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Prevalence and predictors of mental health problems in refugee children living in informal settlements in Lebanon

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Fiona S. McEwen[1,2,10], Claudinei E. Biazoli Jr[1,3,10], Cassandra M. Popham[1], Patricia Moghames[4], Dahlia Saab[5,6], John Fayyad[5,6,7,11], Elie Karam[5,6,7], Tania Bosqui[8,9] & Michael Pluess[1]

Millions of people are currently displaced. About half of them are children who are at increased risk of mental health problems. While some risk factors such as war exposure are well established, less is known regarding the effects of the local refugee environment. Here we show that the prevalence and comorbidity of mental health problems in Syrian refugee children living in settlements in Lebanon are high. We assessed individual, familial and social factors in a prospective cohort study (N = 1,591 child–caregiver dyads interviewed between October 2017 and January 2018; n = 1,000 interviewed at 1 yr follow-up). Of these children, 39.6% met the criteria for post-traumatic stress disorder, 26.9% for conduct/oppositional defiant disorder, 20.1% for depression and 47.8% for anxiety disorders. Exposure to daily stressors was the factor most strongly associated with children's mental health problems. Interventions and policies addressing ongoing daily stressors are as important as scaling up mental health services for refugee families.

According to the most recent statistics, more than a hundred million people are currently fleeing wars, violence, persecution and human rights violations, almost half of whom are children.[1] Most refugees live in low- and middle-income countries, with a considerable number living in camps and informal settlements[1,2]. As well as exposure to war-related events, many face ongoing adversities, including violence, insufficient access to basic resources, poor-quality accommodation, compromised livelihood, lack of job opportunities, child labour and limited access to education. These cumulative stressors contribute to a substantially elevated risk of mental health problems[2].

Accurate epidemiological data from refugee children living in vulnerable contexts are critically important to plan and deliver mental health services. However, most of the available data are from children living in high-income countries and less-challenging settings[3–5]. Furthermore, there is substantial variation in prevalence rates of common mental disorders across studies[6]. Reliance on cross-sectional designs, non-probabilistic sampling, transcultural measurement errors and the use of screening measures rather than clinical interviews contributes to this heterogeneity[3,7,8]. The prevalence of mental disorders in refugee children probably also depends on a broad range of individual, familial and socioecological factors that are often not systematically measured in epidemiological studies[2].

To address these gaps in the literature, we report on children's mental health in a cohort of Syrian refugees living in informal tented settlements in Lebanon. Lebanon is a middle-income country with a population of around 6 million people, which accommodates an

[1]Department of Biological and Experimental Psychology, Queen Mary University of London, London, UK. [2]Department of War Studies, King's College London, London, UK. [3]Centre of Mathematics, Computing and Cognition, Universidade Federal do ABC, Sao Paulo, Brazil. [4]Médecins du Monde France, Beirut, Lebanon. [5]Institute for Development, Research, Advocacy and Applied Care, Beirut, Lebanon. [6]Saint George Hospital University Medical Center, Beirut, Lebanon. [7]Faculty of Medicine, Balamand University, Beirut, Lebanon. [8]Department of Psychology, American University of Beirut, Beirut, Lebanon. [9]School of Psychology, Trinity College Dublin, Dublin, Ireland. [10]These authors contributed equally: Fiona S. McEwen, Claudinei E. Biazoli Jr. [11]Deceased: John Fayyad. e-mail: m.pluess@qmul.ac.uk

estimated 1.5 million Syrian refugees, approximately half of whom are children[9,10]. Syrian refugees in Lebanon face significant challenges, including lack of legal residency, extreme poverty, food insecurity and accommodation that is overcrowded or below humanitarian standards[11]. This cohort is thus considerably more representative of global refugee populations than samples settled in high-income countries.

We aimed to accurately estimate the prevalence of mental health problems and their patterns of co-occurrence and to identify the main predictors among refugee children in a cohort representative of refugee populations living in informal settlements in Lebanon. We report on prevalence of depression, anxiety disorders, post-traumatic stress disorder (PTSD) and conduct/oppositional defiant disorder (CD/ODD) in children and adolescents. To tackle methodological factors that potentially bias prevalence estimates, we (1) employed settlement-based probabilistic sampling, (2) collected longitudinal data and (3) used culturally adapted structured clinical interviews and locally validated screening tools for mental health problems. Further examination of psychopathological presentations was performed by evaluating concurrent comorbidity. Finally, we estimated the effect of a range of risk factors on children's mental health problems, including exposure to war, maltreatment, caregiver psychopathology and the immediate refugee environment (for example, housing conditions and social environment).

Evidence to date

Two systematic reviews and meta-analyses were published in 2020 (one on high-income countries, covering up until 2019, and the other on low- and middle-income countries, covering 2003–2018), providing pooled prevalence estimates of mental health problems in refugee and asylum-seeking children[3,5]. We conducted a search on PubMed for more-recent literature, covering the period from 1 January 2018 to 10 September 2021. The search strategy used MeSH terms and keywords to identify studies about child or adolescent ('child*', 'adolesc*') refugees or asylum seekers ('refugee*', 'asylum-seek*') and reporting on mental illness, diagnosis or trauma (for example, 'mental health', 'mental*', 'mental disorder*', 'depress*', 'anxiety*', 'phobi*', 'emotional disorder*', 'trauma', 'PTSD'). A total of $N = 1{,}102$ abstracts were reviewed, identifying 46 papers for review. Nineteen empirical studies were of sufficiently high quality ($N > 50$, sampling strategy likely to result in representative sample and outcomes measured using structured or semi-structured clinical interviews or established questionnaires) and reported prevalence of common mental disorders. Eleven studies reported on Syrian refugees. Pooled prevalence estimates from previous meta-analyses showed elevated prevalence of PTSD (22.7–52.0%), depression (13.8–28.0%) and anxiety (15.8–32.0%) and lower rates of externalizing behaviour problems (ODD, 1.7%; attention-deficit/hyperactivity disorder (ADHD), 8.6%). Higher prevalence was found using questionnaires compared with diagnostic interviews. More-recent literature suggested higher prevalence of PTSD and depression, but this was probably driven by a preponderance of studies (18/19) using questionnaires rather than clinical interviews.

