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a nationwide, register-based, cohort study**

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# Risk of childhood psychiatric disorders in children of refugee parents with post-traumatic stress disorder: a nationwide, register-based, cohort study



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## Summary

**Background** Children of refugees are often exposed to the consequences of parental post-traumatic stress disorder (PTSD), potentially leaving them vulnerable to intergenerational transmission of psychopathology. The present study aimed to determine whether parental PTSD is associated with childhood psychiatric morbidity among children of refugees.

**Methods** This study is a two-generation nationwide cohort study using the Danish Immigration Services database. We followed up children younger than 18 years with at least one refugee parent until psychiatric contact, end of the study, their 18th birthday, emigration, or death. We excluded children if their parents were diagnosed only with psychiatric diagnoses other than PTSD or if they had received a psychiatric contact before parental PTSD diagnosis. Information on parental PTSD and offspring psychiatric morbidity was obtained from the Danish Psychiatric Central Research Register. We used Cox proportional hazards regression models to assess the risk of psychiatric contacts among children of refugees with PTSD compared with children of refugees with no psychiatric diagnosis.

**Findings** Between Jan 1, 1995, and Dec 31, 2015, 102 010 refugees obtained residency permission in Denmark and 62 239 biological children of refugees were born in Denmark before Dec 31, 2015. 51 793 were eligible and included in the study (median follow-up 7·15 years [IQR 3·37–11·78]); of these, 1307 (2·5%) children had a psychiatric contact. 7486 (14·5%) children of refugees were exposed to parental PTSD. Parental PTSD significantly increased the risk of psychiatric contact in offspring (hazard ratio 1·49 [95% CI 1·17–1·89] for paternal PTSD,  $p=0\cdot0011$ ; 1·55 [1·20–2·01] for maternal PTSD,  $p=0\cdot00084$ ) after adjustment for sociodemographic variables.

**Interpretation** Children of refugees exposed to parental PTSD are at increased risk of psychiatric morbidity. Targeted screening and interventions are necessary to prevent psychiatric morbidity and ensure access to adequate care.

**Funding** Section for Immigrant Medicine, Department of Infectious Diseases, Copenhagen University Hospital Hvidovre.

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## Introduction

An estimated 68·5 million people are forcibly displaced worldwide because of persecution, violence, conflict, and human rights violations.<sup>1</sup> Of these, approximately 25·4 million are refugees residing in other countries,<sup>1</sup> and between Jan 1, 2014, and Dec 31, 2017, the EU alone received 4 million asylum applications.<sup>2</sup>

Regarding mental health problems, refugees constitute a particularly vulnerable group of migrants because they often experience cumulative stressors over the course of the entire migration process, including during the premigration, flight, exile, and resettlement periods.<sup>3,4</sup> Premigration traumas—such as exposure to war and organised violence, which frequently force migration—are often only the beginning of a long period of adversity, turbulence, and uncertainty.<sup>4</sup> Several studies from various countries have shown a higher prevalence of mental disorders among refugees than in the general population

in the countries of immigration.<sup>3,6,7</sup> Post-traumatic stress disorder (PTSD)—characterised by re-experiencing of traumas (eg, in nightmares and flashbacks) and avoidance behaviour—is particularly common in refugees.<sup>6</sup> In a meta-analysis<sup>6</sup> from 2005, the authors suggested that refugees were about ten-times more likely to have PTSD than the general population in the countries of resettlement.

Many refugees who have PTSD are parents, which might place children of refugees in a particularly vulnerable position because of a risk of exposure to the consequences of parental PTSD. Children of parents with severe mental disorders are at an increased risk of mental health problems themselves.<sup>8</sup> The published literature shows that the mental state of ethnic minority parents (including refugee parents in the countries where they seek asylum) is an important factor for both the mental wellbeing and the prevalence of mental disorders in their

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### Research in context

#### Evidence before this study

To inform this cohort study, a comprehensive and systematic search for literature was done in medical and psychology research databases, which were MEDLINE, PubMed, Embase, and PsycINFO, for articles published in English from inception to Dec 18, 2018, using the following key search terms: “refugees”, “asylum seeker”, “post-traumatic stress disorder”, “trauma”, “mental health”, “psychiatric morbidity”, “wellbeing”, “offspring”, “parental”, “intergenerational transmission”, and “secondary traumatisation”. Adverse mental health outcomes in children of parents with post-traumatic stress disorder (PTSD) are well documented in systematic reviews in families of war veterans and holocaust survivors, but refugee families are only sparsely represented in the published literature. Apart from one study published in 2018 that reported the transgenerational effects of PTSD in 660 children of refugees, only a few, small, cross-sectional studies have examined these problems in refugees. To our knowledge, no large-scale studies on the effect of parental PTSD on children’s psychiatric morbidity have previously been done in refugees.

