

First, childhood adversity has been associated with suicide, mental illness, and lower household income in adulthood, and could explain the higher incidence of these outcomes in the children of parents with mental illness.[12–14] Second, adversity might interact with parental mental illness to aggravate the risks of poor outcomes in

Research in context

Evidence before this study

We searched for original articles using both a systematic search (on PsycINFO, Embase, MEDLINE, and PsychArticles) and hand search strategy (ie, grey literature and reference lists), using the search terms "prevalence" AND ("children" OR "offspring" OR "preschool" OR "infant" OR "baby" OR "adolescent" OR "teen") AND ("parent" OR "father" OR "mother" OR "maternal" OR "paternal") AND ("mental illness" OR "psychiatric disorder" OR "depression" OR "depressive" OR "mood disorders" OR "anxiety" OR "neurotic" OR "affective disorder" OR "schizophrenia" OR "bipolar" OR "psychosis" OR "psychotic" OR "substance abuse" OR "alcohol abuse" OR "alcohol misuse" OR "substance misuse" OR "eating disorder" OR "personality disorder"). Our database search was between Jan 1, 1970, and April 2, 2019, with no language restrictions, and the hand search had no time restrictions. Only three previous studies, including our own UK study, provided prevalence estimates of children with parental mental illness. Estimates ranged from 12·1% to 23·2%. The use of different data sources (ie, primary care, secondary care, or survey) in previous analyses made international comparisons difficult. To our knowledge, no recent population-based study has attempted to provide reliable prevalence estimates of children with maternal and paternal mental illness across the spectrum of disorders. Additionally, no recent population-based study has comprehensively described the socioeconomic conditions of these children, either in terms of overall mental illness or by type across a wide range of illness.

Added value of this study

To our knowledge, this is the largest population-based study (n=2 110 988) to provide prevalence estimates of a wide variety of maternal and paternal mental illness from childhood through adolescence. We estimate that overall, one in ten children and adolescents in Sweden have a mother or father diagnosed with any mental illness in secondary care. This proportion increased with the age of children, and the period prevalence of parental mental illness also increased over time. Overall, maternal mental illness was about a third more common than paternal mental illness. Children with parental mental illness were more likely than other children to experience family poverty, live separately from their parents, and have unemployed or teenage parents. The risk of socioeconomic adversity was similar for parental common mental illness (ie, depression and anxiety) and psychotic illness, showing that a larger number of children with parental mental illness is exposed to concomitant adversity than was previously thought. These findings highlight how parental mental illness overlaps with broad socioeconomic adversity in the lives of these children and represents an important factor in considering these children's risk of adverse health and social outcomes.

Implications of all the available evidence

Parental mental illness is highly prevalent and strongly linked to broad socioeconomic adversity. These links are probably bidirectional, which further highlights the vulnerability of these families. Policy makers and commissioners should consider this information to channel resources to target the individuals in greatest need. Supportive policies for children of parents with mental illness should consider adversity, which relates to children's outcomes. Given the associations between parental mental illness and childhood poverty or adversity and future life outcomes, there is a need to understand the interplay between these factors and how they affect the health and wellbeing of children into adulthood.

this group. For example, women with schizophrenia are more likely to have their children removed than are women with depression or healthy women, but the outcomes of children brought up in the foster care system are also bleak.[10] Comprehensive information on exposure to relevant risk factors is therefore essential to understanding which factors allow for resilience or might foster vulnerability among the children of parents with mental illness. Finally, supportive policies for children of parents with mental illness should consider adversity. However, reliable information about the extent and nature of these children's exposure to adversity is scarce.

Our recent study[15] in the UK, which used primary care data, reported that about one in four children has a mother with a current mental illness. We found that the prevalence of maternal mental illness treated within primary care increased during childhood and during the period of analysis (2005–17). A Canadian national survey[16] estimated that about 12% of children had a parent with a mood, anxiety, or substance use disorder. Another study[17] from Australia estimated that about 23% of children had a parent with a non-substance use mental disorder. However, these studies focused exclusively on exposure to maternal mental illness,[15] were based on self-reported information,[16] or assessed few categories of mental illness.[17]

This descriptive study capitalises on Sweden's extensive and high-quality registers to extend the findings from our UK study[15] and estimate the prevalence of children with maternal and paternal mental illness, by type of illness and age of the child. Further, we aim to examine trends in prevalence from 2006 to 2016 and to quantify the concurrent association between socioeconomic adversity and parental mental illness, overall and by type of illness.

Methods

Study design and population

We did a population-based cohort study among all children born in Sweden between Jan 1, 1991, and Dec 31, 2011, and their parents, followed up between

Jan 1, 2006, and Dec 31, 2016. We analysed longitudinal data, to examine the period prevalence of different types of parental mental illness since birth, as well as a cross-section of this sample, to describe their concurrent association with indicators of socioeconomic adversity.