A systematic review of socioecological factors contributing to risk and protection of the mental health of refugee children was published in 2021[4]. Risk factors included cumulative exposure to war-related events, family separation, parental mental health problems, negative parenting, lower socioeconomic status, child labour, perceived discrimination, bullying and cumulative exposure to daily stressors. However, there is little previous research in low- and middle-income countries and in camps.

Contribution of this work

This study addresses the bias towards high-income countries by providing data from a large cohort of Syrian refugees living in informal settlements in Lebanon. These data are more representative of the majority of refugees globally and particularly those living in camps. We used probabilistic sampling, culturally adapted clinical interviews and locally validated symptom scales to provide more-accurate prevalence estimates for a range of mental health problems. We also examined comorbidity to better guide service planning. Finally, we estimated the effect sizes of a range of psychosocial and environmental risk factors to provide a clearer picture of their relative importance.

Results

Sample

At baseline, data were available from $n = 1{,}591$ children (52.5% female, mean (s.d.) age = 11.44 (2.44) yr) and their primary caregivers (Table 1). The sample at 1 yr follow-up ($n = 1{,}000$) was broadly representative of the baseline sample, although children who participated were slightly younger, more likely to participate with their mother, to have left Syria ≥3 yr ago, to be registered with UNHCR and to have access to education. They were less likely to be from the most vulnerable localities, and caregivers were less likely to be working and less likely to have very low literacy. However, all these differences were small[12]. A subsample selected for clinical interview ($n = 134$) was also broadly representative of the baseline cohort, although participating children were slightly younger, had higher levels of externalizing behaviour problems, were more likely to be from the most vulnerable localities and were more likely to attend school. Other than the bias towards more-vulnerable localities, the differences were small[12]. See Table 1 and Supplementary Table 3 for details.

Prevalence of mental disorders

Point prevalence estimates for mental disorders based on clinical interview ($n = 134$) are presented in Table 2. Mental disorders were common: 39.6% of children met criteria for PTSD, 26.9% for either conduct disorder (CD) or oppositional defiant disorder (ODD), 20.1% for major depressive disorder and 47.8% for any anxiety disorder, with separation anxiety, agoraphobia, social phobia and specific phobia being most prevalent. Importantly, more than half of the children (57.5%) met the criteria for any common mental disorder. Diagnosis of ADHD applied in 5.2% of children. Prevalence was higher in males than in females for externalizing disorders. There was a trend towards obsessive compulsive disorder being more prevalent in children >11 yr and towards depression and separation anxiety being more common in children who had left Syria ≥3 yr ago.

Point prevalence estimates for common mental disorders based on symptom scales in the entire cohort are presented in Table 3. Adjusted estimates (adjusted for both the false-positive rate and false-negative rate) were on average 66.2% of the magnitude of raw estimates and consistent with prevalence based on clinical interview. Externalizing behaviour problems were more common in males, while anxiety disorders were more common in females; no other group differences reached significance.

Comorbidity

We focus on comorbidity patterns based on clinical interview data here (Fig. 1), but results for the whole sample based on symptom scales and separated by age, gender and time since leaving Syria are presented in Supplementary Figs. 1–4. Of those children who had a diagnosis, 79.2% met criteria for more than one disorder. Depressive and anxiety disorders were significantly associated (odds ratio (OR): 21.8 [95% confidence interval (CI): 4.9–97.4], $P < 0.001$). This mixed depressive–anxiety presentation was observed in 4.5% of children while isolated depression was observed in 0.7% and an isolated anxiety disorder was observed in 3.7%. An isolated PTSD diagnosis was ascribed to 6.0% of children while concurrent presentations of PTSD with anxiety, with mixed depression–anxiety or with combined depression, anxiety and CD/ODD ranged from 6.0% to 10.4% each; 33.6% of children had a diagnosis of PTSD with anxiety, depression and/or CD/ODD. PTSD and anxiety diagnoses were significantly associated (OR: 12.3 [95%