#### Added value of this study

Nationwide data from 51 793 children of refugees who arrived in Denmark over a 21-year period (Jan 1, 1995, to Dec 31, 2015) provide strong evidence for a considerable detrimental effect of parental PTSD on mental health outcomes of their children. Although this effect was particularly true for children who were also refugees themselves, the effect of parental PTSD was also evident in children who were born in Denmark, indicating a specific transgenerational effect of PTSD in refugees.

#### Implication of all the available evidence

The accumulated scientific findings point to a major public mental health concern for decades to come due to the rise in the numbers of refugees who have been displaced in countries in which they have sought asylum, since 2014. These findings suggest a need for political focus on substantive preventive strategies and interventions to ensure adequate mental health care and support for these vulnerable families.

children, with parental mental ill-health resulting in an increased risk of mental ill-health in their children.<sup>5,9,10</sup> Substantial evidence supports an association between parental PTSD and offspring mental health issues, investigated mainly among children of war veterans and holocaust survivors.<sup>11,12</sup> The diverse explanations for this association include genetics, epigenetics, and exposure to parents’ psychological distress, as well as growing up in a potentially dysfunctional environment with social challenges secondary to parental PTSD.<sup>13,14</sup>

Parents with PTSD have functional impairment as part of their diagnosis, which might lead to engagement in negative behaviours and maladaptive parenting.<sup>11,15</sup> A review,<sup>12</sup> published in 2015, highlighted that parenting limitations could cause a poor and unhealthy relationship between parent and child, and several studies show an association between PTSD and poor family functioning, including decreased parenting satisfaction.

Only a few small studies have investigated the effect of parental PTSD on their refugee children, as reviewed by Lambert and colleagues<sup>15</sup> in 2015. Results from one study<sup>16</sup> published in 2018 showed that PTSD in refugees was associated with adverse outcomes in their children, in part mediated through harsh parenting. However, overall, the complexities and the effect of intergenerational factors in families coping with adverse traumatic experiences, social disadvantage, and mental illness are not sufficiently investigated in this group.<sup>5</sup>

To respond to this gap in the literature, we investigated the association between parental PTSD and offspring psychiatric morbidity among children of refugees in a nationwide register-based cohort study. We aimed to examine the consequences of parental PTSD in refugees

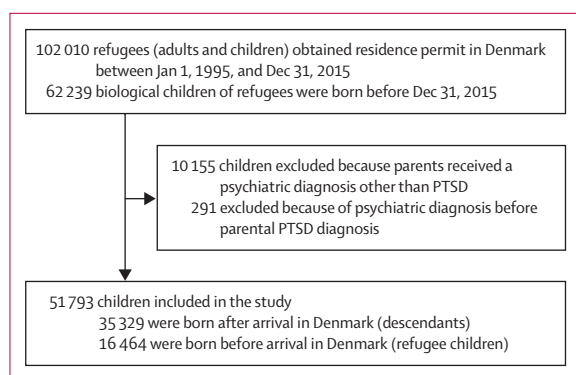
on the mental health of their children. We hypothesised that children of refugee parents with PTSD would have an increased risk of psychiatric morbidity compared with children of refugees without PTSD. We differentiated between refugee children and descendants born in Denmark with a refugee background, which allowed us to assess the role of parental PTSD independently of migration traumas that the children themselves might have experienced.

## Methods

### Study design and participants

This nationwide register-based cohort study is a two-generation study of children born to all refugees who obtained permission to reside in Denmark between Jan 1, 1995, and Dec 31, 2015. Study participants were eligible to enter the study if they were younger than 18 years and had at least one biological parent with a refugee status, and for whom relevant data for the study were available. Participants entered the study either at birth in Denmark or upon obtaining a residency permit in Denmark. Study participants were followed up from the date of entry into the study until the date of psychiatric contact, end of the study, their 18th birthday, emigration, or death. Children were excluded from the cohort study if their parents were diagnosed exclusively with non-PTSD psychiatric diagnoses (ie, we included children whose parents had PTSD comorbid with another psychiatric condition) or if the child had received psychiatric contact before parental PTSD diagnosis (to avoid reverse causation).