The study population included all children born in the study period who were identified in the Total Population Register and linked to their birth parents. We excluded adopted children and those with missing information on both birth parents. The study population was followed up for parental mental illness from the latest date out of either birth or Jan 1, 2006 (the earliest date with good-quality outpatient data), until the earliest date out of either emigration from Sweden, death, the date when both parents were dead or emigrated from Sweden, or Dec 31, 2016 (the latest date with complete data at the time of study design). We excluded children who ceased follow-up before Jan 1, 2006, and those whose follow-up did not completely span a 3-year age group (between 0 to >3 years and 15 to >18 years).

Procedures

We used a comprehensive register linkage called Psychiatry Sweden, which is designed to examine the occurrence, risk and protective factors, and life trajectories of mental illness. Using the unique Swedish personal identity number, Psychiatry Sweden links data from several nationwide registers: the Total Population Register, containing demographic data on age, sex, country of birth, emigration dates, and personal identifiers of birth parents; the Longitudinal Integration Database for Health Insurance and Labour Market Studies (LISA), which integrates existing data from the labour market, educational, and social sectors; the National Patient Register, which includes records of all inpatient care since 1987 and specialised outpatient care since 2001 (with satisfactory coverage since 2006); and the Causes of Death Register, comprising information on all deaths in Sweden since 1952 (appendix p 15). Ethical approval for the study was given by the Regional Ethics Review Board in Stockholm, Sweden (Dnr 2010-1185-31-5).

Information on parental mental illness was obtained from the National Patient Register through registered codes from the International Classification of Diseases 10, within the following diagnostic categories: non-affective psychotic disorders (F20–24, F28–29); affective psychotic disorders (F25, F30–31, F32·3, F33·3); alcohol use disorders (F10·1–10·9, but not F10·0 [acute intoxication]); substance use disorders (F11–19); depressive disorders (F32–34, F38–39, excluding F32·3, F33·3); anxiety and stress related disorders (F40–45, F48); personality disorders (F60–63, F68–69); eating disorders (F50); and attention-deficit hyperactivity disorder (ADHD; F90). We included mental illness recorded as either primary or secondary diagnosis.

Indicators of socioeconomic adversity were selected on the basis of known associations with adverse health and social outcomes.[18] The following indicators for each year of follow-up were obtained from LISA: both parents unemployed (yes or no); household receiving public assistance (yes or no), defined as either parent being in receipt of public assistance, which is the last safety net for individuals or households who prove their inability to meet the basic standards of living (eg, food, clothing, health care, housing); and household in the lowest disposable income quintile (yes or no), where quintiles were calculated using the sample (ie, disposable income distribution from family households). Household disposable income is calculated by Statistics Sweden as the yearly sum of income and public benefits earned by all family members, adjusted for taxation. The Total Population Register provided information on whether a child was living with her or his mother or father during a specific age period, age of the parents at the child's birth, and birth country of the parents (Sweden or other). Teenage parenthood was defined as a parent being younger than 18 years at the time of giving birth. Parents' highest education level was obtained from LISA and was categorised as compulsory (≤9 school-years), secondary (10–12 school-years), or post-secondary (≥13 school-years).

For the **Psychiatry Sweden register** see https://ki.se/en/gph/psychiatry-sweden-the-register-linkage-epicss-group

Statistical analysis

Each child's follow-up was divided into 3-year age groups (0 to <3 years, 3 to <6 years, 6 to <9 years, 9 to <12 years, 12 to <15 years, and 15 to <18 years). We selected only age groups in which the child had complete follow-up. Age group-specific period prevalence was defined as the proportion of children who had a parent with a secondary care event, during that age group, in which mental illness was recorded. This analysis included all mental illness events during follow-up, not only the first recorded diagnosis.

Period prevalence was estimated using marginal predictions from a standard logistic regression model fitted to the data. This model included categorical variables for both the age group and each observation year, such that the age-specific estimates accounted for temporal trends and vice versa. Missing data was recorded for children whose parent had emigrated or died before the end of that age group. Children who had missing data for their mother were still included in the analysis for fathers and vice versa. Follow-up was not censored when the child no longer lived with their parent. Because of the size and complexity of the dataset, standard errors accounted for clustering by maternal sibships using the Huber-White sandwich estimator. We decided to cluster at the maternal rather than child level for two reasons. First, of the two, maternal is the higher level, and would therefore account for clustering by child. Second, clustering by maternal sibships provided slightly larger standard errors and a more conservative estimate. In a post-hoc analysis, we compared standard errors adjusted for either maternal or child clustering and they were similar up to the fourth decimal place (data not