Table 1 | Description of sample

			Baseline (*N*=1,591)	1yr follow-up (*N*=1,000)	Clinical interview (*N*=134)	Comparison of those with clinical interview versus those not included on baseline measures	
						Test statistic	Details
Child gender, *N* (%) female / male			836 (52.5) / 755 (47.5)	535 (53.5) / 465 (46.5)	63 (47.0) / 71 (53.0)	χ^2 (1)=1.80, *P*=0.180, tau[a]=0.001	
Child age at assessment, mean (s.d.) [range][b]			11.44 (2.44) [6–19]	12.26 (2.38) [8–20]	12.15 (2.15) [8–19]	*t* (164.08)=3.60, *P*<0.001, *d*=0.30	Included children were younger at baseline than those not included
Caregiver gender, *N* (%) female / male			1,518 (95.4) / 73 (4.6)	966 (97.6) / 24 (2.4)	130 (97.0) / 20 (14.9)[c]	χ^2 (1)=3.20, *P*=0.073, tau[a]=0.002	
Caregiver age at assessment, mean (s.d.) [range][b]			39.01 (8.58) [18–75]	39.60 (8.42) [15–76]	38.07 (7.54) [16–57]	*t* (170.68)=3.38, *P*<0.001, *d*=0.26	Included children had younger caregivers at baseline
Caregiver relationship to child, *N* (%)	Mother		1,424 (89.4)	908 (90.7)	123 (91.8)[c]	χ^2 (11)=11.91, *P*=0.370, tau[a]=0.005	
	Father		64 (4.0)	24 (2.4)	20 (14.9)[c]		
	Stepmother		25 (1.6)	20 (2.0)	2 (1.5)		
	Grandmother		24 (1.5)	14 (1.4)	1 (0.7)		
	Sister		21 (1.3)	7 (0.7)	3 (2.2)		
	Aunt		18 (1.1)	8 (0.8)	0 (0)		
	Brother		6 (0.4)	0 (0)	0 (0)		
	Uncle		3 (0.2)	0 (0)	0 (0)		
	Cousin		3 (0.2)	1 (0.1)	0 (0)		
	Other		3 (0.2)	7 (0.7)	1 (0.7)		
	Missing[d]		0 (0)	11 (1.1)	0 (0)		
Time since leaving Syria, *N* (%)	Baseline	Follow-up				χ^2 (1)=2.54, *P*=0.111, *d*[e]=0.02	
	<3 yr	<4 yr	743 (46.9)	465 (46.5)	54 (40.3)		
	≥3 yr	≥4 yr	842 (53.1)	535 (53.5)	80 (59.7)		
	Missing	Missing	6 (0.4)	0 (0)	0 (0)		
Child depression (CES-DC-10), mean (s.d.) [range 0–30]			8.23 (7.04)	6.35 (6.88)	10.80 (7.82)[f]	*t* (1,587)=1.19, *P*=0.235, *d*=0.11	
Child anxiety (SCARED-15), mean (s.d.) [range 0–30]			15.40 (6.75)	13.43 (6.98)	13.36 (6.64)[f]	*t* (1,587)=0·46, *P*=0.645, *d*=0.04	
Child PTSD (CPSS), mean (s.d.) [range 0–51]			15.86 (12.30)	10.79 (13.22)	18.04 (11.67)[f]	*t* (1,583)=1.11, *P*=0.265, *d*=0.10	
Child externalizing behaviour problems (SDQ+CD/ODD items), mean (s.d.) [range 0–34]			11.47 (6.32)	11.04 (6.52)	12.26 (5.75)[f]	*t* (1,586)=2.55, *P*=0.011, *d*=0.23	Included children had higher levels of externalizing problems at baseline

Gap between baseline and 1 yr follow-up, mean (s.d.)=51.55 (1.84) weeks; gap between 1 yr follow-up and clinical interview, mean (s.d.)=27.03 (7.17) weeks. Families participating in the clinical interview were compared with those not participating on variables from baseline. CES-DC, Center for Epidemiological Studies Depression Scale for Children (abridged 10-item version); SCARED, Screen for Child Anxiety Related Emotional Disorders (abridged 15-item version); CPSS, Child PTSD Symptom Scale; SDQ, Strengths and Difficulties Questionnaire. [a]Goodman–Kruskal tau. [b]Age is best estimate rounded to nearest year, based on all available data (data on date of birth and reported age at baseline and follow-up were inspected for consistency and a best estimate made; using this new age variable, some children fell outside of the age range we planned to sample; see (ref. [12]) for details); caregiver age is missing for *n*=3 cases. [c]In *n*=16 cases, both parents attended the appointment; total for Caregiver gender and Caregiver relationship to child is *n*=150; in *n*=94 cases, the clinical interview was completed with both child and caregiver(s), and in *n*=40, it was completed with the child only. [d]At 1 yr follow-up, *n*=9 children took part without a caregiver, and for *n*=1, caregiver data were missing due to tablet failure; caregiver reported data are missing for *n*=10 cases. [e]Somers' *d* (if not marked, Cohen's *d* is used). [f]Based on *n*=122–124 with contemporaneous questionnaire data. Two-sided tests (χ^2 and *t*-test) are reported.

CI: 5.2–28.7], *P* < 0.001) as were PTSD and mixed depression–anxiety (OR: 4.3 [95% CI: 1.8–10.4], *P* = 0.01). Similar patterns of concurrent comorbidity emerged in the whole sample at baseline and follow-up (Supplementary Fig. 1).

Predictors of mental health symptoms

Table 4 shows effect sizes and significance of associations between risk factors and children's depression, anxiety, PTSD and CD/ODD symptoms over time based on linear mixed-effects models (LMMs).

Table 2 | Prevalence estimates for common mental disorders derived from clinical interview

