Adverse childhood experiences among children of parents who are refugees affected by trauma in Denmark: a register-based cohort study

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Summary

Background Children in families who are refugees might experience more adversities than their peers. Adverse childhood experiences (ACEs) are well known risk factors for poorer adulthood health and adjustment. The risk of ACEs for children with a parent who is a refugee affected by trauma is unknown. We aimed to estimate the hazard of individual and cumulative ACEs using a unique sample of children with parents who are refugees affected by and seeking treatment for trauma and population level data.

Methods This was a register-based cohort study carried out in Denmark. All children aged 0–15 years, residing in Denmark between Jan 1, 1990, and Dec 31, 2016, were followed up from birth or migration into the country to their 15th birthday. We linked data from the Danish Civil Registration System, the Danish National Patient Register, the Danish Psychiatric Central Research Register, the Employment Classification Module, the Register of Causes of Death, and the Income Statistics Register to investigate ten ACE categories (parental: natural and unnatural death, serious mental illness, substance use disorder, somatic illness, and disability; child: residential instability, family disruption, poverty, and stressors) and the cumulative number of ACE categories for children with a parent from a refugee-sending country and children with a parent who is a refugee in treatment for trauma. The main outcome was the hazard ratio (HR) of the individual and cumulative ACEs among children with a parent from a refugee-sending country and children with a parent who is a refugee affected by trauma, compared with the general population of children in Denmark, both adjusted and unadjusted for parental country of origin.

Findings 2 688 794 children were included in the study, 252 310 of whom had parents from refugee-sending countries. 11 603 children had parents affected by trauma and seeking treatment, of whom 1163 (10%) migrated to Denmark before their second birthday and 10 440 (90%) were born in Denmark. Compared with the general population of children in Denmark, the hazard for most ACEs was significantly higher for both children with parents from a refugee-sending country and children with parents who are refugees affected by trauma. For children with a parent from a refugee-sending country, the highest HR was related to the child living in relative poverty for 3 years (3·62 [95% CI 3·52–3·73]). After adjusting for parental country of origin, the hazards for five ACEs were significantly greater for children of parents who are refugees affected by trauma compared with the remaining children of parents from the same countries. The highest HR for this child group was for parental serious mental illness (1·98 [1·85–2·12]). The hazard for experiencing multiple ACEs was significantly higher for both child groups compared with the general population.

Interpretation Our findings suggest that children with parents from refugee-sending countries have a higher rate of several ACEs compared with the general population. Furthermore, having a parent who is a refugee affected by trauma and seeking treatment seems to be an independent risk factor for poorer health and adjustment in adulthood. This study informs decision makers and caregivers that there might be much added value in addressing needs within the whole family, as opposed to only attending to the parent who is seeking treatment.

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Introduction

Childhood and adolescence are formative years that can have a lasting effect across the life course.[1] For children growing up in families who are refugees, the burden of adversity and stress might be profound. Many families who have fled war and persecution manage to create safe environments for their children. However, for the most vulnerable families with parents who are refugees affected by trauma, the cohesion and wellbeing of the family can be severely challenged.[2,3] Unfortunately, traumatic experiences have ramifications across generations.[4] The vulnerability experienced by parents who are refugees affected by trauma could increase their children's risk of distressing experiences, and have

Research in context

Evidence before this study

We searched PubMed, Cinahl, Embase, and psychInfo for original research articles and systematic reviews published in English from inception until Feb 2, 2022, using variations and combinations of the terms ["refugee offspring" OR "children of refugees" OR "refugee children"] AND ["adverse childhood experiences" OR "adversity" OR "stressor" OR "resettlement" OR "early life adversity"]. Most of the screened material pertaining to adverse childhood experiences were original research articles or systematic reviews of adversity in the general population. Studies investigating outcomes in children with a refugee background typically focused on a single domain outcome, such as psychological morbidity. Evidence suggests that parental trauma history and post-traumatic stress disorder in the refugee population is associated with adverse behavioural and emotional outcomes, and poorer school outcomes in children. Questionnaire data were a frequent source of information on traumatic or stressful events before, during, and after the migration journey in the reviewed articles. Here, the reviewed articles showed that families who are refugees, including children, are exposed to a range of stressors, spanning individual, family, and community stressors.

Added value of this study

By using the population registers, we created a comprehensive overview of adversities faced by children of parents from refugee-sending countries and parents who are refugees affected by trauma and seeking treatment. This study captures more of the burden of the collective stressors in childhood and adolescence, without having to rely on self-reported data. Moreover, the combination of register data and clinical information on a group of parents who are refugees affected by trauma enabled us to follow up the population of interest over a longer time span than most studies investigating outcomes in this group. To our knowledge, this is the first study to give an overview of several types of stressors during childhood and adolescence for this group of children with parents who are refugees affected by trauma.

