Risk of psychiatric disorders in offspring of parents with a history of homelessness during childhood and adolescence in Denmark: a nationwide, register-based, cohort study

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Summary

Background Children and adolescents from deprived backgrounds have high rates of psychiatric problems. Parental and social factors are crucial for children’s healthy and positive development, but whether psychiatric morbidity is associated with parental social marginalisation is unknown. We aimed to analyse the association between mother’s and father’s history of homelessness and the offspring’s risk of psychiatric disorders, including substance use disorder, during childhood and adolescence.

Methods We did a nationwide, register-based cohort study of 1072882 children and adolescents aged 0–16 years, who were living or born in Denmark between Jan 1, 1999, and Dec 31, 2015. Parental homelessness was the primary exposure, data on which were obtained from the Danish Homeless Register. The Danish Civil Registration System was used to extract the population and link offspring to parental information, and the outcome, psychiatric disorders in the offspring, was obtained from the Danish Psychiatric Central Research Register and the Danish National Patient Register. We analysed the association between parental history of homelessness and risk of psychiatric disorders in offspring by survival analysis using Poisson regression and incidence rate ratios (IRRs), adjusted for year and offspring characteristics, and additionally adjusted for parental factors (age at offspring’s birth and parental psychiatric disorders).

Findings 17 238 (2%) offspring had either one or two parents with a history of homelessness, and 56 330 (5%) children and adolescents were diagnosed with any psychiatric disorder during the study period. The incidence of any psychiatric disorder was 15·1 cases per 1000 person-years (95% CI 14·4–15·8) in offspring with at least one parent with a history of homelessness, compared with 6·0 per 1000 person-years (95% CI 6·0–6·1) in those whose parents had no such history (IRR 2·5 [95% CI 2·3–2·7] for mother homelessness, 2·3 [2·2–2·5] for father homeless, and 2·8 [2·4–3·2] for both parents homeless, after adjustment for year and offspring characteristics). This risk remained elevated after additional adjustment for factors including parental psychiatric disorders. IRRs in offspring were increased for most specific psychiatric disorders, with the highest risk for attachment disorder when both parents had a history of homelessness (IRR 32·5 [95% CI 24·6–42·9]) and substance use disorder when only the mother had a history of homelessness (6·9 [4·9–9·7]). In offspring whose mothers had a history of both homelessness and a psychiatric disorder, 35·9% (95% CI 27·1–44·8) had been diagnosed with a psychiatric disorder by the age of 15 years.

Interpretation Parental homelessness was associated with an increased risk of psychiatric disorders in offspring during childhood and adolescence. These findings have important implications for public health and policy because they suggest a need for improvement in the support of socially marginalised families to help prevent psychiatric illness in offspring.

Funding University of Copenhagen, The Lundbeck Foundation Initiative for Integrated Psychiatric Research (iPSYCH).

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Introduction

Children and adolescents from socially marginalised families have severe health problems compared with those from higher socioeconomic backgrounds.1 In a report2 from the UK, half of adult mental health problems were estimated to begin before the age of 14 years. Emotional influence and social support from parents have been acknowledged as important factors in child mental health and development.3 Social determinants are suggested to be among the biggest influences of children’s health.4 Homelessness has been linked to severe health problems and excess mortality.5 Additionally, in a review6 from 2014, it was stated that rates of homelessness have increased in countries in the European Union during the past 5 years, with young people, women, and families accounting for a higher proportion of people who are homeless than previously.

Children living without a home or who have mothers who were formerly homeless have been found to have more psychiatric problems than housed children from low-income backgrounds.7,8 Additionally, substance use
problems (ie, use of recreational drugs, alcohol, and other psychoactive substances) are prevalent in homeless adolescents.10 However, findings have been inconsistent, for example, for specific psychiatric disorders and age groups.7,10–13 with some studies showing no differences between children in homeless families versus low-income housed families.14.15 The effect of homelessness on children’s health is difficult to measure,12 and there were methodological limitations in previous studies (eg, small sample sizes, and absence of comparison groups and adjustment for confounders).13 Research into the associations between social determinants (including parental homelessness) and child psychiatric illness are scarce.17,18,11 especially studies outside the USA. We aimed to analyse the risk of any and specific psychiatric disorders during childhood and adolescence in individuals whose parents had a history of homelessness.

Methods
Data sources and study participants
The population in this cohort study comprised children and adolescents living or born in Denmark between Jan 1, 1999, and Dec 31, 2015. The Danish Civil Registration System,9 which contains data since 1968, was used to establish the study population. This register contains information on vital status, date of birth, country of origin, sex, and the personal identification number (civil registration system number) assigned to all Danish residents. The civil registration system number makes accurate linkage between registries and linkage to parents possible. We excluded children and adolescents with an unknown mother or father.

Parental history of homelessness was the main exposure, data on which were collected from the Danish Homeless Register, established on Jan 1, 1999.7 The register covers dates for all contacts with homeless shelters in Denmark, which are covered by the Act on Social Services 110, and states that the municipal council should offer temporary accommodation to people with specific problems who need support and who either have no home or are not able to stay in their home. Women with children who have experienced violence or threats of violence are not covered by this register. A parent was defined as having a history of homelessness from the date of first homeless shelter contact since 1999 and onwards.

Information on parental psychiatric disorders was obtained from the Danish Psychiatric Central Research Register,8 which contains data on all psychiatric inpatient admissions in Denmark since 1969 and outpatient admissions in Denmark since 1997.

Added value of this study
This is the first nationwide register-based cohort study with prospectively collected data and up to 16 years’ follow-up, studying both the mother’s and father’s history of homelessness and its association with offsprings’ risk of psychiatric disorders, including substance use disorder, during childhood and adolescence. We found an association between both mother’s and father’s homelessness and offspring’s risk of any and most specific psychiatric disorders, including after adjustment for parental psychiatric disorders, and we noted a higher risk associated with maternal than paternal homelessness. The highest excess risk in the offspring of specific psychiatric disorders was found for attachment and substance use disorder.