	Whole sample (% [95% CI])	Gender (% [95% CI])		Age (% [95% CI])		Time since leaving Syria (% [95% CI])	
		Male	Female	≤11 yr	>11 yr	<3 yr	≥3 yr
	n=134	*n*=71	*n*=63	*n*=60	*n*=74	*n*=62	*n*=72
PTSD	39.6 [31.3–47.9]	43.7 [32.2–55.2]	34.9 [23.1–46.7]	41.7 [29.2–54.2]	37.8 [26.8–48.9]	43.5 [31.2–55.8]	36.1 [25.0–47.2]
Any externalizing behaviour disorder	26.9 [19.4–34.4]	35.2* [24.1–46.3]	17.5* [8.1–26.9]	31.7 [19.9–43.5]	23.0 [13.4–32.6]	29.0 [17.7–40.3]	25.0 [15.0–35.0]
CD	12.7 [7.1–18.3]	22.5* [12.8–32.2]	1.6* [−1.5–4.7]	13.3 [4.7–21.9]	12.2 [4.7–19.7]	16.1 [7.0–25.2]	9.7 [2.9–16.5]
ODD	22.4 [15.3–29.5]	28.2** [17.7–38.7]	15.9** [6.9–24.9]	26.7 [15.5–37.9]	18.9 [10.0–27.8]	22.6 [12.2–33.0]	22.2 [12.6–31.8]
Depression	20.1 [13.3–26.9]	18.3 [9.3–27.3]	22.2 [11.9–32.5]	20.0 [9.9–30.1]	20.3 [11.1–29.5]	12.9** [4.6–21.2]	26.4** [16.2–36.6]
Any anxiety disorder	47.8 [39.3–56.3]	52.1 [40.5–63.7]	42.9 [30.7–55.1]	46.7 [34.1–59.3]	48.6 [37.2–60.0]	40.3 [28.1–52.5]	54.2 [42.7–65.7]
Panic disorder	6.7 [2.5–10.9]	7.0 [1.1–12.9]	6.3 [0.3–12.3]	8.3 [1.3–15.3]	5.4 [0.3–10.5]	8.1 [1.3–14.9]	5.6 [0.3–10.9]
Agoraphobia	22.4 [15.3–29.5]	21.1 [11.6–30.6]	23.8 [13.3–34.3]	21.7 [11.3–32.1]	23.0 [13.4–32.6]	21.0 [10.9–31.1]	23.6 [13.8–33.4]
Separation anxiety	35.1 [27.0–43.2]	40.8 [29.4–52.2]	28.6 [17.4–39.8]	31.7 [19.9–43.5]	37.8 [26.8–48.8]	27.4** [16.3–38.5]	41.7** [30.3–53.1]
Social anxiety	13.4 [7.6–19.2]	14.1 [6.0–22.2]	12.7 [4.5–20.9]	11.7 [3.6–19.8]	14.9 [6.8–23.0]	17.7 [8.2–27.2]	9.7 [2.9–16.5]
Specific phobia	17.2 [10.8–23.6]	16.9 [8.2–25.6]	17.5 [8.1–26.9]	16.7 [7.3–26.1]	17.6 [8.9–26.3]	22.6 [12.2–33.0]	12.5 [4.9–20.1]
Obsessive compulsive disorder	5.2 [1.4–9.0]	7.0 [1.1–12.9]	3.2 [−1.1–7.5]	1.7** [−1.6–5.0]	8.1** [1.9–14.3]	8.1 [1.3–14.9]	2.8 [−1.0–6.6]
Generalized anxiety disorder	11.9 [6.4–17.4]	14.1 [6.0–22.2]	9.5 [2.3–16.7]	8.3 [1.3–15.3]	13.5 [5.7–21.3]	11.3 [3.4–19.2]	12.5 [4.9–20.1]
ADHD	5.2 [1.4–9.0]	4.2 [−0.5–8.9]	6.3 [0.3–12.3]	8.3 [1.3–15.3]	2.7 [−1.0–6.4]	6.5 [0.4–12.6]	4.2 [−0.4–8.8]
Any common mental disorder[a]	57.5 [49.1–65.9]	62.0 [50.7–73.3]	52.4 [40.1–64.7]	56.7 [44.2–69.2]	58.1 [46.9–69.3]	54.8 [42.4–67.2]	59.7 [48.4–71.0]

[a]Includes depression, any anxiety disorder, PTSD and CD/ODD. *Estimates differ between groups (gender, male versus female; age, ≤11 yr versus >11 yr; time since leaving Syria, <3 yr versus ≥3 yr) at $P<0.05$ based on the two-proportion z test (two-sided); **$P<0.10$.

Depression, anxiety and PTSD symptoms all showed a significant decrease between baseline and follow-up. The quality of the refugee environment was associated with all but anxiety symptoms, with effect sizes (Cohen's $d = -0.20$ to -0.28) roughly an order of magnitude larger than other risk factors. The refugee environment was consistently the strongest predictor across a range of sensitivity analyses, suggesting that this was a robust effect (Supplementary Information section 6). Moreover, specific aspects of the environment contributed differently to mental health symptoms. For example, poor housing quality was specifically associated with children's depression symptoms, lack of access to services was associated with children's PTSD and CD/ODD symptoms, and a hostile and unsupportive community environment was associated with children's depression, PTSD and CD/ODD symptoms.

Depression and PTSD symptoms were positively associated with age while CD/ODD symptoms were negatively associated. As expected, anxiety symptoms were more pronounced in girls while CD/ODD symptoms were more pronounced in boys.

The level of exposure to war-related events was associated with all outcomes, with the greatest effect size ($d = 0.05$) for PTSD followed by depression ($d = 0.03$) symptoms. Child-reported maltreatment was also associated with all outcomes, with strongest effects for PTSD ($d = 0.03$) and depression ($d = 0.02$). Conflict between child and caregiver had strongest effects for PTSD ($d = 0.05$), followed by depression ($d = 0.03$) and CD/ODD ($d = 0.02$).

Caregiver mental health was associated with all children's mental health symptoms. Caregiver depression and anxiety symptoms were particularly associated with CD/ODD ($d = 0.04$ and 0.04, respectively) and depressive symptoms ($d = 0.03$ and 0.04). Caregiver impulsivity was associated with CD/ODD ($d = 0.03$) and depressive ($d = 0.02$) symptoms in children. Although to a lesser extent, caregiver PTSD was associated with all child mental health outcomes.