See **Online** for appendix

	All	0 to <3 years	3 to <6 years	6 to <9 years	9 to <12 years	12 to <15 years	15 to <18 years
Any disorder							
Maternal	5·91% (5·89–5·94)	4·05% (4·00–4·10)	5·41% (5·36–5·46)	5·96% (5·91–6·02)	6·42% (6·36–6·48)	6·69% (6·63–6·74)	6·71% (6·66–6·77)
Paternal	4·28% (4·26–4·31)	3·11% (3·07–3·16)	4·02% (3·98–4·06)	4·33% (4·28–4·37)	4·56% (4·51–4·61)	4·73% (4·68–4·77)	4·82% (4·77–4·86)
Either	9·53% (9·50–9·57)	6·72% (6·65–6·78)	8·80% (8·74–8·86)	9·61% (9·54–9·67)	10·27% (10·20–10·34)	10·66% (10·59–10·73)	10·80% (10·73–10·87)
Non-affective psychotic disorders							
Maternal	0·20% (0·20–0·21)	0·13% (0·12–0·14)	0·16% (0·15–0·17)	0·20% (0·19–0·21)	0·22% (0·21–0·23)	0·25% (0·24–0·26)	0·27% (0·26–0·28)
Paternal	0·21% (0·21–0·22)	0·15% (0·14–0·16)	0·19% (0·18–0·19)	0·20% (0·19–0·21)	0·23% (0·22–0·24)	0·25% (0·24–0·26)	0·25% (0·24–0·27)
Affective psychotic disorders							
Maternal	0·77% (0·76–0·78)	0·46% (0·45–0·48)	0·65% (0·63–0·66)	0·78% (0·76–0·80)	0·87% (0·85–0·89)	0·90% (0·88–0·92)	0·94% (0·92–0·97)
Paternal	0·50% (0·49–0·51)	0·32% (0·31–0·34)	0·43% (0·41–0·44)	0·50% (0·48–0·51)	0·54% (0·52–0·56)	0·58% (0·56–0·60)	0·62% (0·60–0·63)
Depressive disorders							
Maternal	2·51% (2·49–2·53)	1·68% (1·64–1·71)	2·27% (2·24–2·30)	2·54% (2·50–2·57)	2·73% (2·70–2·77)	2·86% (2·82–2·90)	2·88% (2·85–2·92)
Paternal	1·50% (1·49–1·52)	1·01% (0·98–1·03)	1·38% (1·36–1·41)	1·54% (1·51–1·57)	1·65% (1·62–1·68)	1·69% (1·66–1·72)	1·69% (1·66–1·72)
Anxiety disorders							
Maternal	3·70% (3·68–3·72)	2·57% (2·53–2·61)	3·50% (3·46–3·54)	3·78% (3·74–3·83)	3·99% (3·94–4·03)	4·13% (4·08–4·18)	4·05% (4·01–4·10)
Paternal	2·16% (2·15–2·18)	1·70% (1·66–1·73)	2·16% (2·13–2·19)	2·25% (2·22–2·29)	2·31% (2·27–2·34)	2·29% (2·25–2·32)	2·19% (2·16–2·22)
Eating disorders*							
Maternal	0·15% (0·15–0·16)	0·12% (0·11–0·13)	0·17% (0·16–0·18)	0·18% (0·17–0·19)	0·17% (0·16–0·18)	0·14% (0·14–0·15)	0·11% (0·10–0·12)
Personality disorders							
Maternal	0·49% (0·48–0·49)	0·29% (0·28–0·30)	0·43% (0·42–0·45)	0·50% (0·49–0·52)	0·55% (0·53–0·57)	0·57% (0·55–0·59)	0·55% (0·54–0·57)
Paternal	0·28% (0·28–0·29)	0·22% (0·20–0·23)	0·27% (0·26–0·28)	0·29% (0·28–0·30)	0·31% (0·30–0·33)	0·31% (0·30–0·32)	0·30% (0·29–0·31)
Attention-deficit hyperactivity disorder							
Maternal	0·62% (0·61–0·63)	0·41% (0·39–0·42)	0·57% (0·55–0·58)	0·64% (0·63–0·66)	0·70% (0·68–0·72)	0·71% (0·69–0·72)	0·64% (0·62–0·66)
Paternal	0·57% (0·56–0·58)	0·51% (0·49–0·53)	0·60% (0·59–0·62)	0·60% (0·58–0·61)	0·60% (0·58–0·61)	0·58% (0·56–0·60)	0·52% (0·51–0·54)
Alcohol use disorders							
Maternal	0·36% (0·36–0·37)	0·09% (0·09–0·10)	0·21% (0·20–0·22)	0·31% (0·30–0·32)	0·42% (0·40–0·43)	0·52% (0·50–0·54)	0·62% (0·60–0·63)
Paternal	0·82% (0·81–0·83)	0·37% (0·35–0·38)	0·57% (0·56–0·59)	0·72% (0·70–0·74)	0·90% (0·88–0·92)	1·08% (1·06–1·11)	1·27% (1·25–1·30)
Substance use disorders							
Maternal	0·26% (0·25–0·27)	0·12% (0·11–0·13)	0·21% (0·20–0·22)	0·25% (0·24–0·26)	0·29% (0·27–0·30)	0·33% (0·32–0·35)	0·35% (0·33–0·36)
Paternal	0·52% (0·52–0·53)	0·41% (0·39–0·42)	0·52% (0·50–0·53)	0·54% (0·52–0·55)	0·55% (0·54–0·57)	0·57% (0·55–0·58)	0·55% (0·53–0·56)