Implications of all the available evidence
This study adds a new perspective by focusing on the mother’s and father’s history of homelessness as a social determinant. Parental history of homelessness can be seen as an important long-lasting indicator of susceptibility to psychiatric illness in offspring besides from that associated with parental psychiatric disorders. Our findings suggest a need for increased political focus on the risk of severe child and adolescent psychiatric morbidity associated with parents’ social marginalisation. Better support for the socially marginalised families is needed to improve the children’s lives and reduce adverse consequences in the longer term. Future prospective studies focusing on the causes of homelessness are needed to guide prevention of homelessness in practice.
contacts from 1995. We also collected data from the Danish National Patient Register, which contains information on all somatic inpatient hospital contact, including psychiatric diagnoses given at the somatic wards, since 1977 and outpatient contacts from 1995. We defined psychiatric diagnoses according to the 10th revision of the International Classification of Diseases (ICD-10), which has been used in Denmark since 1994 and ICD-8, used in 1969–93.

We used two covariates of parental psychiatric disorders. We defined the overall covariate as any psychiatric disorder, which included substance use disorder, from the first date of diagnosis since 1969 and onwards. We defined a specific hierarchical covariate according to mutually exclusive categories with the first mentioned regarded as the most severe based on the hierarchical ICD-10 system: organic disorder; substance use disorder; schizophrenia or bipolar disorder; single and recurrent depressive disorder; neurotic, stress-related, and somatoform disorder; personality disorder; behavioural and emotional disorders including hyperkinetic disorder; other mental disorders; and no psychiatric contact.

Table 1: Characteristics of parents and offspring with any psychiatric disorder by parental history of homelessness

| At least one parent with a history of homelessness | No parents with a history of homelessness |
|---------------------------------------------------|------------------------------------------|
| **Offspring with any psychiatric disorder in childhood and adolescence** | **Person-years** | **Incidence (per 1000 person-years; 95% CI)** | **Offspring with any psychiatric disorder in childhood and adolescence** | **Person-years** | **Incidence (per 1000 person-years; 95% CI)** |
| All | 1714 | 113,839 | 15.1 (14.4–15.8) | 54,616 | 9,051,089 | 6.0 (6.0–6.1) |
| Offspring’s sex | | | | | | |
| Girl | 601 | 55,698 | 10.8 (10.0–11.7) | 19,765 | 4,453,363 | 4.4 (4.4–4.5) |
| Boy | 1113 | 58,141 | 19.1 (18.1–20.3) | 34,851 | 4,597,726 | 7.6 (7.5–7.7) |
| Offspring’s country of origin | | | | | | |
| Denmark and other high-income countries | 1480 | 77,397 | 19.1 (18.2–20.1) | 51,724 | 8,256,325 | 6.3 (6.2–6.3) |
| Low-income and middle-income countries | 234 | 36,443 | 6.4 (5.7–7.3) | 289 | 794,764 | 3.6 (3.5–3.8) |
| Mother’s age at offspring’s birth (years) | | | | | | |
| <25 | 680 | 36,956 | 18.4 (17.1–19.8) | 9629 | 117,209 | 8.2 (8.1–8.4) |
| 25–34 | 817 | 59,231 | 13.8 (12.9–14.8) | 35,937 | 6,279,247 | 5.7 (5–5.8) |
| ≥35 | 217 | 17,652 | 12.3 (10.8–14.0) | 9050 | 1,599,783 | 5.7 (5–5.8) |
| Father’s age at offspring’s birth (years) | | | | | | |
| <25 | 341 | 17,025 | 20.0 (18.0–22.3) | 4906 | 539,246 | 9.1 (8.9–9.4) |
| 25–34 | 837 | 55,533 | 15.1 (14.1–16.1) | 32,685 | 5,497,418 | 6.0 (5.9–6.0) |
| ≥35 | 536 | 41,281 | 13.0 (11.9–14.1) | 17,025 | 3,014,425 | 5.7 (5–5.8) |
| Mother’s psychiatric disorder† | | | | | | |
| Organic disorder | 26 | 750 | 34.7 (23.6–50.9) | 213 | 12,138 | 17.6 (15.3–20.1) |
| Substance use disorder | 304 | 12,949 | 23.3 (20.6–26.3) | 1881 | 118,898 | 15.8 (13.1–16.6) |
| Schizophrenia or bipolar disorder | 40 | 1419 | 28.2 (27.0–38.4) | 514 | 28,039 | 18.3 (16.8–20.0) |
| Single and recurrent depressive disorder | 129 | 6130 | 21.1 (17.7–25.0) | 3200 | 224,245 | 14.3 (13.8–14.8) |
| Neurotic, stress-related, and somatoform disorder | 210 | 8783 | 23.9 (20.9–27.4) | 3601 | 300,766 | 12.0 (11.1–12.4) |
| Personality disorder | 51 | 1708 | 29.9 (27.3–39.3) | 653 | 49,842 | 13.1 (12.1–14.2) |
| Behavioural and emotional disorder including hyperkinetic disorder | 24 | 1152 | 20.8 (14.0–31.1) | 380 | 22,998 | 16.5 (14.9–18.3) |
| Other mental disorders | 18 | 1147 | 16.7 (12.0–24.9) | 642 | 7,389 | 8.7 (8.0–9.4) |
| No psychiatric contact | 912 | 79,802 | 11.4 (10.7–12.2) | 43,532 | 8,220,266 | 5.3 (5.3–5.4) |
| Father’s psychiatric disorder‡ | | | | | | |
| Organic disorder | 37 | 1809 | 20.5 (14.8–28.2) | 241 | 16,951 | 14.2 (12.7–16.1) |
| Substance use disorder | 546 | 27,821 | 19.6 (18.1–21.3) | 2351 | 161,980 | 13.3 (12.7–13.9) |
| Schizophrenia or bipolar disorder | 28 | 1795 | 16.6 (16.0–22.6) | 242 | 22,889 | 10.6 (9.3–12.0) |
| Single and recurrent depressive disorder | 47 | 3038 | 15.5 (12.6–20.6) | 988 | 84,920 | 11.6 (10.9–12.4) |
| Neurotic, stress-related, and somatoform disorder | 85 | 5297 | 16.1 (13.0–19.9) | 1553 | 143,227 | 10.8 (10.3–11.4) |
| Personality disorder | 24 | 1569 | 15.3 (10.3–22.8) | 300 | 24,651 | 12.2 (10.9–13.6) |
| Behavioural and emotional disorders including hyperkinetic disorder | 25 | 1201 | 20.8 (14.1–30.8) | 435 | 28,281 | 15.4 (14.0–16.9) |
| Other mental disorders | 37 | 891 | 19.3 (11.9–30.7) | 334 | 35,542 | 9.4 (8.4–10.5) |
| No psychiatric contact | 905 | 70,419 | 12.9 (12.0–13.7) | 48,372 | 8,532,606 | 5.7 (5–6.5) |