Implications of all the available evidence

Studies focusing on childhood and adolescence are important as they indicate circumstances important to later life wellbeing that might be modifiable in the earlier stages of life, and thus point to possible future interventions. The results of this study suggest that there might be an unmet need among children of refugees affected by trauma, and thus a potential for improving their health over the life-course through early interventions. The study might inform decision makers and caregivers providing treatment for this group of parents who are refugees affected by trauma that there might be much added value in identifying and addressing needs within the whole family, rather than attending only to the parent seeking treatment. Combining the results of studies using self-reported questionnaire data together with register-based indicators of adverse childhood experiences provides not only persuasive evidence of the effects of trauma in families who are refugees but also points to clearly identifiable and therefore actionable risk factors for caregivers and decision makers.

long-lasting implications into adulthood.[5,6] Early detection and interventions targeting childhood adversities have great potential to improve the health and wellbeing of children in general.[7] Understanding what vulnerabilities children of parents who are refugees affected by trauma are exposed to could help direct preventive efforts to break the cycle of transmission.[8,9]

Adverse childhood experience (ACE) is a broad concept, often defined as a severe environmental event or a series of events that might affect the child over time.[7,10] Around 40–50% of the general population encounter at least one ACE during childhood.[1,11,12] Although the amount of distress this causes depends on the context, the widespread nature makes the burden of ACEs a public health concern because ACEs have been shown to negatively affect later life.[7,13] Several studies have documented that adversities such as household substance misuse, household mental illness, family members with convictions, child abuse, financial issues, parental disability, parental death, parental separation, and parental divorce, among others, have a clear link to child distress[1] and a child's risk of unipolar depression,[12] anxiety, psychotic disorders, attention deficit hyperactivity disorder,[11] and suicide.[14] In addition to the possible mental health consequences of ACEs, studies have found an association between early adversities and physical inactivity, diabetes, smoking, poor self-rated health, cancer, heart disease, respiratory disease, drug and alcohol misuse, and violence, among other outcomes.[1] ACEs are also associated with poorer socioeconomic outcomes, such as higher probability of dropping out of school, lower income,[15] being unemployed, or living in relative poverty in adulthood.[16] The accumulation of adversities is particularly concerning because individuals who experience four or more ACEs seem to be at higher risk of negative outcomes than those who experience no ACEs.[1,17]

In families who are refugees where one or both parents have experienced torture or war, children might be at high risk of experiencing several ACEs. In particular, parents who are refugees affected by trauma and have mental or physical health issues might be less able to provide emotional or material support for their children.[6] Parental trauma has been linked to harsh parenting style as well as being a risk factor for family-related violence and child abuse.[8,18] In addition to the mental health burden of trauma-affected refugee populations, post-migratory stressors[19] can also be a driver of ACEs in their

children.[2,5,20] Increased focus is directed towards the negative effect of postmigration living difficulties, such as economic hardship, in sustaining refugee trauma over time.[20,21] Such stressors might be part of the underlying mechanisms driving transmission of trauma across generations, possibly intensifying when parents are affected by trauma.[3,19,20]

The aim of this study was to ascertain whether children of migrants from refugee-sending countries (specific countries are listed in the Exposures section of the Methods; information on the legal status of this group is not available and individuals might have refugee status or a different legal status) and children of parents who are refugees affected by trauma and seeking treatment had an increased rate of individual and cumulative ACEs, and whether this increased rate persisted after adjusting for maternal and paternal country or region of origin. Because both groups typically migrate from low-resource settings, and many will have a refugee background, we hypothesised that both children of parents from refugee-sending countries and children of parents who are refugees affected by trauma would experience more adversity compared with the general population.

Methods

Study design and participants

This register-based cohort study used Danish population register data, for which the central pillar is the Civil Registration System (CRS). The CRS contains a unique personal identifier for each individual residing in Denmark after April 2, 1968. This identifier was used to link different databases as well as linking parents and children, and provided information on the study participants' sex, date and place of birth, vital status, and dates of migration to and from Denmark. All children aged 0–15 years, residing in Denmark between Jan 1, 1990, and Dec 31, 2016, and with a personal identifier, were included in the study. We excluded children who migrated into Denmark after their second birthday and children with no maternal identifier to ensure sufficient information on the children in the study.

First, we investigated ACEs in children in a group of migrants from refugee-sending countries residing in Denmark. Second, we investigated ACEs in a group of children with parents who are refugees affected by trauma and seeking treatment, who constitute a subgroup of the children with parents from refugee-sending countries.

The Danish Patient Safety Authority approved the identification of the group of parents who had been affected by trauma. Statistics Denmark approved and guaranteed secured access to register data. The personal identifiers for the study population were encrypted and only aggregated data were extracted from the secured servers.

Approval by the Ethics Committee and written informed consent is not required for register-based projects (act number 1338 of Sept 1, 2020, section 10 on research ethics for administration of health scientific research projects and health data scientific research projects). All data were de-identified and not recognisable at an individual level. The protocol is available in the appendix (p 19).