Data are % (95% CI). 3-year period prevalence estimates from marginal predictions from a logistic regression model controlling for year (categorical). *Paternal eating disorder prevalence values were negligible.

Table 1: **Period prevalence of children with parental mental illness by age-group for 2006–16 (n=2 110 988 children)**

shown), suggesting that the choice of clustering made little substantive difference. Data analysis was done using Stata version 15, and plots were produced using R.

To describe the contemporary association between parental mental illness and socioeconomic adversity, a cross-sectional portion of the data was examined by selecting a random age group for each child. Univariable logistic regression models were fitted to quantify the association between each category of parental mental illness and each socioeconomic adversity indicator. For adversity variables that were time-dependent (eg, household disposable income), we selected data on the basis of the middle calendar year for that age group. For this analysis, mental illnesses were grouped as psychotic illness (defined as non-affective or affective psychotic disorders), common mental illness (defined as anxiety or depression), addiction (defined as substance or alcohol use disorders), and others (defined as ADHD or personality or eating disorders).

Mental disorders tend to co-occur, and parents in the study population might have more than one mental illness diagnosis. A post-hoc analysis was done to examine whether there was a dose–response relationship between parental mental illness diagnosis and being in the lowest disposable income quintile. In this analysis, we also examined the most common combinations of maternal and paternal mental illness diagnoses in relation to the risk.

Role of the funding source

The funders had no role in the study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data and had final responsibility for the decision to submit for publication.

Results

Out of 2 198 289 children born in Sweden between Jan 1, 1991, and Dec 31, 2011, we excluded 1796 (0·08%)