Data are n, unless otherwise specified. *Do not add up to total in some cases because of rounding. †Mother’s and father’s specific psychiatric disorders were included as two time-dependent variables with mutually exclusive groups, and in order of hierarchy.
single and recurrent depressive disorder; neurotic, stress-related, and somatoform disorder; personality disorder; behavioural and emotional disorder; other mental disorders; and no psychiatric contact (see codes in appendix p 1). Thus, we defined a parent as having a psychiatric disorder from the first date of the specific diagnosis from 1969 onwards, but shifted to a category of another disorder from the date of receiving a psychiatric diagnosis higher in the hierarchy than the first one and onwards. The hierarchical covariate was used because of the long follow-up period for parental psychiatric disorders. We regarded the later received diagnoses to be the most influential to the offspring’s risk of psychiatric disorders unless the disorder was less severe than the previous one (according to the hierarchical ICD-10 system). Shifts to disorders higher in the hierarchy than first diagnoses were possible until the end of the study or censoring, whichever came first. Thus, for the main analyses we used two key covariates: maternal and paternal history of homelessness; and, for adjustment and two interaction analyses, the two psychiatric covariates (overall or hierarchical). We used both covariates to elaborate on the influence of parental psychiatric disorders on the association between parental homelessness and offspring’s risk of psychiatric disorders in two interaction analyses. The hierarchical covariate also has limitations as no clear cut can be made between the severity of the specific disorders and thus, we presented data using both covariates in the interaction analysis. For the interaction analyses, the comparison group was defined as parents with neither a homeless shelter contact during the study period, nor a psychiatric contact since 1969.

Permission to use the data was obtained from the Danish Data Protection Agency (2012-58-0004), the National Social Appeals Board, the National Health Data Authority, and the National Board of Health. No ethical permission was required for this study under Danish law.

Outcomes
The main outcome was any psychiatric disorder, which included substance use disorder during childhood and adolescence (with maximum age of 16 years because of the length of study period). We obtained this information from the Danish Psychiatric Central Research Register and the Danish National Patient Register, which was defined according to the ICD-10. Furthermore, the following 14 specific selected psychiatric diagnostic groups were used as secondary outcomes: substance use disorder, psychosis, affective disorder, anxiety and obsessive-compulsive disorder, eating disorder, mental retardation, developmental disorder, autism spectrum disorder, attention-deficit hyperactivity disorder, oppositional defiant disorder and conduct disorder, attachment disorder, tics and Tourette’s disorder, other developmental disorders, and a group of other mental disorders (appendix p 1).

Statistical analysis
The follow-up of the cohort began on Jan 1, 1999, the date of birth, or date of becoming a Danish citizen, whichever came last. Each cohort member was followed up until first psychiatric diagnosis or, in the 14 diagnosis-specific subanalyses, until the first diagnosis of that specific disorder, Dec 31, 2015, the date of death, or the date of emigration from Denmark, whichever came first.
We analysed the association between parental history of homelessness and risk of psychiatric disorders in the offspring by survival analysis using Poisson regression in SAS (version 9.4). This analysis provided incidence rate ratios (IRRs), which were estimated by log-likelihood estimation, and Wald 95% CIs were calculated.

To show the unadjusted associations with any child and adolescent psychiatric disorder, we present incidence (cases per 1000 person-years) for participants' characteristics, parental characteristics, and parental homelessness and parental psychiatric disorders before offsprings' birth. We used two regression models to calculate adjusted associations. Model 1 was adjusted for calendar year and the offsprings' age, sex, and country of origin (Denmark and other high-income countries versus low-income and middle-income countries). Model 2 was additionally adjusted for parental factors: mother’s and father’s age at offsprings’ birth (<25 years, 25–34 years, ≥35 years) and the hierarchical covariate of parental psychiatric disorders. Both models were used with the two different psychiatric outcomes in children and adolescents: any psychiatric disorder, or specific disorders or groups. In the subanalyses with 14 specific psychiatric disorders or groups as an outcome, we noted p values that were significant after Bonferroni correction.

We calculated cumulative incidence to show the probability of an individual having any psychiatric disorder during childhood and adolescence if their mother or father had a history of homelessness and a psychiatric disorder. Because these analyses are probabilities, it was necessary to restrict information on parental psychiatric disorder and homelessness to the time before the offspring’s birth.

We also examined the time of the parents’ first report of homelessness in relation to the time of the offspring’s birth (ie, whether it began before the year before birth, the year before birth, or from birth and onwards) and its relation to the offspring’s risk of any psychiatric disorder. For this analysis, we excluded information on parental homelessness from 1999 to 2000 to obtain a more truly incident homeless population, because 1999 was the first year of the database, so it might have included long-term homeless individuals who were initially registered rather than were newly homeless. We separated the analysis according to offsprings’ age (ie, younger than and from 5 years).