See Online for appendix

Outcomes

Ten ACE categories were included in the study, mainly covering household stressors. These categories were chosen on the basis of availability from the Danish registers and of ACEs showing an association with poorer mental health, physical health, and socioeconomic outcomes in later life.[1] These ten ACE categories were parental natural and unnatural death, residential instability, parental serious mental illness and substance use disorder, family disruption, parental somatic illness, parental disability, relative poverty, and childhood stressors.

For parental mental and physical health-related factors, information on parental death came from the cause of death register and was separated into natural and unnatural causes.[22] Parental psychopathology was defined as serious mental illness and substance use disorder and this information came from the Danish National Patient Register (DNPR) and the Danish Psychiatric Central Research Register (DPCRR).[23] For the three variables (parental death, parental serious mental illness, and parental substance use disorder), the outcome was registered if at least one parent experienced the event in question. The parental serious mental illness diagnosis was included because of research showing a high vulnerability among children whose parents were diagnosed with a serious mental illness[24,25] and was defined as follows; schizophrenia (International Classification of Diseases [ICD]-8: 295 [excluding 295·79]; ICD-10: F20), bipolar disorder (ICD-8: 296·19, 296·39, and 298·19; ICD-10: F30, F31, F34·0, and F38·0), and unipolar depression (ICD-8: 296·09, 296·29, 296·89, 296·99, 298·09, 300·49, and 301·19; ICD-10: F32, F33, F34 [excluding F34·0], F38 [excluding F38·0], and F39). Information on parental somatic illness was obtained from the DNPR and defined according to the Charlson Comorbidity Index as the presence of at least one Charlson disease for both parents. Diagnoses in the DPCRR and DNPR are registered as ICD-10 codes from 1994 and ICD-8 codes before 1994. Parental disability was registered as an outcome if at least one parent received disability pension, registered in the Employment Classification Module.[26]

For childhood living conditions, information on residential instability and family disruption came from the CRS. Residential instability was defined as change of address between municipalities twice before the child's sixth birthday. If the child did not share the same address as both parents during the first 6 years, this was defined as family disruption.[27] Two measures of relative poverty were defined as the child having lived either 1 or 3 years

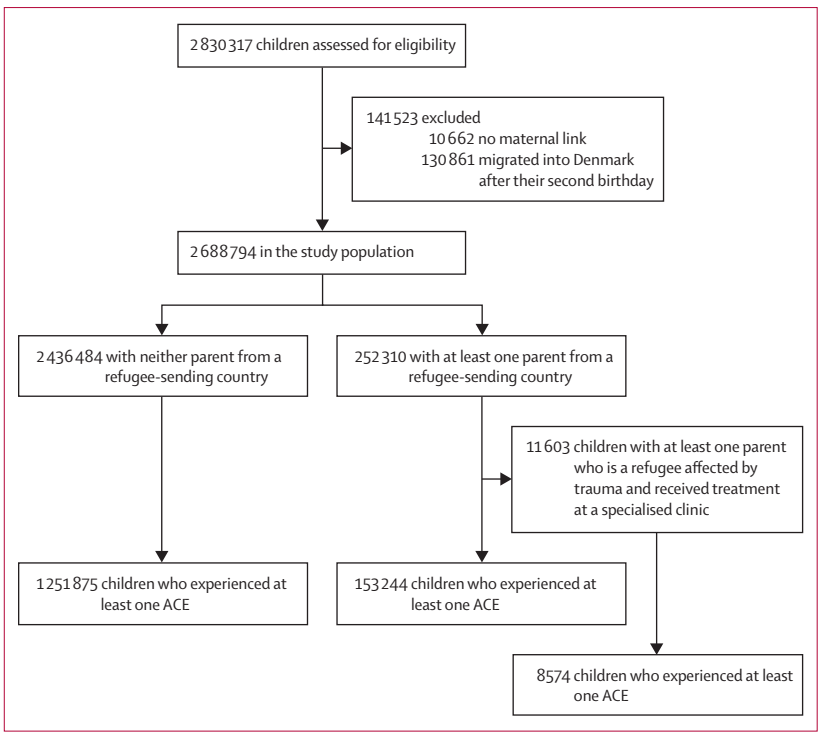

Figure 1: **Flowchart of the study population**
ACE=adverse childhood experience.

in relative poverty. Children were defined as living in relative poverty if the combined parental income, including wealth, was less than 50% of the national median income of the entire Danish population aged 18–55 years in the given year (data taken from the Income Statistics Register[28]). Parental income was weighted according to family size, with the first adult assigned the value 1, each additional adult assigned the value 0·5, and children assigned the value 0·3.[29] Finally, a variable on childhood stressors was measured. This variable consisted of multiple factors that could be deemed to be stressful or traumatising. These events included accidents recorded in the DNPR from 1987 onwards, assaults, poisonings, and maltreatment as recorded in the DNPR from 1995. As a reference, we also included child mortality, for which the median follow-up time was calculated.