	2006–09	2007–10	2008–11	2009–12	2010–13	2011–14	2012–15	2013–16
Any								
Maternal	5·29% (5·23–5·35)	5·24% (5·19–5·30)	5·20% (5·14–5·26)	5·52% (5·46–5·58)	6·03% (5·97–6·09)	6·59% (6·53–6·66)	6·79% (6·71–6·86)	6·97% (6·90–7·05)
Paternal	3·87% (3·82–3·92)	3·94% (3·89–3·99)	3·94% (3·89–3·99)	4·12% (4·07–4·17)	4·39% (4·34–4·45)	4·63% (4·57–4·69)	4·73% (4·67–4·79)	4·81% (4·75–4·87)
Either	8·62% (8·54–8·69)	8·63% (8·56–8·70)	8·59% (8·52–8·66)	9·04% (8·97–9·12)	9·75% (9·67–9·83)	10·46% (10·38–10·54)	10·70% (10·61–10·78)	10·95% (10·86–11·03)
Non-affective psychotic disorders								
Maternal	0·22% (0·21–0·24)	0·21% (0·20–0·22)	0·20% (0·19–0·21)	0·21% (0·19–0·22)	0·20% (0·19–0·21)	0·20% (0·19–0·21)	0·20% (0·19–0·22)	0·20% (0·18–0·21)
Paternal	0·22% (0·21–0·23)	0·22% (0·20–0·23)	0·22% (0·20–0·23)	0·21% (0·20–0·22)	0·21% (0·20–0·22)	0·21% (0·20–0·22)	0·22% (0·21–0·23)	0·21% (0·20–0·23)
Affective psychotic disorders								
Maternal	0·60% (0·58–0·62)	0·65% (0·63–0·67)	0·67% (0·65–0·69)	0·74% (0·72–0·76)	0·82% (0·80–0·85)	0·89% (0·87–0·92)	0·92% (0·90–0·95)	0·96% (0·93–0·98)
Paternal	0·41% (0·39–0·43)	0·44% (0·42–0·46)	0·47% (0·45–0·49)	0·50% (0·48–0·51)	0·52% (0·50–0·54)	0·56% (0·54–0·58)	0·55% (0·53–0·57)	0·58% (0·56–0·60)
Depressive disorders								
Maternal	2·34% (2·30–2·37)	2·30% (2·26–2·33)	2·29% (2·25–2·33)	2·34% (2·30–2·38)	2·52% (2·48–2·56)	2·78% (2·74–2·83)	2·81% (2·77–2·86)	2·81% (2·76–2·85)
Paternal	1·45% (1·42–1·48)	1·46% (1·43–1·49)	1·42% (1·39–1·45)	1·43% (1·40–1·46)	1·51% (1·48–1·54)	1·58% (1·54–1·61)	1·61% (1·57–1·64)	1·61% (1·57–1·64)
Anxiety disorders								
Maternal	3·19% (3·15–3·24)	3·22% (3·18–3·27)	3·18% (3·14–3·23)	3·35% (3·31–3·40)	3·71% (3·66–3·76)	4·18% (4·13–4·24)	4·40% (4·34–4·45)	4·60% (4·54–4·65)
Paternal	1·90% (1·86–1·93)	1·99% (1·95–2·02)	1·96% (1·93–2·00)	2·04% (2·01–2·08)	2·19% (2·15–2·23)	2·36% (2·32–2·40)	2·46% (2·42–2·50)	2·50% (2·45–2·54)
Eating disorders*								
Maternal	0·12% (0·11–0·12)	0·13% (0·12–0·14)	0·13% (0·12–0·13)	0·13% (0·12–0·14)	0·16% (0·15–0·17)	0·18% (0·17–0·19)	0·17% (0·16–0·18)	0·19% (0·18–0·20)
Personality disorders								
Maternal	0·43% (0·41–0·45)	0·43% (0·41–0·44)	0·44% (0·42–0·46)	0·47% (0·45–0·48)	0·51% (0·49–0·53)	0·55% (0·53–0·57)	0·54% (0·52–0·56)	0·55% (0·53–0·57)
Paternal	0·27% (0·26–0·28)	0·28% (0·26–0·29)	0·27% (0·26–0·28)	0·28% (0·27–0·30)	0·29% (0·28–0·31)	0·30% (0·28–0·31)	0·29% (0·27–0·30)	0·30% (0·28–0·31)
Attention-deficit hyperactivity disorder								
Maternal	0·22% (0·21–0·24)	0·30% (0·29–0·31)	0·38% (0·37–0·40)	0·53% (0·51–0·54)	0·71% (0·69–0·73)	0·86% (0·84–0·89)	0·97% (0·94–1·00)	1·11% (1·08–1·14)
Paternal	0·22% (0·21–0·24)	0·30% (0·28–0·31)	0·36% (0·35–0·38)	0·51% (0·49–0·53)	0·65% (0·63–0·68)	0·80% (0·77–0·82)	0·88% (0·86–0·91)	0·98% (0·96–1·01)
Alcohol use disorders								
Maternal	0·37% (0·35–0·38)	0·36% (0·34–0·37)	0·35% (0·33–0·36)	0·36% (0·34–0·37)	0·35% (0·34–0·37)	0·38% (0·37–0·40)	0·39% (0·37–0·40)	0·37% (0·36–0·39)
Paternal	0·82% (0·80–0·84)	0·83% (0·81–0·86)	0·85% (0·82–0·87)	0·81% (0·79–0·84)	0·84% (0·81–0·86)	0·82% (0·79–0·84)	0·83% (0·80–0·85)	0·80% (0·77–0·82)
Substance use disorders								
Maternal	0·23% (0·22–0·25)	0·23% (0·22–0·24)	0·23% (0·22–0·24)	0·25% (0·24–0·26)	0·27% (0·25–0·28)	0·29% (0·28–0·30)	0·30% (0·29–0·32)	0·30% (0·28–0·31)
Paternal	0·45% (0·43–0·46)	0·46% (0·44–0·47)	0·46% (0·44–0·48)	0·52% (0·50–0·53)	0·55% (0·53–0·57)	0·58% (0·56–0·60)	0·61% (0·59–0·63)	0·60% (0·58–0·63)

Data are % (95% CI). 3-year period prevalence estimates from marginal predictions from a logistic regression model controlling for age (categorical). *Paternal eating disorder prevalence values were negligible.

Table 2: **Trends in prevalence of children with parental mental illness by period, 2006–16 (n=2 110 988 children)**

adopted children, 2983 (0·14%) children with missing information on both birth parents, 51126 (2·33%) children who ceased follow-up before Jan 1, 2006, and 31396 (1·43%) children whose follow-up did not completely span a 3-year age group. The final analysis cohort therefore comprised 2 110 988 children (96·03% of the total population) born to 1179754 mothers and 1171497 fathers (appendix p 2). Children of parents with mental illness were more likely to have been born to either younger (≤24 years) or older (≥40 years) parents, to have parents who ceased education before higher education, and to have parents born outside of Sweden (appendix pp 3–4).