Discussion

We report prevalence estimates of common mental disorders, their comorbidity profile and the main predictors of symptoms in a large cohort of Syrian refugee children living in informal settlements in Lebanon. Importantly, previously identified sources of spurious variability on those estimates[8] were explicitly addressed by (1) using probabilistic sampling in (2) a prospective design and (3) using transcultural validated screening measures with (4) cohort-specific cut-offs derived from a subsample of families with whom a structured clinical interview and culturally sensitive diagnostic procedures were conducted. A range of individual, familial and socioenvironmental risk factors were assessed.

A high prevalence of common mental disorders was observed, but with some reduction in depression, anxiety and PTSD symptoms over time. Externalizing behaviour problems, however, were more stable. The observation of decreasing prevalence of disorders associated with acute distress, particularly PTSD and anxiety disorders, but maintenance of the prevalence of externalizing behaviour problems seems consistent with a change in symptom manifestation due to greater time since exposure to an acute stressor such as war while being continually exposed to the chronic stressors of displacement. However, longitudinal investigations with more than two timepoints and over a longer period will be necessary to better understand the relationship between changing symptom manifestation and differential exposure to acute and chronic stressors in refugee children.

Prevalence was high even after accounting for the expected false-positive rates resulting from screening tools. The difference between

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Table 3 | Prevalence estimates for common mental disorders in BIOPATH cohort at baseline and 1 yr follow-up

	Whole sample		Gender[a] (% [95% CI])		Age[a] (% [95% CI])		Time since leaving Syria[a] (% [95% CI])	
	Raw (%)	Adjusted[a] (% [95% CI])	Male	Female	≤11 yr	>11 yr	<3 yr	≥3 yr
Baseline	*n*=1,591		*n*=755	*n*=836	*n*=865	*n*=726	*n*=743	*n*=842
PTSD	55.8	36.1 [33.7–38.5]	35.9 [32.5–39.3]	36.0 [32.7–39.3]	34.4 [31.2–37.6]	38.1 [34.6–41.6]	36.6 [33.1–40.1]	35.7 [32.5–38.9]
Externalizing behaviour disorders	42.7	27.6 [25.4–29.8]	31.4* [28.1–34.7]	24.2* [21.3–27.1]	29.4 [26.4–32.4]	25.6 [22.4–28.8]	26.8 [23.6–30.0]	28.3 [25.3–31.3]
Depression	38.6	19.0 [17.1–20.9]	18.9 [16.1–21.7]	19.1 [16.4–21.8]	17.6 [15.1–20.1]	20.8 [17.8–23.8]	20.1 [17.2–23.0]	18.0 [15.4–20.6]
Anxiety disorders	78.4	54.2 [51.8–56.6]	52.0* [48.4–55.6]	56.2* [52.8–59.6]	55.2 [51.9–58.5]	53.0 [49.4–56.6]	53.9 [50.3–57.5]	54.5 [51.1–57.9]
Any common mental disorder[b]	92.1	58.7 [56.3–61.1]	58.1 [54.6–61.6]	59.2 [55.9–62.5]	58.9 [55.6–62.2]	58.4 [54.8–62.0]	58.4 [54.9–61.9]	58.8 [55.5–62.1]
Follow-up	*n*=1,000		*n*=465	*n*=535	*n*=431	*n*=569	*n*=465	*n*=535
PTSD	34.8	30.4 [27.5–33.3]	30.1 [25.9–34.3]	30.6 [26.7–34.5]	29.6 [25.3–33.9]	31.0 [27.2–34.8]	30.7 [26.5–34.9]	30.1 [26.2–34.0]
Externalizing behaviour disorders	41.6	27.2 [24.4–30.0]	31.5* [27.3–35.7]	23.3* [19.7–26.9]	29.0 [24.7–33.3]	25.8 [22.2–29.4]	26.8 [22.7–30.9]	27.5 [23.7–31.3]
Depression	27.1	16.0 [13.7–18.3]	15.2 [11.9–18.5]	16.8 [13.6–20.0]	14.3 [11.0–17.6]	17.3 [14.2–20.4]	16.3 [12.9–19.7]	15.9 [12.8–19.0]
Anxiety disorders	68.8	50.8 [47.7–53.9]	46.7* [42.2–51.2]	54.3* [50.1–58.5]	52.0 [47.3–56.7]	49.8 [45.7–53.9]	51.3 [46.8–55.8]	50.3 [46.1–54.5]
Any common mental disorder[b]	85.6	55.1 [52.0–58.2]	53.4 [48.9–57.9]	56.5 [52.3–60.7]	56.5 [51.8–61.2]	54.0 [49.9–58.1]	55.2 [50.7–59.7]	55.0 [50.8–59.2]

Estimates derived from questionnaires and validated cut-offs. [a]Adjusted for rate of false positives and false negatives; adjusted prevalence only presented for breakdown by gender, age and time since leaving Syria. [b]Includes depression, any anxiety disorder, PTSD and CD/ODD. *Estimates differ between groups (gender, male versus female; age, ≤10 yr versus >10 yr; time since leaving Syria, <3 yr versus ≥3 yr) at $P<0.05$ based on the two-proportion z test (two-sided).

unadjusted and adjusted prevalence estimates—adjusted estimates were, on average, a third lower than raw estimates—confirms that the use of screening tools probably results in problems such as over-reporting of mental health problems[13–18]. Prevalence of PTSD was similar to that reported in one recent meta-analysis[3] but higher than another[5]. However, the one recent study that was most comparable to ours—conducting clinical interviews with Syrian refugee children aged 7–18 yr in Lebanon and Jordan—found a similar prevalence of PTSD (45.6%)[19]. Prevalence of depression was broadly consistent with previous reports, but prevalence of anxiety was higher in our study[3,5]. The high level of adversity faced by families in informal settlements in Lebanon[11], including daily stressors and events such as army raids on settlements[20], may contribute to a higher burden of mental health problems compared with those resettled in high-income countries[2,21]. For example, the high prevalence of specific phobia reflected the unsafe nature of settlements: triggers included dogs and snakes (which come into tents) as well as fire (fires causing fatalities are not uncommon).