As a sensitivity analysis, we examined whether restriction of parental history of homelessness and psychiatric disorders to the time before the offspring’s birth would change the risk of any psychiatric disorder or the four most prevalent specific psychiatric disorders in the cohort. Because of our definition of homelessness is broad, we did a sensitivity analysis using a more narrow definition (at least three homeless shelter contacts). In this analysis, parents with a history of homelessness were regarded more severely homeless. To check for clustering of offsprings with the same mother, we restricted the

| Offspring with psychiatric disorders in childhood and adolescence | Model 1 IRR (95% CI)† | p value† | Model 2 IRR (95% CI)‡ | p value† |
|---------------------------------------------------------------|------------------------|---------|------------------------|---------|
| Any psychiatric disorder including substance use disorder (n=58 330) | – – | <0.0001 | – – | <0.0001 |
| Both parents homeless | 202 2.8 (2.4–3.2) | – | 1.6 (1.4–1.9) | – |
| Only mother homeless | 647 2.5 (2.3–2.7) | – | 1.6 (1.5–1.7) | – |
| Only father homeless | 865 2.3 (2.2–2.5) | – | 1.4 (1.3–1.5) | – |
| Neither parent homeless | 54 618 1 | – | 1 | – |
| Substance use disorder (n=944) | – – | <0.0001§ | – – | <0.0001§ |
| Both parents homeless | 5 3.7 (1.5–9.0) | – | 1.4 (0.6–3.4) | – |
| Only mother homeless | 36 6.9 (4.9–9.7) | – | 3.3 (2.3–4.7) | – |
| Only father homeless | 33 4.0 (2.8–5.6) | – | 1.7 (1.1–2.4) | – |
| Neither parent homeless | 870 1 | – | 1 | – |
| Psychosis (n=850) | – – | <0.0001§ | – – | 0.01 |
| Both parents homeless | 5 5.4 (2.7–1.9) | – | 2.9 (1.4–5.9) | – |
| Only mother homeless | 16 3.1 (1.9–5.0) | – | 1.8 (1.3–3.0) | – |
| Only father homeless | 13 1.6 (0.9–2.7) | – | 0.9 (0.5–1.5) | – |
| Neither parent homeless | 813 1 | – | 1 | – |
| Affective disorder (n=2264) | – – | <0.0001§ | – – | 0.053 |
| Both parents homeless | 5 1.6 (0.7–3.8) | – | 1.0 (0.4–2.3) | – |
| Only mother homeless | 21 1.6 (1.1–2.5) | – | 1.1 (0.7–1.7) | – |
| Only father homeless | 24 1.1 (0.8–1.7) | – | 0.8 (0.5–1.1) | – |
| Neither parent homeless | 2214 1 | – | 1 | – |
| Anxiety and OCD (n=16 752) | – – | <0.0001§ | – – | 0.00025 |
| Both parents homeless | 52 2.3 (1.7–3.0) | – | 1.2 (0.9–1.5) | – |
| Only mother homeless | 198 2.4 (2.0–2.7) | – | 1.3 (1.1–1.5) | – |
| Only father homeless | 265 2.1 (1.9–2.4) | – | 1.2 (1.1–1.4) | – |
| Neither parent homeless | 16 237 1 | – | 1 | – |
| Eating disorder (n=2275) | – – | 0.74 | – | 0.38 |
| Both parents homeless | 3 0.9 (0.3–2.7) | – | 0.7 (0.2–2.2) | – |
| Only mother homeless | 15 1.2 (0.7–2.0) | – | 1.1 (0.6–1.8) | – |
| Only father homeless | 15 0.8 (0.5–1.4) | – | 0.7 (0.4–1.1) | – |
| Neither parent homeless | 2242 1 | – | 1 | – |
| Mental retardation (n=5642) | – – | <0.0001§ | – – | 0.0001§ |
| Both parents homeless | 37 2.4 (2.4–4.6) | – | 2.1 (1.5–2.9) | – |
| Only mother homeless | 95 2.9 (2.3–3.5) | – | 1.9 (1.6–2.4) | – |
| Only father homeless | 119 2.9 (2.4–3.5) | – | 1.7 (1.4–2.1) | – |
| Neither parent homeless | 5391 1 | – | 1 | – |
| Developmental disorder (n=13 843) | – – | <0.0001§ | – – | 0.0001§ |
| Both parents homeless | 57 3.7 (2.9–4.8) | – | 2.2 (1.7–2.9) | – |
| Only mother homeless | 129 2.4 (2.0–2.8) | – | 1.5 (1.3–1.8) | – |
| Only father homeless | 186 2.4 (2.1–2.8) | – | 1.5 (1.3–1.8) | – |
| Neither parent homeless | 11 000 1 | – | 1 | – |
| Autism spectrum disorder (n=13 843) | – – | <0.0001§ | – – | 0.0001§ |
| Both parents homeless | 23 1.1 (0.7–1.7) | – | 0.8 (0.5–1.2) | – |
| Only mother homeless | 145 2.0 (1.7–2.4) | – | 1.6 (1.3–1.9) | – |
| Only father homeless | 176 1.8 (1.5–2.1) | – | 1.3 (1.1–1.5) | – |
| Neither parent homeless | 13 499 1 | – | 1 | – |

(Table 2 continues on next page)
Poisson regression analysis of mother’s and father’s history of homelessness and offspring’s risk of psychiatric disorder in childhood and adolescence (Continued from previous page)

| Attention-deficit hyperactivity disorder (n=29,005) | Model 1 IRR (95% CI)* | p value† | Model 2 IRR (95% CI)† | p value† |
|---|---|---|---|---|
| Both parents homeless | 97 | 4.0 (2.2–4.8) | <0.0001§ | 2.0 (1.6–2.4) | <0.0001§ |
| Only mother homeless | 289 | 3.2 (2.9–3.6) | 1.9 (1.6–2.3) | 1.5 (1.4–1.7) | 0.0207§ |
| Only father homeless | 275 | 2.9 (2.6–3.2) | 1.5 (1.4–1.7) | 1.5 (1.4–1.7) | 0.0207§ |
| Neither parent homeless | 18,244 | 1 | 1 | 1 | 0.3003§ |

| Oppositional defiant disorder (n=1847) | Model 1 IRR (95% CI)§ | p value‡ | Model 2 IRR (95% CI)‡ | p value‡ |
|---|---|---|---|---|
| Both parents homeless | 7 | 2.8 (1.3–5.9) | 1.1 (0.5–2.3) | 0.0042 |
| Only mother homeless | 28 | 3.1 (2.2–4.6) | 1.5 (1.0–2.2) | 0.0042 |
| Only father homeless | 50 | 3.9 (3.0–5.3) | 1.7 (1.3–2.3) | 0.0042 |
| Neither parent homeless | 1762 | 1 | 1 | 1 | 0.3003§ |