Exposures

Three separate analyses were carried out. In the first analysis (model 1), the primary exposure was whether the child had at least one parent from a refugee-sending country. Having a parent from a refugee-sending country was defined as a binary variable if at least one parent originated from Iraq, Lebanon, Afghanistan, Iran, any other country in the Middle East, Bosnia and Herzegovina, Croatia, Kosovo, Montenegro, North Macedonia, Serbia, Slovenia, Africa, Asia, South America, or information on their country of origin was missing or unknown. The comparison group consisted of the remaining population residing in Denmark.

In models 2a and 2b, the exposed children were a subgroup of the children with one or both parents from a refugee-sending country where at least one parent was a refugee and was known to have received treatment at one of five specialised treatment centres for refugees affected by trauma. This group represents individuals who have been recognised as refugees with formal residency and have been referred mainly by their general practitioner to an outpatient care facility specialising in refugee trauma. This group was sampled through a non-probability approach, ensuring as many individuals as possible could be included in the study. The personal identification number was obtained from the clinics' electronic patient file systems and, if possible, from the clinics' physical archives. The sampling covered treatments provided in the period 1982–2017, with more parents identified after 2000.

Covariates

The sex and age of the included children were obtained from the CRS. Maternal country or region of origin and paternal country or region of origin were coded in two separate variables as follows; Denmark, Iraq, Lebanon, Afghanistan, Iran, any other country the Middle East, Bosnia and Herzegovina, Croatia, Kosovo, Montenegro, North Macedonia, Serbia, Slovenia, Africa, Asia, South America, any other country, and data missing or unknown. Calendar time was defined as a categorical and time-varying variable (1990–94, 1995–99, 2000–04, 2005–11, and 2012–16).

Statistical analysis

The study population was followed up from birth, migration into Denmark if this occurred before their second birthday, or from Jan 1, 1990, whichever came last. Cohort members were followed up until the event of interest, their 15th birthday, date of migration out of Denmark, death, or to the end of the study period (Dec 31, 2016), whichever came first. The total person-time was calculated as person-years at risk by the different groups included in the analyses. The crude incidence rates were obtained from the number of events divided by the person-years. Quadratic approximation to the Poisson log-likelihood for the log-rate parameter was used to calculate the CIs for the incidence rates. Cox proportional hazards regression was used to estimate the hazard ratio (HR) for the individual ACEs and the cumulative number of different ACE categories, by analysing the HR for the first, second, third, and fourth ACE experienced by the exposed children versus the comparison group.

In the first analysis (model 1), parental migration status into Denmark from a refugee-sending country was the exposure of interest. This model adjusted for calendar time, the child's sex, and the child's age as the underlying

	General population			Parent who is a refugee affected by trauma			Total	
	Number of children (n=2 677 191)*	Person-years	Crude incidence rate (95% CI)	Number of children (n=11 603)*	Person-years	Crude incidence rate (95% CI)	Number of children (n=2 688 794)*	Crude incidence rate ratio (95% CI)
Parental death								
Natural	31 145	25 636 991	1·21 (1·20–1·23)	96	131 406	0·73 (0·60–0·89)	31 241	0·60 (0·49–0·73)
Unnatural	12 167	25 714 717	0·47 (0·46–0·48)	37	131 586	0·28 (0·20–0·39)	12 204	0·59 (0·42–0·82)
Residential instability	111 544	24 470 521	4·55 (4·53–4·58)	634	124 856	5·08 (4·70–5·49)	112 178	1·11 (1·03–1·20)
Parental serious mental illness	109 388	24 706 486	4·42 (4·40–4·45)	2634	112 814	23·35 (22·46–24·26)	112 022	5·27 (5·07–5·48)
Parental substance use disorder	88 297	24 284 079	3·64 (3·60–3·66)	662	125 410	5·28 (4·88–5·70)	88 959	1·45 (1·34–1·57)
Parental disability	152 451	24 765 624	6·16 (6·12–6·19)	3875	99 869	38·79 (37·60–40·03)	156 326	6·30 (6·10–6·51)
Family disruption	407 483	20 984 234	19·42 (19·35–19·48)	3704	94 721	39·10 (37·86–40·38)	411 187	2·01 (1·95–2·08)
Parental somatic illness	35 278	25 593 708	1·37 (1·36–1·38)	452	129 125	3·50 (3·18–3·83)	35 730	2·54 (2·31–2·79)
Relative poverty								
1 year lived in poverty	209 594	23 920 855	8·75 (8·72–8·80)	3598	104 344	34·47 (33·36–35·63)	213 192	3·94 (3·81–4·07)
3 years lived in poverty	65 406	25 364 311	2·58 (2·56–2·60)	1373	123 951	11·08 (10·50–11·67)	66 779	4·30 (4·07–4·53)
Child stressors	1 317 534	16 664 735	79·06 (78·93–79·20)	6955	78 225	88·90 (86·85–91·01)	1 324 489	1·12 (1·10–1·15)
Deaths	9507	25 811 274	0·37 (0·36–0·38)	67	131 865	0·51 (0·40–0·65)	9574	1·38 (1·07–1·75)

ACE=adverse children experience. *ACE categories are not mutually exclusive and children can count in multiple rows.