In accordance with the 2000 Danish Act on Processing Personal Data all datasets were constructed by Statistics



**Figure: Study profile**

PTSD=post-traumatic stress disorder.

Denmark with encrypted personal identification numbers to make individuals anonymous to the investigator.<sup>17</sup> Before analysing the data, research approval was granted from the Danish Data Protection Agency and all data were stored and analysed on Statistics Denmark's remote access servers. Data were made available from Statistics Denmark and hence no written consent was required, which was consistent with the Act on Processing Personal Data.

### Procedures and outcomes

Nationwide Danish population-based registers (Danish Civil Registration System, the Danish Immigration Service, the Danish Psychiatric Central Research Register, and Statistics Denmark) provided data for the current study. Personal identification numbers from the Danish Civil Registration System were used to make accurate linkages between refugees and their biological children.

Exposure (parental PTSD) and outcome (offspring psychiatric morbidity) variables were obtained through the Danish Psychiatric Central Research Register. Parental PTSD was defined as when a child had at least one biological parent with any psychiatric hospital contact (outpatient, inpatient, or emergency room) during the study period, at which a PTSD diagnosis was assigned. Diagnoses were based on the International Classification of Diseases, tenth revision (ICD-10). The outcome variable of offspring psychiatric morbidity was measured as any psychiatric contact in childhood (age 0–18 years) during the study period (Jan 1, 1995, to Dec 31, 2015). A psychiatric contact was defined as any psychiatric hospital contact (outpatient, inpatient, or emergency room), during which a psychiatric diagnosis according to the ICD-10 classification system (codes F10–99) was assigned; it does not include diagnoses made exclusively in primary care or private practice.

The primary outcome was the first psychiatric contact of children from refugees who had PTSD evaluated in all eligible populations. We also analysed the first psychiatric contact of children who were born before arrival in Denmark (refugees) and who were born after arrival in Denmark (descendants; secondary outcome).

	Parental PTSD (n=7486)	No parental psychiatric diagnosis (n=44 307)	p value
Sex			0.91
Male	3847 (51.4%)	22 799 (51.5%)	..
Female	3639 (48.6%)	21 508 (48.5%)	..
Migrant status			
Asylum	2050 (27.4%)	12 016 (27.1%)	0.63
Quota refugee	328 (4.4%)	1893 (4.3%)	0.67
Family reunification	26 (0.3%)	151 (0.3%)	0.93
Descendant	5082 (67.9%)	30 247 (68.3%)	0.51
Country of origin			
Denmark	5082 (67.9%)	30 247 (68.3%)	0.51
Bosnia and Herzegovina	388 (5.2%)	4396 (9.9%)	<0.0001
Iraq	502 (6.7%)	1776 (4.0%)	<0.0001
Somalia	39 (0.5%)	1881 (4.2%)	<0.0001
Afghanistan	459 (6.1%)	1291 (2.9%)	<0.0001
Other	313 (4.2%)	2008 (4.5%)	<0.0001
Geographical origin*			
Denmark	5082 (67.9%)	30 247 (68.3%)	0.51
Eastern Europe and central Asia	946 (12.6%)	5905 (13.3%)	0.10
Middle East and central Europe	1286 (17.2%)	4575 (10.3%)	<0.0001
Sub-Saharan Africa	108 (1.4%)	2783 (6.3%)	<0.0001
Other	64 (0.9%)	797 (1.8%)	<0.0001
Yearly disposable household income, €			
0–15 999	4478 (59.8%)	20 651 (46.6%)	<0.0001
16 000–25 500	2484 (33.2%)	16 560 (37.4%)	<0.0001
>25 500	113 (1.5%)	3353 (7.6%)	<0.0001
Missing information	411 (5.5%)	3743 (8.4%)	<0.0001
Sibling status†	6718 (89.7%)	38 462 (86.8%)	<0.0001
Event of interest or censoring distribution			
Any psychiatric contact	181 (2.4%)	1126 (2.5%)	0.53
Turning 18 years old	1593 (21.3%)	10 970 (24.8%)	<0.0001
Death	36 (0.5%)	160 (0.3%)	0.12
Emigration	481 (6.4%)	5574 (12.6%)	<0.0001
End of follow-up	5195 (69.4%)	26 477 (59.8%)	<0.0001

Data are n (%). PTSD=post-traumatic stress disorder. \*Country of origin divided into regions based on World Bank definitions (The World Bank Group, 2017). †Having at least one biological sibling (same biological mother, father, or both).