| Attachment disorder (n=15,339) | Model 1 IRR (95% CI)* | p value† | Model 2 IRR (95% CI)† | p value† |
|---|---|---|---|---|
| Both parents homeless | 54 | 32.5 (24.6–42.9) | 6.1 (4.6–8.1) | 0.0003§ |
| Only mother homeless | 98 | 16.0 (13.0–19.7) | 4.2 (3.4–5.2) | 0.0003§ |
| Only father homeless | 89 | 10.2 (8.2–12.7) | 2.5 (2.0–3.2) | 0.0003§ |
| Neither parent homeless | 1298 | 1 | 1 | 1 | 0.3003§ |

| Tics and Tourette’s disorder (n=4443) | Model 1 IRR (95% CI)* | p value† | Model 2 IRR (95% CI)† | p value† |
|---|---|---|---|---|
| Both parents homeless | 11 | 1.8 (1.0–3.3) | 1.2 (0.7–2.2) | 0.0003§ |
| Only mother homeless | 50 | 2.3 (1.7–3.0) | 1.6 (1.2–2.2) | 0.0003§ |
| Only father homeless | 65 | 2.1 (1.6–2.7) | 1.4 (1.1–1.8) | 0.0003§ |
| Neither parent homeless | 437 | 1 | 1 | 1 | 0.3003§ |

| Other development disorders including enuresis, encopresis (n=7736) | Model 1 IRR (95% CI)* | p value† | Model 2 IRR (95% CI)† | p value† |
|---|---|---|---|---|
| Both parents homeless | 41 | 3.8 (2.8–5.2) | 2.3 (1.7–3.1) | 0.0003§ |
| Only mother homeless | 76 | 2.1 (1.6–2.6) | 1.3 (1.1–1.7) | 0.0003§ |
| Only father homeless | 102 | 2.1 (1.7–2.5) | 1.3 (1.1–1.6) | 0.0003§ |
| Neither parent homeless | 7497 | 1 | 1 | 1 | 0.3003§ |

| Other mental disorders (n=27,84) | Model 1 IRR (95% CI)* | p value† | Model 2 IRR (95% CI)† | p value† |
|---|---|---|---|---|
| Both parents homeless | 5 | 2.2 (0.9–5.3) | 1.4 (0.6–3.4) | 0.28 |
| Only mother homeless | 14 | 1.7 (1.0–2.9) | 1.1 (0.7–2.0) | 0.28 |
| Only father homeless | 26 | 2.3 (1.6–3.4) | 1.5 (1.1–2.2) | 0.28 |
| Neither parent homeless | 1729 | 1 | 1 | 1 | 0.3003§ |

Data are n, unless otherwise specified. A history of homelessness was defined as a time-dependent variable with onset on the date of first homeless shelter contact during the study period and onwards. IRR-incidence rate ratio. *Model 1 was adjusted for calendar time, offspring’s age, offspring’s sex, and offspring’s country of origin. †Overall p value for the group comparison. ‡Model 2 was adjusted for factors included in model 1 as well as parental age at offspring’s birth and parental psychiatric disorders included as two time-dependent variables with mutually exclusive groups, and in order of hierarchy. §Statistically significant after Bonferroni correction.

Table 2: Poisson regression analysis of mother’s and father’s history of homelessness and offspring’s risk of psychiatric disorder

Articles

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

Results
From Jan 1, 1999, to Dec 31, 2015, 1072,882 individuals aged 0–16 years were included in the study and followed up for 9,164,928 person-years. 64,928 (6%) of 1,137,810 children and adolescents had an unknown mother or father, and were therefore excluded from the study. 549,972 (51%) of 1,072,882 individuals were boys. In all, 17,238 (2%) offspring had either one or two parents with a history of homelessness during the study period. Specific numbers of offspring who had a parent with a history of homelessness and the proportion of the parents who had a psychiatric disorder are reported in the appendix (p 2). 56,330 (5%) children and adolescents were diagnosed with any psychiatric disorder during the study period (table 1).

Characteristics of individuals in the cohort and their parents by parental history of homelessness are in table 1. The incidence of any psychiatric disorder was 15·1 cases per 1000 person-years (95% CI 14·4–15·8) in offspring with at least one parent having a history of homelessness compared with 6·0 cases per 1000 person-years (95% CI 6·0–6·1) in those whose parents had no such history. Independent of characteristics, an increased risk of any psychiatric disorder was found in the offspring of parents with a history of homelessness. Corresponding figures when parental history of homelessness and psychiatric disorders were restricted to the time before the offspring’s birth are provided in the appendix (p 3).

Especially in the youngest age groups, the offspring of parents with a history of homelessness had higher IRRs of any psychiatric disorder than those whose parents had no history of homelessness (figure 1). For children aged 2–4 years who had a mother with a history of homelessness, the IRR was 2·3·9 (95% CI 1·9–2·9) after adjustment for parental psychiatric disorders.

For any psychiatric disorder, the IRR was 2·5 (95% CI 2·3–2·7) for offspring with only a mother having a history of homelessness compared with those whose parents had no such history (table 2). Similar IRRs were found if both parents or only the father had a history of homelessness, although the risk was lower if only the father had a history of homelessness than if only the mother had a history of homelessness (in fully adjusted analyses). We identified a higher risk for most of the specific disorders in offspring having one or two parents with a history of homelessness (IRR 32·5 [95% CI 24·6–42·9]). Parental history of homelessness was also associated with high risk of substance use disorders in offspring, especially in those whose mothers had a history of homelessness (6·9 [4·9–9·7]). Besides these two outcomes, the risk of psychosis, and attention-deficit hyperactivity disorder in the fully adjusted model only, were also found to be higher when only the mother had a history of homelessness than

cohort to the mother’s first-born offspring in a third sensitivity analysis.
when only the father had such a history. After adjustment for parental psychiatric disorders, an increased risk associated with parental history of homelessness was found for most of the psychiatric outcomes, but not affective disorders and eating disorders (estimates for parental psychiatric disorders in the fully adjusted model are reported in the appendix pp 4–9).