Table 1: **Crude incidence rates for ACEs per 1000 person-years analysed among children of parents affected by trauma compared with the general population**

timescale. These covariates were chosen to consider possible differences between the groups being compared as well as the possible effect of changes in the registers over time.

In the second and third analyses (models 2a and 2b), the main exposure was being a child of a parent who is a refugee affected by, and seeking treatment for, trauma. In model 2a, the estimated HRs for the outcomes were adjusted for child age, sex, and calendar time, effectively comparing this group to all others residing in Denmark. Model 2b was adjusted for maternal and paternal country or region of origin in addition to the basic covariates (age, sex, and calendar year), to allow for a comparison of children of the parents who are refugees affected by trauma with children of parents from the same country of origin with unknown trauma history. Maternal and paternal origin were included in the analysis because country of origin is closely related to refugee status, trauma history, as well as many of the ACE categories, such as parental mental illness.

All models were estimated with 95% CIs and robust SEs were used to account for the correlation between siblings with the same mother. Potential violations of the proportional hazard assumption were visually checked in a log–log plot. To evaluate the robustness of the results to changes in the variables over time, a prespecified sensitivity analysis was also done with follow-up commencing Jan 1, 2000. Statistical analyses were carried out in Stata (version 15.1).

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Results

Between Jan 1, 1990, and Dec 31, 2016, 2 688 794 children were included in the study, 252 310 of whom had parents from refugee-sending countries (figure 1). Via the clinics, 11 603 children were identified as having parents affected by trauma and seeking treatment (n=5539). Of these children, 1163 (10%) migrated to Denmark before their second birthday and the remaining 10 440 (90%) were born in Denmark. Child sex and parental country or region of origin for the children of parents from refugee-sending countries and for the children of parents who are refugees affected by trauma, compared with the remaining population, are shown in the appendix (pp 3–4). The number of ACEs per category, person-years analysed, and the crude incidence rate (IR) and incidence rate ratio (IRR) for the children of parents affected by trauma compared with the general population are shown in table 1 (see appendix p 5 for the comparison of children of parents from refugee-sending countries with children of parents from other countries). The median follow-up time, as estimated for child mortality, was 10·7 years (IQR 5·1–15·0). Table 2 shows the estimated HRs for ACEs in the three models.

The results from model 1, adjusting for age, sex, and calendar time, suggest that children of parents from refugee-sending countries had a greater hazard for most ACE categories except for childhood stressors (accidents, assaults, poisonings, and maltreatment) and parental unnatural death, for which the hazards were significantly lower in the children of parents from refugee-sending countries than in the remaining population (table 2). The HR for living 3 years in relative poverty was particularly high, as was the HR for having a parent on disability pension (table 2).

	Model 1: parent migrated from a refugee-sending country*		Model 2a: parent who is a refugee and affected by trauma (unadjusted)*		Model 2b: parent who is a refugee and affected by trauma (adjusted)†	
	HR (95% CI)	p value	HR (95% CI)	p value	HR (95% CI)	p value
Parental death						
Natural	1·14 (1·08–1·20)	<0·0001	0·72 (0·54–0·97)	0·029	0·74 (0·54–1·00)	0·051
Unnatural	0·78 (0·71–0·87)	<0·0001	0·71 (0·44–1·12)	0·14	1·00 (0·60–1·69)	0·99
Residential instability	1·21 (1·18–1·23)	<0·0001	0·99 (0·90–1·09)	0·84	0·96 (0·87–1·06)	0·41
Parental serious mental illness	1·84 (1·79–1·88)	<0·0001	4·60 (4·34–4·87)	<0·0001	1·98 (1·85–2·12)	<0·0001
Parental substance use disorder	1·06 (1·03–1·09)	0·0002	1·37 (1·22–1·54)	<0·0001	1·43 (1·26–1·63)	<0·0001
Parental disability	3·14 (3·08–3·20)	<0·0001	8·16 (7·77–8·57)	<0·0001	1·65 (1·55–1·74)	<0·0001
Family disruption	2·10 (2·07–2·12)	<0·0001	1·71 (1·62–1·79)	<0·0001	1·16 (1·09–1·22)	<0·0001
Parental somatic illness	1·88 (1·80–1·96)	<0·0001	2·26 (1·96–2·60)	<0·0001	1·18 (1·01–1·38)	0·039
Relative poverty						
1 year lived in poverty	3·10 (3·06–3·15)	<0·0001	3·55 (3·37–3·74)	<0·0001	0·98 (0·92–1·03)	0·39
3 years lived in poverty	3·62 (3·52–3·73)	<0·0001	4·15 (3·79–4·54)	<0·0001	0·95 (0·86–1·04)	0·27
Childhood stressors‡	0·96 (0·95–0·96)	<0·0001	0·98 (0·96–1·01)	0·27	0·97 (0·94–1·00)	0·022
Deaths	1·97 (1·86–2·08)	<0·0001	1·35 (1·06–1·73)	0·016	1·06 (0·82–1·37)	0·67

HR=hazard ratio. *Adjusted for calendar time, child sex, and child age. †Adjusted for calendar time, child sex, child age, and parental origin. ‡Accidents, assaults, poisonings, and maltreatment.