**Table 1: Characteristics of children of refugees in Denmark**

### Statistical analysis

We investigated the association between parental PTSD and offspring psychiatric contact with a Cox proportional hazards model. All estimates were calculated as hazard ratios (HRs) with corresponding 95% CIs. A significant p value was defined as less than 0.05.

Study participants entered the study at different ages because they were included either at birth or at attainment of residence permission, resulting in a left truncation of data. To consider the delayed entry of participants in the statistical analysis, age was included as the underlying timescale. Because the applied statistical model requires independence between study participants, we adjusted for intracluster correlation among siblings.

	Crude HR (95% CI)	p value for crude HR	Adjusted HR (95% CI)	p value for adjusted HR
<b>Parental PTSD status</b>				
No parental psychiatric diagnosis	1 (ref)		1 (ref)	
Paternal PTSD	1.50 (1.20–1.90)	0.00050	1.49 (1.17–1.89)	0.0011
Maternal PTSD	1.62 (1.20–2.07)	0.00014	1.55 (1.20–2.01)	0.00084
Both parents with PTSD	1.80 (1.34–2.66)	0.00027	1.75 (1.22–2.52)	0.0027
<b>Sex</b>				
Male	..	..	1 (ref)	
Female	..	..	0.56 (0.50–0.69)	<0.0001
<b>Disposable household income, €</b>				
0–15 999	..	..	1 (ref)	
16 000–25 500	..	..	1.02 (0.90–1.15)	0.82
>25 500	..	..	1.18 (0.90–1.54)	0.24
<b>Geographical origin of children</b>				
Denmark	..	..	1 (ref)	
Eastern Europe and central Asia	..	..	0.63 (0.53–0.76)	<0.0001
Middle East and central Europe	..	..	0.94 (0.78–1.11)	0.43
Sub-Saharan Africa	..	..	0.91 (0.71–1.18)	0.48
Other	..	..	1.24 (0.85–1.79)	0.27

HR=hazard ratio. PTSD=post-traumatic stress disorder. \* Adjusted for sex, age, disposable household income, and geographical origin.

**Table 2: Crude and adjusted\* hazard ratios (HRs) for any first-time psychiatric contact among children of refugees in Denmark**

Consequently, we applied a marginal Cox proportional hazards model approach in which robust standard errors are used to account for the sibling association.<sup>18</sup>

The applied statistical model is also based on an underlying assumption of independent censoring. We do not consider this assumption violated because the majority of censorings were type 1, implying end of follow-up or age 18 years, whereas only a minority were due to emigrations and deaths. Furthermore, the model could introduce death as a competing risk but only a very small proportion of participants died during follow-up.

Age, sex, geographical origin, and sibling status were included as covariates to adjust for potential effects of the investigated association. Disposable household income was also included as a covariate, as a proxy for socioeconomic status. The variable on disposable household income used in the current study was weighted in a standardised way, considering the size and members of the family.<sup>19</sup> For the stratified analysis on descendants, the geographical origin of parents was included.

The proportional hazards assumption inherent in the applied statistical model was tested with Schoenfeld residuals by investigating the correlation between time and the Schoenfeld residuals for each of the variables in the study. The assumption for proportional hazards was fulfilled for all the variables except for geographical origin. To consider this violation, we applied a stratified Cox proportional hazards model, which takes into account that geographical origin is not proportional.

We did a sensitivity analysis in which disposable household income was excluded as a covariate in both the main and the stratified analyses to eliminate possible selection bias among study participants, because data for this variable were missing for 8% of participants. Also, income was originally included in the analysis as a covariate because it can potentially confound the association between parental PTSD and children psychiatric contact. This analysis, however, entails a strong assumption that parental PTSD is affected by socioeconomic factors (such as income) and not the other way around.