Importantly, as Ventevogel and Faiz have argued, results of population surveys on mental health symptoms in war-exposed and forcibly displaced populations might be better understood as general indicators of psychosocial distress rather than evidence of mental disorders[18]. Although we corrected prevalence estimates on the basis of data from clinical interviews, our results still reflect heightened prevalence rates of mental disorder. But these elevated prevalence rates should be interpreted in light of the challenging context of refugee settings that children are living in. Relying exclusively on categorical psychiatric diagnoses that emphasise a focus on individual psychopathology can be misleading in humanitarian settings and may reinforce stigma and direct efforts to ineffective interventions[22,23]. Consequently, comprehensive and systemic treatment approaches will probably benefit refugee children more than interventions focused only on the individual child.

A consistent pattern of concurrent comorbidities was observed, and the majority of children with mental health problems met criteria for more than one disorder. Comorbidity with PTSD was particularly prevalent, suggesting a substantial contribution of complex trauma-related presentations to the higher prevalence of mental disorders in refugee children. This may reflect the multiple and ongoing challenges and stressors that many children face, including violence, family separation, bereavement, child labour, maltreatment and daily stressors in camps[13]. The high degree of concurrent comorbidity reinforces the potential limits of a purely categorical approach to diagnosis in humanitarian settings. In line with this, thematic analysis of supervision notes from our clinical interviews suggests that apparent comorbidity could often be better characterized as a broader traumatic and adjustment reaction to the violence and displacement that children experienced[20]. Hence, a broader diagnostic formulation that links experience, pre-existing difficulties and symptomatology may be more helpful to inform treatment while also reducing the risk of stigma associated with categorical diagnoses.

Our results on the predictors of mental health symptoms confirm known associations of mental health problems in refugee children with exposure to war, maltreatment and caregiver mental health problems[2]. However, a gap in evidence highlighted in a recent review is the paucity of research on social and material factors of displacement[2]. We observed a consistent impact of the quality of the refugee environment on children's mental health, which was an order of magnitude greater than individual and family-level factors. This is consistent with ecological systems models that emphasise a stronger effect of concurrent daily-life stressors compared with previous exposure to catastrophic events in conflict and post-conflict settings and among refugees and asylum seekers[21,24]. We found that an unsupportive and hostile environment was consistently associated with children's mental health

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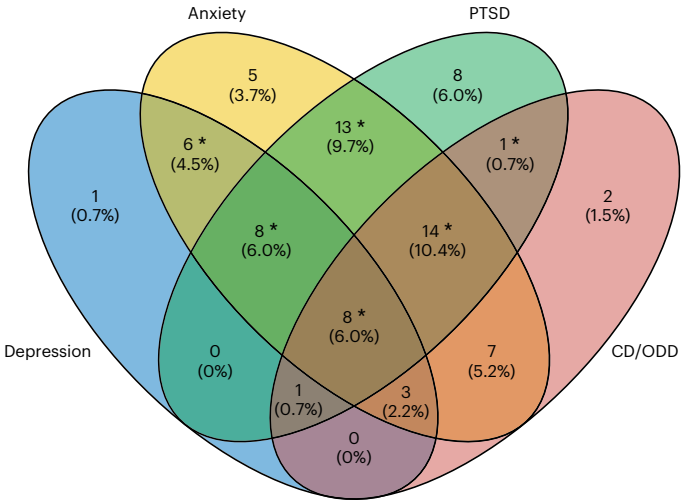

Fig. 1 | Venn diagram showing co-occurrence of PTSD, major depressive disorder, anxiety disorders and CD/ODD in subsample with clinical interview data (*n* = 134). Odds ratios, with 95% CIs, were calculated to evaluate the degree of association between each pair of co-occurring disorders, and Bonferroni correction for multiple comparisons were used. *$P < 0.05$ after correction for multiple comparisons. PTSD versus depression (OR: 3.3 [95% CI: 1.4–8.1], Bonferroni-corrected P value: 0.09); PTSD versus anxiety (OR: 12.3 [95% CI: 5.2-28.7], $P = 2.7 \times 10^{-9}$); PTSD versus CD/ODD (OR: 4.7 [95% CI: 2.1–10.8], $P = 0.002$); depression versus anxiety (OR; 21.8 [95% CI: 4.9–97.4], $P = 1.3 \times 10^{-6}$); depression versus CD/ODD (OR: 2.8 [95% CI: 1.1–6.7], $P = 0.32$); anxiety versus CD/ODD (OR: 16.5 [95% CI: 5.4–50.7], $P = 3.9 \times 10^{-8}$); PTSD and anxiety versus depression (OR: 4.3 [95% CI: 1.8–10.4], $P = 0.01$); PTSD and anxiety versus CD/ODD (OR: 5.8 [95% CI: 2.5–13.2], $P = 4.7 \times 10^{-4}$); PTSD and depression versus CD/ODD (OR: 3.7 [95% CI: 1.3–10.7], $P = 0.18$); anxiety and depression versus CD/ODD (OR: 2.6 [95% CI: 1.1–6.5], $P = 0.28$); anxiety and depression and CD/ODD versus PTSD (OR: 4.6 [95% CI: 1.2–18.3], $P = 0.28$).

symptoms, in line with research in asylum-seeking adults showing that poor social integration is more strongly associated with depression and PTSD than traumatic events[25]. Such ongoing chronic stressors in the social ecology may explain the modest effect sizes of mental health interventions for children in post-conflict settings[22]. Hence, our results further support an emerging consensus in global mental health arguing for a multi-layered mental health care model, including assistance with issues such as housing, health and education and broader interventions and policy change aimed at fostering livelihoods, permitting employment and facilitating social support networks[21].