The prevalence of children with parents with mental illness was 9·53% (95% CI 9·50–9·57) during 2006–16 (table 1). This prevalence increased with age of the child, from 6·72% (6·65–6·78) of children aged between 0 years and less than 3 years, up to 10·80% (10·73–10·87) among those aged 15 years to less than 18 years. This increase was observed for exposure to most parental mental illness categories, except for eating disorders and ADHD, which were similar across age groups. More children were exposed to maternal than paternal mental illness for most illness categories; overall, exposure to maternal mental illness (5·91% [95% CI 5·89–5·94]) was about one third higher than exposure to paternal mental illness (4·28% [4·26–4·31]). However, exposure to mothers or fathers with non-affective psychotic disorders was similar (overall maternal exposure 0·20% [0·20–0·21] *vs* paternal exposure 0·21% [0·21–0·22]), whereas exposure to paternal addiction was higher than was exposure to maternal addiction (eg, for alcohol use disorder, overall paternal exposure 0·82% [0·81–0·83] *vs* maternal exposure 0·36% [0·36–0·37]).

The prevalence of children with parents with mental illness increased steadily during the study period, from 8·62% (95% CI 8·54–8·69) in 2006–09, up to 10·95% (10·86–11·03) in 2013–16 (table 2). Increases were seen for most mental illness categories, except for non-affective psychotic disorders, alcohol use disorder, and paternal

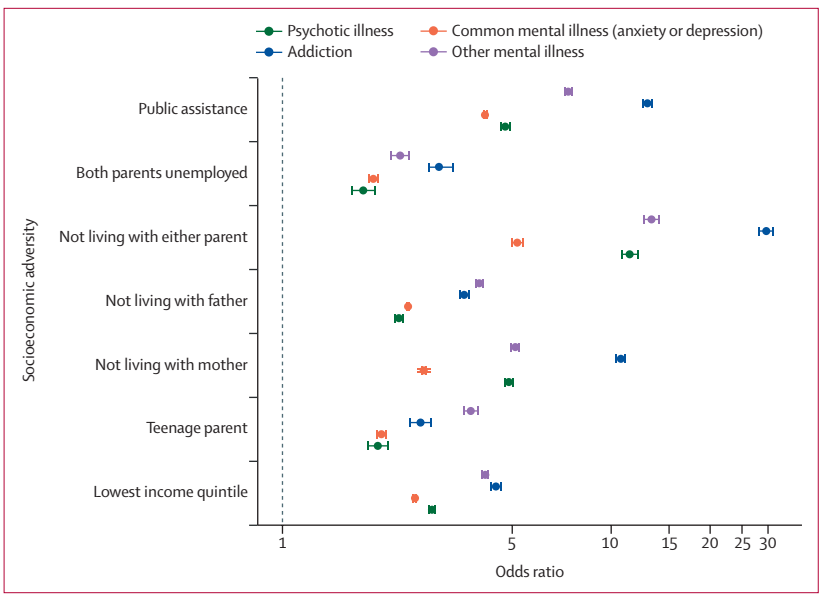

Figure 1: **Odds ratio for association between socioeconomic adversity and maternal mental illness**
Horizontal bars represent the 95% CIs.

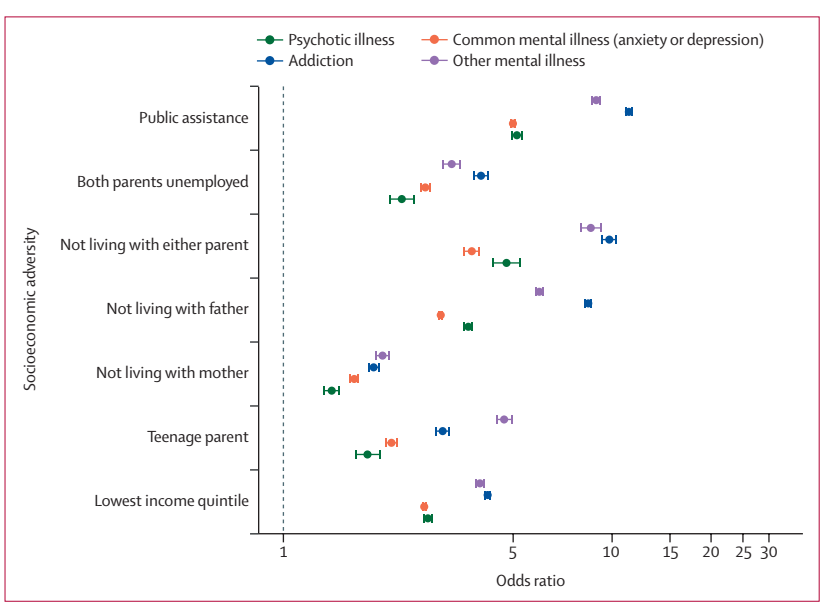

Figure 2: **Odds ratio for association between socioeconomic adversity and paternal mental illness**
Horizontal bars represent the 95% CIs.

personality disorders, all of which remained fairly stable. In sensitivity analyses, increases were observed for parental mental illness treated within outpatient and inpatient care (appendix pp 5—11), with larger increases for outpatient care.