The IRRs of any psychiatric disorder in the offspring of mothers or fathers with a history of homelessness in combination with any and specific psychiatric disorders are shown in table 3. Offspring with a mother who had both a history of homelessness and any psychiatric disorder had a higher IRR of 2.8 (95% CI 2.5–3.0) than those whose mothers neither had a history of homelessness, nor a psychiatric disorder. The corresponding IRR for fathers was 2.0 (95% CI 1.8–2.1). A history of maternal homelessness was associated with increased risk of any psychiatric disorder in offspring, both in those whose mothers had any psychiatric disorder (and the specific disorders; neurotic, stress-related, or somatoform disorders; or personality disorders) and in those whose mothers had no psychiatric contact, compared with offspring whose mothers had no history of homelessness (table 3). The offspring of fathers with a substance use disorder and no psychiatric contact also had higher risk of any psychiatric disorder if the father had a history of homelessness compared with those whose fathers had no such history.

Figure 2 shows the cumulative psychiatric morbidity in offspring from birth to 16 years of age according to mother’s and father’s history of homelessness and any psychiatric disorder prior to the offspring’s birth. By the age of 15 years, the highest proportion of offspring with any psychiatric disorder were found in those with a mother who had both a history of homelessness and any psychiatric disorder (35.9% [27.1–44.8]; appendix p 10). Similar risks of having any psychiatric disorder were found in offspring when the first parental homeless shelter contact took place before 1 year before birth, in the year before birth, and after birth (appendix p 11).

Our three sensitivity analyses showed no considerable changes from the main analyses (table 2; restriction of parental covariates to the time before the offspring’s birth, restriction of the homeless definition to at least three homeless shelter contacts [only higher estimates in model 1], and restriction of the cohort to include mother’s first born child only; appendix pp 12–17).

Discussion
This Danish register-based cohort study is the first, to our knowledge, to show an association between parental history of homelessness and the offspring’s risk of psychiatric disorders. The highest risks were found for attachment disorder and substance use disorder, and risk in offspring whose mother had a history of homelessness was higher than in those with a father who had such a history. Offspring had a particularly high risk of being diagnosed with a psychiatric disorder in early childhood if a parent had a history of homelessness. By the age of 15 years, around a third of the offspring who had a mother

| Mother or father with a history of homelessness* | Mother or father without a history of homelessness* |
|-----------------------------------------------|---------------------------------------------------|
| Offspring with any psychiatric disorder in childhood and adolescence | Offspring with any psychiatric disorder in childhood and adolescence |
| Model 2 IRR (95% CI)† | Model 2 IRR (95% CI)† |
| No psychiatric contact | 3.7 | 1.7 (1.5–1.9) | 4.066 | 1.1 (ref) |
| Primary outcome: any psychiatric disorder§ | 4.7 | 2.8 (2.5–3.0) | 11.4 | 2.1 (2.1–2.2) | <0.0001 |
| Secondary outcome: specific psychiatric disorders‡ | | | | |
| Organic disorder | 1.9 | 4.4 (2.8–6.9) | 2.2 | 2.6 (2.3–2.9) |
| Substance use disorder | 2.1 | 2.6 (2.2–2.9) | 1.9 | 2.2 (2.2–2.3) |
| Schizophrenia or bipolar disorder | 2.3 | 3.4 (2.3–5.1) | 5.3 | 2.7 (2.4–2.9) |
| Single and recurrent depressive disorder | 5.6 | 2.3 (1.8–3.0) | 3.2 | 2.2 (2.2–2.3) |
| Neurotic, stress-related, and somatoform disorder | 1.1 | 3.1 (2.6–3.8) | 3.7 | 2.0 (1.9–2.0) |
| Personality disorder | 0.3 | 3.9 (2.7–5.6) | 6.4 | 2.2 (2.0–2.4) |
| Behavioural and emotional disorder including hyperkinetic disorder | 1.0 | 2.3 (1.3–4.3) | 3.9 | 2.8 (2.5–3.1) |
| Other psychiatric disorders | 1.1 | 2.4 (1.3–4.4) | 6.4 | 1.5 (1.4–1.6) |
| Father’s psychiatric disorder |
| No psychiatric contact | 4.2 | 1.7 (1.5–1.9) | 48.8 | 1.1 (ref) |
| Primary outcome: any psychiatric disorder§ | 6.4 | 2.0 (1.8–2.1) | 6.4 | 1.7 (1.6–1.7) | <0.0001 |
| Secondary outcome: specific psychiatric disorders‡ | | | | |
| Organic disorder | 0.3 | 2.3 (1.6–3.3) | 2.4 | 1.9 (1.7–2.1) |
| Substance use disorder | 4.6 | 2.0 (1.8–2.2) | 2.2 | 1.7 (1.6–1.8) |
| Schizophrenia or bipolar disorder | 1.6 | 1.8 (1.1–2.9) | 2.5 | 1.6 (1.4–1.8) |
| Single and recurrent depressive disorder | 3.0 | 1.8 (1.2–2.5) | 1.0 | 1.6 (1.5–1.7) |
| Neurotic, stress-related, and somatoform disorder | 5.5 | 1.8 (1.3–2.4) | 3.5 | 1.6 (1.5–1.6) |
| Personality disorder | 1.7 | 2.0 (1.2–3.2) | 3.0 | 1.8 (1.6–2.0) |
| Behavioural and emotional disorder including hyperkinetic disorder | 2.1 | 2.9 (1.9–4.4) | 4.3 | 2.2 (2.0–2.4) |
| Other psychiatric disorders | 10.0 | 2.2 (1.2–4.0) | 3.4 | 1.4 (1.2–1.5) |

Data are n, unless otherwise specified. IRR=incidence rate ratio. *A history of homelessness was defined as a time-dependent variable with onset on the date of first homeless shelter contact since 1999 and onwards; no history of homelessness was defined as having no homeless shelter contact during the study period. †This model was mutually adjusted for mother’s or father’s history of homelessness and psychiatric disorder, and additionally adjusted for calendar time, offspring’s age, offspring’s sex, offspring’s country of origin, and parental age at offspring’s birth, and the reference group was mothers or fathers who had no history of homelessness and no psychiatric contact. ‡Overall p value for the group comparison. §Any psychiatric disorder received during a hospital contact was defined as a time-dependent variable with onset on first diagnosis since 1969 and onwards. ¶Specific maternal or paternal psychiatric disorders were included as two time-dependent variables with mutually exclusive groups, and in order of hierarchy.