Table 2: **Estimated HRs for individual adverse childhood experiences in the three models**

In model 2a, adjusting for age, sex, and calendar time, eight of 12 outcomes were elevated in children with a parent affected by trauma compared with children without a parent affected by trauma (table 2). The largest HRs were for parental disability, parental serious mental illness, and for the child living at least 3 years in relative poverty (table 2). In model 2b, in which the estimates were further adjusted for paternal and maternal country or region of origin, five of 12 outcomes were significantly more likely in children of parents who were refugees affected by trauma than in the general population. The ACEs for which the HRs remained elevated in model 2b were parental serious mental illness, parental substance use disorder, parental disability, family disruption, and parental somatic illness. The highest HRs in model 2b were observed for parental serious mental illness and parental disability (table 2). The difference in the HRs between the individual ACEs and child death are shown in figure 2A.

The person-years analysed and the crude incidence rates for the cumulative number of ACEs for children of parents affected by trauma are shown in table 3 (see appendix p 6 for person-years analysed and crude incidence rates for children of parents from a refugee-sending country). Of the 11 603 children with a parent affected by trauma, 8574 (74%) experienced at least one ACE and 1581 (14%) experienced four or more ACEs. This compares with 1 396 545 (52%) children in the general population experiencing at least one ACE and 101 079 (4%) children in the general population who experienced four or more ACEs (table 3). The HRs for the cumulative ACEs showed that the hazard of experiencing any number of ACEs was increased for children of parents from a refugee-sending country and children of parent affected by trauma, in all three models (table 4; figure 2B). For children with a parent from a refugee-sending country, the highest relative hazard was observed for two or more ACEs and for three or more ACEs (table 4). For children of parents affected by trauma, the highest relative hazard estimate was for three or more ACEs, unadjusted for parental origin (table 4). After adjusting for maternal and paternal origin, the highest HR estimate was for four or more ACEs (table 4). The results suggest that for children with a parent who is a refugee affected by and seeking treatment for trauma, there is an increasing relative hazard rate up to the third or fourth ACE category. The results suggest that these children are more vulnerable to experiencing multiple adverse events across ACE categories compared with all others living in Denmark (model 2a), and compared with children of parents from the same country or region of origin who have not been identified from the specialised clinics (model 2b). The results from the sensitivity analysis with follow-up commencing in 2000 showed similar results to those in the main analysis (appendix pp 8–11).

Discussion

This study aimed to investigate whether children of all migrants from refugee-sending countries, and a subgroup children of parents who are refugees affected by and seeking treatment for trauma, experienced increased individual and cumulative ACEs. We found an increased hazard for a range of childhood adversities among children of parents from refugee-sending countries in general and in those whose parents had

been affected by torture and war trauma. For children of parents affected by trauma, after adjusting for parental country of origin, several adversities stood out as being elevated, including parental disability, psychopathology, substance use disorder, and somatic illness. Overall, the results suggest that children of parents who are refugees affected by trauma live with substantial stressors. Knowing how influential early life stress is in terms of long-term health and wellbeing, these findings are concerning.

A central part of the ACE concept is the emphasis on the accumulating load of psychological stress that might compound over time and result in psychological and physical morbidity.[30] Our results also suggest that children of parents who are refugees affected by trauma who also received treatment for their trauma, had an increased likelihood of multiple ACEs during their childhood and adolescence. The HR increased with the number of ACEs, underlining the relative burden of vulnerability placed on children of this parent group.

However, children of parents who are refugees and have experienced torture or war trauma not only experience the burden associated with having a parent affected by trauma, but they also most often have the additional life stressors associated with having a parent who has migrated from a refugee-sending country. In this study, these stressors were found to be relative poverty, residential instability, family disruption, parental somatic illness, and increased child mortality, in line with the results of a previous study.[31] The association of parental country or region of origin with relative poverty and disability pension is also evident in that the estimates change from model 2a to 2b. For instance, the HR for disability pension is lower in model 2b than in model 2a, suggesting that much of the initial increased risk is associated with parental country or region of origin.