Overall, exposure to all categories of parental mental illness was strongly associated with concomitant socioeconomic adversity (figures 1, 2; appendix pp 12–13). Odds ratios (ORs) were somewhat similar for parental psychotic illness and common mental illness, with the exception of chilren not living with either parent (eg, ORs ranged from 1·76 [95% CI 1·62–1·92] to 11·38 [10·70–12·12] for maternal psychotic illness, and from 1·89 [1·82–1·96] to 5·18 [4·97–5·41] for maternal common mental illness. The highest ORs were observed for exposure to parental addiction (eg, ORs ranged from 2·63 [2·43–2·85] to 29·64 [28·09–31·27] for maternal addiction, and from 1·89 [1·82–1·97] to 11·23 [10·95–11·52] for paternal addiction), followed by the "other" category (personality and eating disorders and ADHD). Within this category, the strongest association was found for maternal personality disorders (eg, OR for lowest quintile of disposable income 4·43 [4·26–4·61]; data not shown).

The most common combination of maternal and paternal mental illness diagnoses was that of mood and anxiety disorders (appendix p 14). There was evidence of a dose–response relationship between parental mental illness and being in the lowest disposable income quintile. Children of parents with five or more mental illness diagnoses had almost seven times higher odds of being in the lowest disposable income quintile (OR 6·71, 95% CI 6·18–7·28; appendix p 14).

Discussion

Using a contemporary population of 2 110 988 Swedish children observed between 2006 and 2016, we estimate that, overall, one in ten children and adolescents have a mother or father diagnosed with mental illness in secondary care. Within the overall estimate was an increase with age, such that 6·72% of children aged 0 to less than 3 years had a parent with mental illness, increasing to 10·80% of those aged 15 to less than 18 years. The overall estimate also varied over time, increasing from 8·62% in 2006–09 up to 10·95% in 2013–16. Overall, exposure to maternal mental illness (5·91%) was about one third higher than exposure to paternal mental illness (4·28%). We found that, even in the context of the extensive Swedish welfare system, children of parents with mental illness had markedly higher risks of broad socioeconomic adversity than did other children.

Our prevalence estimates concern parental mental illness serious enough to be treated within secondary care, because we did not have information on individuals with mental illness that were treated exclusively within primary care. This limitation means that we are likely to have underestimated the prevalence of common mental illness, which is often treated exclusively within primary care. By comparison, our study[15] in the UK did use primary care data and reported a higher prevalence of children exposed to maternal mental illness at any time: about one in four children. The prevalence that we now report of children whose parents have been diagnosed with mental illness is similar to the 1-year weighted prevalence reported in a 2002 Canadian national survey[16] using diagnostic interviews (12·1%).

Furthermore, both our Swedish and UK studies[15] report increasing prevalence of exposure to diagnosed parental

mental illness during the past decade. We reported increases in exposure to parental common mental illness (ie, anxiety or depression), affective psychosis, ADHD, and personality disorders, whereas exposure to parental non-affective psychosis remained stable. Although our findings might represent a genuine increase in the burden of mental illness among parents over time and an increase in the severity of cases such that individuals are coming to secondary care, other explanations of our findings might exist. Increased awareness about mental illness, improved availability of treatments, and a lower threshold for help-seeking could have contributed to the increased prevalence of diagnosed mental illness among parents in both countries.[19,20] Similarly, increasing trends in prevalence of children with parents with mental illness reported in both our studies could represent a reduction in the hidden proportion of mental illness among parents, perhaps meaning that previously unmet mental health-care needs are increasingly being met, and that a greater proportion of parents are obtaining treatment in both primary and secondary care.

Except for exposure to parental substance and alcohol use disorders, which was twice as common for fathers' than mothers' addictions, more children were exposed to maternal mental illness than paternal mental illness. Men might be less likely to seek help than are women, which could lead to their mental health problems being less well recorded in the registers.[21] The relevance of paternal mental health to children is increasingly recognised;[22] therefore, our findings are an important addition to previous work, most of which only examined exposure to maternal mental illness in primary care.