More specifically, Syrian families living in informal settlements in Lebanon tend to experience difficulty with access to health care, work and education[26–28], and Syrian refugee children have been reported to experience widespread discrimination, harassment and social isolation[29]. Refugee boys are particularly vulnerable to physical violence and exploitation as child labourers[29] while girls experience gender-related violence and forced marriage or child labour[30,31].

In a recent qualitative study with Syrian refugee families in Lebanon[26], caregiver well-being was found to be intimately tied to parents' financial situation. Economic hardship in war-torn environments and forcibly displaced populations has previously been shown to significantly impact parents' mental health and, consequently, to lead to harsh parenting, familial conflict, violence and neglect[32,33]. Growing evidence also supports the crucial influence of caregiver mental health on the well-being and mental health of war-affected children[34–37]. Our results regarding caregivers' symptoms of common mental disorders predicting children's symptoms are in line with these findings and further support the need for interventions targeting caregiver mental health.

Importantly, our findings emphasise the need to address structural challenges (including access to health care, education and work) that probably affect both caregivers' and children's mental health[30,38]. Multilevel and cross-sectoral interventions and policies that reduce structural stressors, as captured here with the Perceived Refugee Environment Index (PREI), as well as family-level stressors (for example, caregiver's mental health symptoms, conflict, maltreatment and neglect), will be of paramount importance to effectively promote the mental health of refugee children[34]. Qualitative research on the perspectives of Syrian refugee parents highlights the important role of economic and social daily stressors during displacement[30]. Hence, policies and programmes that aim to remove structural barriers to refugee families' economic security will probably impact caregivers' well-being, resulting in improved parenting quality and better child mental health outcomes[34].

Despite the many strengths of the study, there are some limitations that should be considered. Biases in estimates induced by an inflated false-positive rate on the MINI Kid structured clinical interview cannot be fully ruled out as the instrument has not been specifically validated for Syrian refugee children. We attempted to address this by assigning diagnoses after supervision with an experienced clinical psychologist, critically reflecting on cultural and contextual factors that might influence the expression and diagnosis of mental disorders[20]. Interestingly, prevalence of ADHD was not significantly higher than seen in other populations[39], providing some reassurance that the diagnostic approach per se was not artificially inflating prevalence. Mental health symptom scales were broadly found to be reliable and valid in this sample, although the SCARED fell below conventional standards for diagnostic accuracy and there was poor discrimination between anxiety cases and non-cases[40]. While we could address this in prevalence estimates by adjusting for the rate of false positives and negatives, this was potentially problematic for comorbidity and risk-factor analyses and may explain why few significant predictors of anxiety symptoms emerged. Finally, the sample that completed clinical interviews was not perfectly representative of the cohort.

In conclusion, Syrian refugee children living in informal settlements in Lebanon show a high level of mental health problems with substantial comorbidity, whether measured through clinical interview or validated symptom scales, and we identified a range of relevant risk factors with clear policy implications. Importantly, the finding that the effects of the current refugee environment are substantially greater than other factors highlights the need to focus on concurrent social determinants of mental health[41]. Policy change and interventions that reduce the social inequities that make it difficult for people to live dignified lives are required, in addition to scaling up quality mental health services, to address the mental health needs of refugee children[41].

Methods

Ethics statement

This study complied with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Ethical approval was granted by the Institutional Review Board of the University of Balamand/Saint George Hospital University Medical Center, Lebanon (ref: IRB/O/024-16/1815). The study was also reviewed by the Lebanese National Consultative Committee on Ethics and approved by the Ministry of Public Health. The linked clinical trial was granted ethical approval by the Institutional Review Board of the American University of Beirut (ref: SBS-2018-0582) and the Ministry of Public Health. The sponsor, Queen Mary University of London, reviewed the study for compliance with all relevant legal and regulatory requirements.

In all cases, written informed consent was first obtained from caregivers, and then written assent was obtained from children after verbal explanation by trained staff supported by a written information sheet. Financial compensation was offered to families for their time.

Mental health services were offered to anyone from participating communities; to reduce the risk of perceived pressure to participate, service access was not dependent on study participation. Services

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Table 4 | Risk factors for mental health problems in the whole longitudinal sample (*N*=1,591, 2,595 observations)