However, many of these risk factors for poorer health and socioeconomic outcomes in adulthood are identifiable and might be modifiable.[30] Early detection of these risk factors might occur when children and their families interact with the surrounding communities. Approximately 80% of Danish children attend the public school system for primary and secondary school.[32] Therefore, public schools are a particularly relevant place to monitor the wellbeing of children, as all children are routinely seen by a school nurse. Moreover, we have previously demonstrated that children of parents who are refugees affected by trauma show early indications of falling behind academically.[33] Therefore, extra effort might be needed to ensure the social inclusion and skill development of children of parents who are refugees affected by trauma. For instance, to avoid social exclusion driven by economic hardship, children living in low-income households could participate in youth clubs or sports activities with reduced or waived fees. In some cases, parental support through counselling focusing on facilitating healthy parent–child interaction might be needed. As many parents who are refugees seek treatment in the somatic health-care system for the consequences of their trauma, training health professionals to identify and treat refugees who are affected by trauma could increase timely and relevant interventions for the affected individuals and their families.

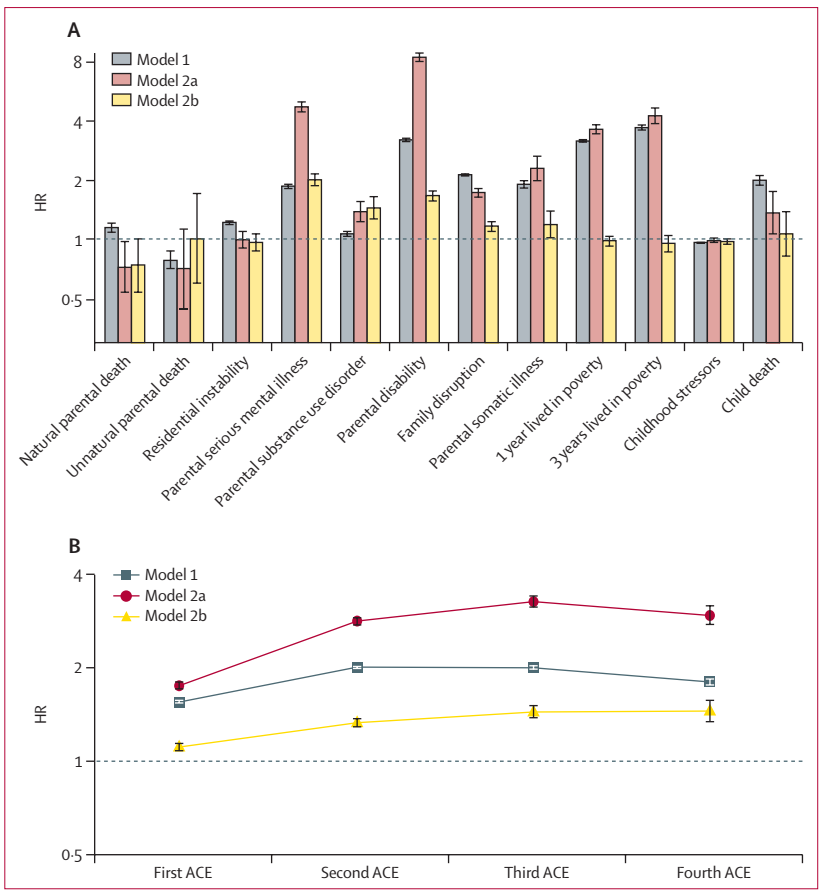

Figure 2: **HRs for individual and cumulative ACEs**
(A) HRs for individual ACEs, plus child death, in each of the three models. (B) HRs for cumulative ACEs, in each of the three models. Error bars are 95% CIs. ACE=adverse childhood experience. HR=hazard ratio. Model 1=parent migrated from a refugee-sending country. Model 2a=parent who is a refugee and affected by trauma (unadjusted). Model 2b=parent who is a refugee and affected by trauma (adjusted).

Few studies have been able to follow up survivors of torture and their children over long periods. By a combination of information from specialised rehabilitation clinics and comprehensive register data, this study contributed to the evidence base of which factors families who are refugees might be especially susceptible to, and which areas warrant attention by society. Moreover, unlike most ACE studies, which rely on self-reported survey data,[30] this study is not subject to issues of recall bias and issues of attrition.

Although our study provides important knowledge about this group of children, several limitations need to be considered. Although the group of migrants from refugee-sending countries included most refugees in

	General population			Parent who is a refugee affected by trauma			Total	
	Number of children (n=2 677 191)*	Person-years	Crude incidence rate (95% CI)	Number of children (n=11 603)*	Person-years	Crude incidence rate (95% CI)	Number of children (n=2 688 794)*	Crude incidence rate ratio (95% CI)
One ACE	1 396 545	11 858 616	117·76 (117·56–117·95)	8574	34 748	246·75 (241·58–252·03)	1 405 119	2·10 (2·05–2·14)
Two ACEs	662 396	20 799 938	31·85 (31·76–31 ·92)	7676	75 654	101·45 (99·21–103·76)	670 072	3·19 (3·11–3·26)
Three ACEs	271 562	24 127 211	11·25 (11·21–11·30)	4305	108 399	39·71 (38·54–40·92)	275 867	3·53 (3·42–3·64)
Four ACEs	101 079	25 280 178	4·00 (3·97–4·01)	1581	124 561	12·68 (12·08–13·33)	102 660	3·17 (3·02–3·34)

ACE=adverse childhood experience. *ACE categories are not mutually exclusive and children can count in multiple rows.