All analyses were done with SAS statistical software, version 9.4.

**Role of the funding source**

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

Between Jan 1, 1995, and Dec 31, 2015, a total of 102 010 refugees obtained residency permission in Denmark (figure) and 62 239 biological children of refugees were born in Denmark before Dec 31, 2015. We included 51 793 children in the study (figure 1): 35 329 (68.2%) descendants born after arrival in Denmark, and 16 464 (31.8%) refugee children born before arrival in Denmark.

Table 1 describes the sociodemographic characteristics of all children in the study. Data from children who were exposed to parental PTSD and children unexposed to parental psychiatric diagnosis were presented separately. 7486 (14%) of 51 793 children were exposed to parental PTSD. Most markedly, families with parental PTSD had lower average annual household incomes compared with those families without a parent with PTSD (p<0.0001). The same sociodemographic characteristics were reported for children with or without psychiatric contact (appendix).

During a median follow-up of 7.15 years (IQR 3.37–11.78), 1307 (2.5%) children had a psychiatric contact (181 [2.4%] of 7486 children in the parental PTSD group and 1126 [2.5%] of 44 307 in the no parental psychiatric diagnosis group). We found a significantly increased risk of any psychiatric contact in childhood among children exposed to parental PTSD in the crude analysis, compared with children of refugees with no psychiatric diagnosis in Denmark, with the risk lowest for affected fathers and highest when both parents were affected (paternal PTSD HR 1.50 (95% CI 1.20–1.90), p=0.00050; maternal PTSD 1.62 (1.20–2.07), p=0.00014; both parents 1.80 (1.34–2.66), p=0.00027; table 2). The estimates did not change substantially after adjustment for age, sex, disposable household income, and geographical origin (table 2). According to the analysis, girls were less likely to have psychiatric contacts during

See Online for appendix

the study period compared with boys. Refugee children from eastern Europe and central Asia were also less likely to have psychiatric contacts compared with descendants born in Denmark when adjusted for all other variables. No statistically significant differences were measured between the different income groups.

When we analysed the risk of any psychiatric contact among children of refugees, we found that those whose parents had PTSD had an increased risk of psychiatric morbidity compared with children whose parents did not have a psychiatric diagnosis, regardless of the child's own refugee status (table 3). Among descendants, girls were less likely to have psychiatric contacts during the study period compared with boys; descendants with a higher income were more likely to have a psychiatric contact. Furthermore, both descendants with parents from Middle East, central Europe, sub-Saharan Africa, and refugee children from the same regions were more likely to have psychiatric contacts compared with descendants and refugee children from eastern Europe and central Asia.

The most frequent assigned diagnoses at psychiatric contact (table 4) were nervous disorders (ICD-10 codes F40–49), disorders of psychological development (F80–89), and behavioural and emotional disorders (ICD-10 codes F90–99). Nervous disorders were more frequent among children of parents with PTSD.

The sensitivity analysis done with the exclusion of disposable household income as a covariate did not change the estimates for the association between parental PTSD and offspring psychiatric contact, when applied to both the main analysis and the stratified analysis on refugee children and descendants (data not shown). The stratified Cox proportional hazards model applied to account for variables that did not fulfill the proportional hazards assumption (ie, geographical origin) also did not change the estimates (data not shown).

## Discussion

The current study is, to our knowledge, the first to show that parental PTSD is a predictor of offspring psychiatric contact in a large population of children of refugees. Increased risk of offspring psychiatric contact was found both among descendants born in Denmark and among children who were also refugees themselves, independently of sociodemographic characteristics. Having two parents with PTSD slightly increased the estimated association. Our findings are consistent with the existing literature from samples of war veterans and holocaust survivors that has found an association between parental PTSD and offspring psychiatric morbidity.<sup>11,12</sup> Also, nervous disorders were more frequent among children of parents with PTSD as we hypothesised on the basis of existing literature investigating the intergenerational effect of PTSD.<sup>13,14,20</sup>

When investigating children of refugees, we need to consider that the refugee children born before arrival in Denmark might have been exposed to the same