Table 3: Interaction analysis of mother’s and father’s history of homelessness and psychiatric disorders and offspring’s risk of any psychiatric disorder including substance use disorder during childhood and adolescence, 1999–2015
with both a history of homelessness and a psychiatric disorder had received a psychiatric diagnosis themselves. These results are important for helping to understand the development of psychiatric problems in children and adolescents growing up under difficult circumstances. Several factors might explain the link between parental homelessness and the increased risk of psychiatric disorders in offspring. Previous results have underlined that homelessness makes parenting difficult, partly due to an absence of positive parenting role models, and partly due to high rates of chronic medical conditions, untreated emotional and behavioural disorders, unstable living conditions, and histories of adverse life experiences. Previous studies have suggested that children living in homeless families often have poorer psychiatric outcomes than children from low-income, housed families. One explanation could be high rates of undiagnosed and untreated psychiatric disorders in homeless parents or an absence of adjustment for family history of psychiatric morbidity in this research. Pregnancy and disrupted early attachment have been suggested to be important in the development of behavioural problems in offspring. Thus, we had expected that the association would be stronger when the parent’s first homeless shelter contact took place during pregnancy or after the child’s birth rather than before pregnancy. However, our results suggested a consistently increased risk of psychiatric disorders in offspring independent of the time of first homeless shelter contact, perhaps suggesting that any period of homelessness, even before pregnancy, is a marker of long-lasting instability of the home environment. Previous studies have suggested that substance use disorders, anxiety, and depression in mothers can influence the offspring’s risk of psychiatric problems. Our results confirmed that these maternal psychiatric disorders were associated with an increased risk of offspring having any psychiatric disorder, and we also found an increased risk for the offspring of mothers with all the other psychiatric disorders or groups. However, for mothers with neurotic, stress-related, and somatoform disorders, personality disorders, and organic disorders, the homelessness experience increased the risk further. We also found that the probability of being diagnosed with a psychiatric disorder during childhood and adolescence was highest for those with a mother who had both a history of homelessness and a psychiatric disorder before the offspring’s birth. This finding might indicate that high exposure to genetic and environmental factors is associated with highest risk of psychiatric problems in offspring. However, greater surveillance and detection of health problems in families with vulnerable parents might also be a factor, especially those with psychiatric disorders. Our findings of the high risk of an individual being diagnosed with a psychiatric disorder at an early age could also support this explanation of greater
surveillance of socially marginalised families. However, it could also be the other way around: vulnerable families can be overlooked and underdiagnosed. Poverty could also explain our findings because it is also associated with excess risk of psychiatric problems in children.\(^1,2\) However, children of formerly homeless mothers are at elevated risk of several psychiatric problems even when compared with children of low-income, housed mothers with preclinical levels of problem behaviour.\(^3\)

We found associations between parental history of homelessness and an increased risk of specific psychiatric disorders in offspring. These associations are in line with previous studies of homeless children and adolescents, which showed high levels of developmental delays, conduct disorder, depression, anxiety, psychosis, mania, post-traumatic stress disorder, antisocial behaviour, attention-deficit hyperactivity disorder, and substance use disorder.\(^4,5,6,7,8\) Furthermore, we also found associations with autism spectrum disorders, mental retardation, tics and Tourette’s disorders, and attachment disorder. This study is different from most previous studies because the majority of children in our sample were not expected to experience homelessness themselves, but were more likely to experience parent-related problems or separations from primary care givers because of their parents’ homelessness. Our findings support the notion that socially marginalised families should receive special support with regard to prevention and early intervention of psychiatric problems in offspring, especially attachment disorder, which has been shown to be costly for the child, family, and society.\(^9\)

This study has several strengths. First, the study was based on a nationwide and almost complete cohort of children and adolescents with accurate linkage to their parents’ use of public homeless shelters. Our cohort is likely to be generalisable to children younger than 16 years in other high-income countries with well-developed social support systems. Second, our study design is unique because of its prospectively collected data with long and individual lengths of follow-up. Third, data on death, emigration, and diagnoses from hospital contacts were complete, and we were able to study specific psychiatric outcomes.

Our study also had limitations. We only had access to information about homeless shelter contacts, and thus cannot know whether parents defined as having no history of homelessness had been or were currently homeless, but not using the public shelters. However, we expect the number of parents who were homeless, but not using public shelters, to be small because most homeless people in Denmark use the shelters at some point during a longer follow-up period.\(^9\) Homeless shelters in Denmark are open only to adults, but, some of the children might have experienced unstable living conditions outside of shelters. Women with children would generally not be admitted to a homeless shelter in Denmark. They would instead be offered other emergency accommodation (eg, crisis centres for women which are covered by the 109 act in the Consolidation Act on Social Services).\(^9\) Also, our definition of parental homelessness is likely to capture a range of adverse life events, including adverse childhood experiences, which can affect the risk of homelessness and the ability to care for offspring. Such factors might explain some of the increased risk of psychiatric morbidity in offspring. However, parental homelessness should be seen as an indicator of susceptibility to psychiatric illness in offspring. One study\(^10\) found parental distress and recent adverse life events to be the primary predictors of the children’s behaviour problems, rather than housing. We did not have information on the period after the first homeless shelter contact. Different scenarios might have taken place: some people sleep rough on the streets, others stay temporarily at the homes of friends or families, and others are offered a place to live by the municipality. We only had information from the Homeless Register since 1999 and cannot know whether people had histories of homelessness in previous years. Information on psychiatric disorders was obtained from both psychiatric and somatic hospital and outpatient services. Diagnoses from the somatic wards might be less precise; however, patients in Denmark are most often diagnosed after consultation with a psychiatric specialist. A further limitation is the possibility of residual confounding. We did not have information on other factors such as undiagnosed disorders, parenting,\(^11\) adverse life-events,\(^12\) actual time spent with the child, and parental emotional status.\(^13\) Lastly, we did not include children with no linkage to parents, who might constitute a special subgroup with a different risk profile.

In conclusion, we showed an association between mother’s and father’s history of homelessness and offspring’s risk of any and specific psychiatric disorders during childhood and adolescence even after adjustment for parental psychiatric disorders. Risk was especially high for attachment and substance use disorder. These findings are relevant from a public health and policy perspective because they point to a need for improvement in the support of socially marginalised families. Public services could play an important role in providing the help these families need to reduce or even prevent the development of child and adolescent psychiatric problems. Moreover, research into and increased focus on the prevention of parental homelessness in high-income countries might also reduce the psychiatric morbidity in offspring.