Table 3: **Crude incidence rates of cumulative ACE categories per 1000 person-years analysed**

	Model 1: parent migrated from a refugee-sending country*		Model 2a: parent who is a refugee and affected by trauma (unadjusted)*		Model 2b: parent who is a refugee and affected by trauma (adjusted)†	
	HR (95% CI)	p value	HR (95% CI)	p value	HR (95% CI)	p value
One ACE	1·55 (1·54–1·57)	<0·0001	1·75 (1·71–1·80)	<0·0001	1·11 (1·08–1·14)	<0·0001
Two ACEs	2·01 (1·99–2·02)	<0·0001	2·83 (2·75–2·90)	<0·0001	1·33 (1·29–1·37)	<0·0001
Three ACEs	2·00 (1·98–2·03)	<0·0001	3·27 (3·14–3·41)	<0·0001	1·44 (1·38–1·51)	<0·0001
Four ACEs	1·80 (1·76–1·84)	<0·0001	2·95 (2·76–3·17)	<0·0001	1·45 (1·34–1·57)	<0·0001

ACE=adverse childhood experience. HR=hazard ratio. *Adjusted for calendar time, child sex, and child age. †Adjusted for calendar time, child sex, child age, and maternal and paternal origin.

Table 4: **Estimated HRs for cumulative number of ACE categories in the three models**

Denmark, it was also highly heterogeneous and should be expected to encompass widely different migration experiences. The parents affected by trauma represented a sample of parents who are refugees seeking treatment. We do not know how many refugees in the comparison group were severely affected by trauma, potentially having sought help elsewhere, or not at all, but with similar levels of distress. The substantial difference in some of the estimates after adjusting for parental country of origin probably indicates that children of parents from the same countries as those seeking help for their trauma at the specialised clinics might be experiencing trauma as a consequence of war. However, because several hazard estimates were higher despite adjusting for parental country or region of origin, those receiving specialised care for their traumatic experiences are likely to be a vulnerable subgroup within a minority of people living in Denmark. There is currently no systematic assessment of refugees' health upon starting their residency in Denmark. Therefore, the process of receiving specialised care is dependent on the refugee's own health-seeking behaviour and the attentiveness and vigilance of primary health-care providers. For instance, refugees accessing a specialised clinic might also be more likely to be in contact with the general psychiatric care system and have received a serious mental illness diagnosis, which was one of the outcomes investigated. Consequently, whether these results can be replicated in societies with a different health-care system is unknown.

Another important consideration lies in the limitation of the ACE categories. In this study, we based the ACE categories on the information we had access to in the population registers and, as such, the information was not collected for the specific purpose of this study. Several aspects, such as family-related violence, experiences of discrimination, behavioural outcomes, and the absence of emotional support, could not be included.[7] Moreover, the cumulative approach to ACEs implies that each experience has the same effect on later life outcomes. This is a simplification because we do not know how the sequence and combination of specific adversities were subjectively experienced.[13] Nevertheless, register data enable long-term follow-up with little to no attrition. Therefore, we believe this study adds to the evidence base by investigating multiple ACE categories for children of parents who are refugees affected by trauma.

ACEs are known to be risk factors associated with adverse mental, physical, and socioeconomic outcomes in later life. In this study, we found evidence of increased risk for a range of ACEs as well as the cumulative number of ACEs for children of refugees affected by trauma who had sought treatment at five specialised clinics across Denmark. This increased risk persisted even after taking maternal and paternal country of origin into account. The risk was especially high for parental serious mental illness, parental disability, and parental substance use disorder. However, children of survivors of torture not only experience the ACEs specifically associated with parental torture or war trauma, but they might also have risk factors associated with having a parent who migrated from a refugee-sending country, which we found to be years lived in relative poverty, among others. These estimates point to the burden of adversity children experience, and point to avenues of intervention for breaking the transmission of trauma.

Contributors

LB and MHT were responsible for the conception of the study. Design and formal analysis were carried out by LB and TML. LB and TML had access to and verified the underlying data. LB wrote the original draft. MHT, TML, SP, and LN reviewed, edited, and approved the final manuscript. LB and TML had access to all the data in the study. All authors were responsible for the decision to submit for publication.

Declaration of interests

We declare no competing interests.

Data sharing

The data analysed in this study were not collected for this specific research project but were based on Danish nationwide registers. Individual-level data in the registers can only be accessed through secure servers and only export of aggregated data, as presented in research articles, is allowed as per Danish law. Permission to access data can be made only after fulfilling specific requirements to safeguard the anonymity of the study participants. For these reasons, data cannot be made generally available.

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For the **Danish nationwide registers** see https://econ.au.dk/the-national-centre-for-register-based-research/danish-registers