	Refugee children		Descendants	
	Adjusted HR (95% CI)	p value	Adjusted HR (95% CI)	p value
<b>Parental PTSD status</b>				
No parental psychiatric diagnosis	1 (ref)		1 (ref)	
Parental PTSD	1.75 (1.37–2.23)	<0.0001	1.41 (1.22–1.78)	0.0033
<b>Sex</b>				
Male	1 (ref)		1 (ref)	
Female	0.86 (0.72–1.03)	0.10	0.40 (0.34–0.47)	<0.0001
<b>Disposable household income, €</b>				
0–15 999	1 (ref)		1 (ref)	
16 000–25 500	0.91 (0.75–1.11)	0.35	1.29 (1.02–1.44)	0.029
>25 500	0.99 (0.61–1.66)	0.96	1.46 (1.04–2.05)	0.027
<b>Geographical origin of children</b>				
Eastern Europe and central Asia	1 (ref)		..	
Middle East and central Europe	1.42 (1.15–1.75)	0.0009	..	..
Sub-Saharan Africa	1.41 (1.05–1.90)	0.022	..	..
Other	1.95 (1.32–2.88)	0.0008	..	..
<b>Geographical origin of parents</b>				
Eastern Europe and central Asia	..		1 (ref)	
Middle East and central Europe	..	..	1.38 (1.11–1.71)	0.0036
Sub-Saharan Africa	..	..	1.38 (1.09–1.76)	0.0085
Other	..	..	1.22 (0.95–1.56)	0.12

HR=hazard ratio. PTSD=post-traumatic stress disorder. \*Adjusted for sex, age, disposable household income, and geographical origin.

**Table 3: Adjusted hazard ratios\* (HRs) for any first-time psychiatric contact among children of refugees born after arrival (descendants) and before arrival (refugee children) in Denmark**

	Parental PTSD (n=181)	No parental psychiatric diagnosis (n=1126)	p value
Substance use disorders (F10–19)	6 (3.3%)	79 (7.0%)	0.052
Psychotic and affective disorders (F20–39)	3 (1.7%)	32 (2.8%)	0.32
Nervous disorders (F40–49)	41 (22.8%)	152 (13.6%)	0.0072
Disorders of psychological development (F80–89)	33 (18.3%)	276 (24.6%)	0.058
Behavioural and emotional disorders (F90–99)	53 (29.4%)	309 (27.5%)	0.92
Other psychiatric contact	44 (24.4%)	274 (24.4%)	0.75
Missing information	1 (0.1%)	4 (0.1%)	0.95

Data are n (%). Action diagnosis based on International Classification of Diseases, tenth revision, for the latest psychiatric contact during the study period. PTSD=post-traumatic stress disorder.

**Table 4: Type of psychiatric contact based on the assigned diagnosis for psychiatric contact among exposed and unexposed children**

conflict-related and migration-related traumas as their parent who has PTSD. The present study found an increased risk of psychiatric contact for refugee children and descendants of refugees with PTSD, although the association seems to be stronger for refugee children. This result could be interpreted in line with other published literature that has found an association

between premigration trauma and psychiatric morbidity after arrival in the immigration country.<sup>5,6,21</sup> However, our findings could also indicate that premigration traumas exacerbate the effect of parental PTSD by a process of accumulation. In turn, the exposure to parental PTSD could also exacerbate the effect of previous trauma in refugee children. This explanation is plausible because parental PTSD might disrupt important adaptive systems, such as family support and secure parent–child attachment, which are important for refugee children’s resilient adaptation to stressful life circumstances.<sup>5,21,22</sup> Furthermore, apart from parental psychological distress contributing to harsh parenting, specific stressors, such as economic hardships and insecurity in the community, might lead to impaired positive parent–child interactions in displaced populations.<sup>23</sup>

The increased risk of psychiatric contact among descendants of parents with PTSD born after arrival in Denmark compared with descendants whose parents do not have PTSD supports the notion that parental PTSD affects the mental health of offspring who do not have experiences of migration-related trauma themselves. These findings are consistent with those in the existing literature regarding other demographic groups, in studies that have investigated the association between parents with PTSD and their unexposed children.<sup>11,20,24</sup>

Key strengths of the present study include the collection of data through Danish nationwide registers, which ensured a large study population encompassing all refugees who were given a residence permit during a 21-year period. Furthermore, the nature of the registers ensured accurate linkages across different registers and provided detailed information on several sociodemographic variables. The register-based approach to data collection also allowed us to use discharge diagnoses assessed by a psychiatrist on the basis of ICD-10 codes rather than relying on self-reported data.