Given that ADHD is over-represented in males, it is noteworthy that there was no apparent difference in the prevalence of maternal and paternal ADHD. Further research is needed to understand if gender differences in the timing of diagnosis, treatment, and clinical presentation explain the reduced chance of becoming a father than a mother with diagnosed ADHD.[23]

In agreement with our UK study,[15] we report that the prevalence of exposure to maternal and paternal mental illness increased with the age of the child. Mental illness is often enduring, relapsing, or both;[24] therefore, the increasing prevalence could be explained by an increasing number of incident cases over time, and by few parents becoming well. Moreover, a substantial proportion of depression starts in midlife, when people are already parents.[25] Parenthood itself could also be a risk factor for adult mental illness.[26]

Our descriptive study provides the most extensive examination of the likelihood of exposure to socioeconomic adversity among children of parents with mental illness in a total population. Our findings add to existing knowledge in three important ways.

First, even in the context of the Swedish welfare state, the magnitude of exposure to socioeconomic adversity among children of parents with mental illness was markedly high. These children had more than twice the odds of living in households in the lowest income quintile, more than four times the odds of living in households receiving public assistance, more than three times the odds of living separately from the parent with mental illness, and they were more likely to have unemployed or teenage parents. These results highlight the reality of how parental mental illness overlaps with broad socioeconomic adversity in these children's lives and represents a substantial factor in considering their adverse health and social outcomes.

Second, all categories of parental mental illness were associated with increased risk of childhood socioeconomic adversity. This finding is important because existing evidence has focused on the link between parental psychotic illness and childhood adversity.[27] We found that the odds of poverty (and other indicators of adversity) were similar for exposure to parental common and psychotic mental illness, whereas they were considerably higher for exposure to other mental illness categories. These findings suggest that a much larger number of children with parents with mental illness is exposed to concomitant socioeconomic adversity than was previously thought.

Third, in relation to other types of parental mental illnesses, exposure to parental addiction showed the strongest associations with children's exposure to socioeconomic adversity. For example, children with paternal addiction were four times more likely to have unemployed parents. Yet, it is likely that we have captured only a part of parental addiction because only a fraction of all individuals with addiction disorders seek care.[28] Thus, children exposed to parental addiction might be a particularly hidden group, with high exposure to broad adversity.

The large population-based sample and high-quality nationwide register data are strengths of our study. We were able to follow up all children in Sweden for a long period, and we assessed variables at multiple timepoints. Nevertheless, there are limitations. We were not able to study parents with mental illness treated exclusively within primary care or those who do not seek care. We studied a broad spectrum of parental mental illness, but we did not include children of parents with developmental disabilities, such as autism and intellectual disability, which might overlap with mental illness. Future studies should address the prevalence and exposure to adversity of these children as well. Lastly, we did not have information on the reasons for children living separately from their parents or for parental separation, and this information might be important for outcomes in this group of children.

The substantial overlap observed between parental mental illness and socioeconomic adversity is probably bidirectional, trapping children and families in a vicious cycle of poverty and illness. Any public health interventions designed to ameliorate the effects of socioeconomic adversity need to be tailored to and overcome

the barrier of mental illness. For example, parents with mental illness are less responsive to traditional public health approaches such as information campaigns and signposting.[29] Hence, as the baseline risk of poor health reduces in the population, the relative risk to these children increases.[29] Currently in most high-income countries, financial and social supports are targeted at the parent with mental illness, not their children, which means that these children are missed until they develop problems themselves.[30]

Children of parents with mental illness with unmet needs are likely to derive greatest benefit from preventive or early intervention. The extent of the problem has two implications for policy planners and providers. First, they will have to cater for children according to the breadth and magnitude of adversity that children experience, at a scale and intensity proportionate to their needs. Our findings might help to understand better how to target resources to those at highest risk or greatest need within the risk subset. Second, increased funding and widened efforts to refocus policy and tailor support to the child's needs will be required to address the broader problem of multiple adversities faced by children and families.[30]

Our exploration of the extent to which children are jointly exposed to adversity and parental mental illness has identified highly vulnerable groups in which there might be interactions between the adverse environment and the parental mental illness, resulting in excessive risk of poor life outcomes for some children. These include children exposed to parental addiction.

Finally, given the known detrimental effects that parental mental illness and child poverty and adversity can have on future health and social outcomes, there is a need for research to understand how these combined influences affect the lives of these children.

Contributors

MP, KMA, and KK designed the study. SW extracted and prepared the data, and MP did the analysis. All authors contributed to the interpretation of the data. MP, KMA, JMJ, and KK wrote the initial draft, and all authors contributed to writing the final manuscript.

Declaration of interests

All authors declare no competing interests.

Data sharing

Due to Swedish legal restrictions and the current ethical approval for the study, data are not publicly available to share, but the research group can provide descriptive data in table form. Requests should be made to Kyriaki Kosidou (kyriaki.kosidou@ki.se).

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