**Contributors**

SFN obtained the funding and acquired the data. SFN did the literature search. All authors designed the study. SFN wrote the protocol with supervision from TML, CH, AT, and MN. SFN constructed the database and did all the statistical analyses with supervision from TML, CH, AT, and MN. All authors analysed and interpreted the data. SFN drafted the manuscript, and TML, CH, AT, and MN revised the manuscript. All authors approved the final version.

**Declaration of interests**

We declare no competing interests.
Acknowledgments
The study was funded by the University of Copenhagen, Department of Clinical Medicine, and The Lundbeck Foundation Initiative for Integrated Psychiatric Research (iPSYCH).

References
1 The Lancet. The health inequalities and ill-health of children in the UK. Lancet 2017; 389: 477.
2 Royal College of Paediatrics and Child Health. State of child health report 2017: London: Royal College of Paediatrics and Child Health, 2017.
3 Schuster MA, Fuentes-Afflick E. Caring for children by supporting parents. N Engl J Med 2017; 376: 410–13.
4 Newman L, Judd F, Olsson CA, et al. Early origins of mental disorder—risk factors in the perinatal and infant period. BMC Psychiatry 2016; 16: 170.
5 Nielsen SF, Hjortrup CR, Erlangsen A, Nordentoft M. Psychiatric disorders and mortality among people in homeless shelters in Denmark: a nationwide register-based cohort study. Lancet 2013; 377: 2205–14.
6 Fazel S, Geddes JR, Kusul M. The health of homeless people in high-income countries: descriptive epidemiology, health consequences, and clinical and policy recommendations. Lancet 2014; 384: 1529–40.
7 Bassuk EL, Richard MK, Tertsvadze A. The prevalence of mental illness in homeless children: a systematic review and meta-analysis. J Am Acad Child Adolesc Psychiatry 2015; 54: 86–96.
8 Paquette K, Bassuk EL. Parenting and homelessness: overview and introduction to the special section. Am J Orthopsychiatry 2009; 79: 292–98.
9 Lee SS, August GJ, Gewirtz AH, Klimes-Dougan B, Bloomquist ML, Realmuto GM. Identifying unmet mental health needs in children of formerly homeless mothers living in a supportive housing community sector of care. J Abnorm Child Psychol 2010; 38: 621–32.
10 Medlow S, Klineberg E, Steinbeck K. The health diagnoses of homeless adolescents: a systematic review of the literature. J Adolesc 2014; 37: 531–42.
11 Buckner JC. Understanding the impact of homelessness on children: challenges and future research directions. Am Behav Sci 2008; 51: 721–36.
12 Buckner JC, Bassuk EL, Weinreb LF, Brooks MG. Homelessness and its relation to the mental health and behavior of low-income school-age children. Dev Psychol 1999; 35: 246–57.
13 Bassuk EL, Weinreb LF, Dawson R, Perloff JN, Buckner JC. Determinants of behavior in homeless and low-income housed preschool children. Pediatrics 1997; 100: 92–100.
14 Schenckart J, Mohar J, Klein TP, Lowe CB, Hartmann AE. Homelessness and child functioning in the context of risk and protective factors moderating child outcomes. J Clin Child Psychol 1995; 24: 320–31.
15 Garcia CC, Buckner JC, Brooks MG, Weinreb LF, Bassuk EL. The developmental status and adaptive behavior of homeless and low-income housed infants and toddlers. Am J Public Health 1998; 88: 1371–74.
16 Pedersen CB, Gotsche H, Moller JO, Mortensen PB. The Danish Civil Registration System. A cohort of eight million persons. Dan Med Bull 2006; 53: 441–49.
17 The Danish Ministry of Social Affairs. Consolidation Act on Social Services. Sept 8, 2015. http://www.english.sm.dk/media/14900/consolidation-act-on-social-services.pdf (accessed Oct 31, 2017).
18 Mors O, Pertot GP, Mortensen PB. The Danish psychiatric central research register. Scand J Public Health 2011; 39: 54–57.
19 Lynge E, Søndergaard JL, Rebolj M. The Danish National Patient Register. Scand J Public Health 2011; 39: 30–33.
20 WHO. The ICD-10 classification of mental and behavioural disorders. Clinical descriptions and diagnostic guidelines. Geneva: World Health Organization, 1992.
21 WHO. Manual of the International Classification of Diseases (ICD-8). Geneva: World Health Organization, 1967.
22 Perlman S, Cowan B, Gewirtz A, Haskett M, Stokes L. Promoting positive parenting in the context of homelessness. Am J Orthopsychiatry 2012; 82: 402–12.
23 David DH, Gelberg L, Suchman NE. Implications of homelessness for parenting young children: a preliminary review from a developmental attachment perspective. Infant Ment Health J 2012; 33: 1–9.
24 Grant R, Grady D, Goldenith G, Shapiro A, Redlener I. Twenty-five years of child and family homelessness: where are we now? Am J Public Health 2013; 103 (suppl 2): e1–10.
25 Bassuk EL, Beardslee WR. Depression in homeless mothers: addressing an unrecognized public health issue. Am J Orthopsychiatry 2014; 84: 73–81.
26 Lee S, Castella A, Freidin J, et al. Mental health care on the streets: an integrated approach. Aust N Z J Psychiatry 2010; 44: 505–12.
27 Hodgson KJ, Shelton KH, van den Bree MB, Los FJ. Psychopathology in young people experiencing homelessness: a systematic review. Am J Public Health 2013; 103: e24–37.
28 Masten AS, Milotis D, Graham-Bermann SA, Ramirez M, Neemann J. Children in homeless families: risks to mental health and development. J Consult Clin Psychol 1993; 61: 335–43.
29 Rees GA. Thinking about children’s attachments. Arch Dis Child 2005; 90: 1058–65.
30 Benjaminis L, Andrade SB. Testing a typology of homelessness across welfare regimes: shelter use in Denmark and the USA. Hou Stud 2015; 30: 858–76.