However, several limitations should be taken into consideration when interpreting the results. First, there are several potential sources of underestimation of both child and, particularly, parent psychopathology, including PTSD, because the registers do not provide information on untreated mental disorders and mental disorders treated outside the hospital in the time period of the data collection (eg, family doctor or psychiatrists in private practice). This bias might be of particular relevance for the selection of the parents, because several private rehabilitation clinics in Denmark specifically provide treatment for trauma-affected refugees. Also, refugees might have poor access to health care, resulting in an underestimation of psychiatric diagnoses.<sup>25–27</sup> Furthermore, it is unknown whether refugees included in the study had received treatment for psychiatric disorders in their country of origin or during the asylum-seeking phase before obtaining permission to reside in Denmark. Underestimation of parental psychopathology in the registers (and, particularly, PTSD given that private initiatives for traumatised refugees are

relatively common) probably biased the findings towards a null HR and, thereby, underestimated the magnitude of the HRs found in the current study. However, when applying hospital contacts as a proxy for psychiatric morbidity, we must assume that only the most severe cases of mental disorders are registered, because tertiary hospital care was required, which might magnify the impact of parental PTSD.

Second, parental PTSD might cause difficulties in perceiving and understanding the symptoms of the child, due to less-than-average familial resources available to adjust the family environment to the needs of the child. This factor might reduce detection of psychiatric conditions in children of parents with PTSD. Conversely, these children might receive earlier psychiatric attention because of the psychiatric care received by their parents, potentially increasing detection of psychiatric conditions. However, this risk of detection bias might be ameliorated by the fact that children must be referred separately to child and adolescent mental health services. Similarly, if advised by the clinician to seek assistance for their child on the suspicion of ill health, families with parental morbidity might find it difficult to follow up on such a recommendation because of limited resources. However, systematic health-nurse examinations are offered to all children from infancy and are systematically done throughout primary school, which helps to identify ill-health regardless of parental diagnosis.

Third, it would have been relevant to adjust for parental education, but such variables were not included as covariates because the Danish registers do not contain information on education obtained before arrival to Denmark, which would render the information inaccurate for our population. Fourth, the effect of parental PTSD might be affected by comorbidity. PTSD is often associated with other comorbid disorders, such as depression, anxiety disorders, and alcohol or drug dependency.<sup>28</sup> Also, PTSD can vary over time and mimic other psychiatric disorders.<sup>26</sup> Thus, it is difficult to distinguish the effects of PTSD and determine the unique contribution of this condition. We partly accounted for this confounding factor by excluding children of parents with psychiatric disorders other than PTSD.

These limitations notwithstanding, our study suggests considerable intergenerational transmission of psychopathology among children of parents with PTSD. The current study assessed a large study population, adding much-needed knowledge to the previous literature base, which mainly consisted of studies on war veterans and holocaust survivors. Our study has identified a particularly psychologically vulnerable group of children within an already vulnerable refugee population. We found that even children who were born in Denmark (descendants) had a non-negligible increased risk of psychopathology as a consequence of parental PTSD. This result points at a major public health challenge in the countries in which refugees seek asylum for decades to come, because the

numbers of children of refugee parents will probably rise as a result of the displacement of millions of refugees, particularly to western Europe, since 2014.<sup>2</sup>

Public health interventions should, therefore, focus on the mental health of children of traumatised refugees, not only in the recipient country but also in places processing refugees, by use of appropriate assessment tools to identify children in need and by ensuring the consequent availability of relevant mental health services. Unfortunately, few validated mental health screening tools for refugee children are available.<sup>29</sup> Hence, there is a need for future public health research and practices to develop such tools, as well as relevant treatment interventions targeting refugees and their children both on arrival and after resettlement.<sup>29,30</sup>

#### Contributors

MBN, MN, JC, and MKR conceived the idea. MBN, MN, JHP, and JC contributed to the study design. MN provided study data, which were analysed by MBN and JHP. MBN wrote the first draft of this report, and designed tables and figures, in collaboration with MN, JC, and MKR. All authors contributed to the interpretation of data and revision of the manuscript, and approved its final version.

#### Declaration of interests

We declare no competing interests.

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