	Depression		Anxiety		PTSD		Externalizing	
Predictor	**Effect size**	***P* value**	**Effect size**	***P* value**	**Effect size**	***P* value**	**Effect size**	***P* value**
Time (follow-up)	−0.265*	8.7×10^{-14}*	−0.288*	3.8×10^{-16}*	−0.393*	5.5×10^{-25}*	−0.079	0.011
Demographics								
Age	0.083*	1.3×10^{-21}*	−0.019	0.029	0.061*	8.5×10^{-13}*	−0.052*	2.2×10^{-8}*
Gender (female)	0.101	0.016	0.374*	1.6×10^{-18}*	0.061	0.136	−0.415*	5.6×10^{-21}*
Time since leaving Syria	−0.027	0.022	−0.019	0.110	−0.033	0.003	0.034	0.006
War events	0.033*	2.4×10^{-16}*	0.022*	8.7×10^{-8}*	0.046*	2.4×10^{-29}*	0.023*	4.8×10^{-8}*
Perceived environment (total)	−0.209*	2.2×10^{-7}*	−0.070	0.084	−0.199*	1.0×10^{-6}*	−0.283*	2.3×10^{-13}*
Basic needs	−0.116*	1.8×10^{-6}*	−0.015	0.519	0.009	0.702	−0.091*	4.3×10^{-5}*
Livelihood	−0.065*	6.0×10^{-4}*	−0.061*	0.001*	−0.081*	3.5×10^{-5}*	−0.057*	0.001*
Housing	−0.128*	2.5×10^{-6}*	−0.033	0.224	−0.006	0.825	−0.035	0.178
Community environment	−0.127*	4.6×10^{-7}*	−0.041	0.103	−0.086*	2.9×10^{-4}*	−0.145*	9.7×10^{-10}*
Family environment	−0.100*	2.9×10^{-5}*	−0.033	0.169	−0.057	0.017	−0.152*	3.1×10^{-11}*
Access to services	−0.006	0.757	−0.031	0.128	−0.097*	2.0×10^{-6}*	−0.120*	1.3×10^{-9}*
Work	−0.005	0.827	−0.063	0.005	−0.148*	5.3×10^{-11}*	−0.110*	5.4×10^{-7}*
Learning environment	−0.024	0.333	0.054	0.030	0.005	0.848	0.006	0.812
Mobility	0.048	0.325	0.122	0.013	0.103	0.040	−0.015	0.740
Caregiver–child relationship								
Maltreatment	0.024*	1.4×10^{-13}*	0.018*	8.2×10^{-12}*	0.030*	3.0×10^{-50}*	0.010*	2.3×10^{-7}*
Conflict	0.030*	3.9×10^{-8}*	0.007	0.232	0.045*	6.1×10^{-16}*	0.024*	1.4×10^{-6}*
Caregiver symptoms								
Depression	0.031*	1.8×10^{-27}*	0.019*	4.5×10^{-11}*	0.024*	3.7×10^{-16}*	0.044*	2.2×10^{-58}*
Anxiety	0.036*	8.9×10^{-23}*	0.017*	5.7×10^{-6}*	0.022*	2.1×10^{-9}*	0.041*	1.0×10^{-32}*
PTSD	0.013*	5.4×10^{-34}*	0.006*	1.5×10^{-9}*	0.007*	5.7×10^{-11}*	0.015*	6.9×10^{-51}*
Impulsivity	0.023*	4.5×10^{-12}*	0.013*	6.8×10^{-5}*	0.019*	2.5×10^{-8}*	0.034*	5.8×10^{-28}*

A series of LMMs are reported for each child mental health outcome. The first model included age, gender and time since leaving Syria as predictors. Each subsequent model included one predictor (for example, war events), with age, gender and time since leaving Syria included as covariates (only the effect size for the predictor is reported here). Models for caregiver symptoms included only caregiver age and time since leaving Syria as covariates (sensitivity analyses repeating these models with age, gender and time since leaving Syria as covariates did not change the results). Cohen's *d* effect size and uncorrected *P* values (statistical significance 0.05, Bonferroni correction 0.05/18=0.003). Detailed descriptions of the models are presented in Supplementary Tables 4 and 5. *Significant effects after correction for multiple comparisons.

were provided by an international non-governmental organization that delivers primary care and mental health services in Lebanon, either as part of their standard services or through the linked clinical trial.

Sample

Data are from the Biological Pathways of Risk and Resilience in Syrian Refugee Children (BIOPATH) study, a cohort of Syrian refugees living in informal settlements in the Beqaa region of Lebanon[12]. The cohort was established in 2017, recruiting families who had left Syria within four years, had a child reported to be 8–16 years old and had the primary caregiver (typically the mother) available to participate. A purposive cluster-sampling approach was used to select localities with varying levels of vulnerability, and $n = 77$ settlements were visited. No statistical methods were used to pre-determine sample size for the analyses reported in this paper; however, the cohort sample size was calculated to ensure sufficient power to conduct analyses the cohort was specifically designed for (for example, DNA methylation analyses, not reported here). Within each settlement, all households were approached, and all eligible families were invited to participate. Recruitment and baseline data collection were completed between October 2017 and January 2018. A total of $N = 2,282$ families were approached, $n = 1,591$ (69.9%) of whom were eligible, provided consent and had valid data. Follow-up was completed one year later, between October 2018 and January 2019 (mean [s.d.] = 51.55 [1.84] weeks) and valid data were collected from $n = 1,000$ families (62.8% of the cohort). A subsample ($n = 134$, 8.4%) completed a clinical interview approximately six months later (mean [s.d.] = 27.03 [7.17] weeks), either as part of a sub-study looking at the reliability and validity of mental health questionnaires ($n = 101$) or as part of a linked clinical trial ($n = 33$). See (ref. [12]) for full description of the cohort.

Procedure

At baseline and follow-up, families were visited at home and interviewed in Arabic by trained local research staff. One child from each family was selected using pre-defined criteria (child within age range whose birthday was closest to the interview date). The child and primary caregiver were interviewed simultaneously but separately by different interviewers; interviews took approximately 50–60 min. Clinical interviews in the subsample were completed at home or in a local clinic: children aged ≤12 yr were generally interviewed with one or both caregivers whereas older children were interviewed alone (depending on the preference of child and caregiver). In nearly all cases, the clinical interview was conducted primarily with the child with additional information sought from the caregiver. The visit for the clinical interview took approximately two hours. Recruitment data (including contact details) were collected and managed using REDCap electronic

data-capture tools hosted at Queen Mary University of London[42], and pseudonymized interview data were entered into Qualtrics (Qualtrics, version 2017–2019) via electronic tablet at the time of the interview.

Measures

Clinical assessment. The MINI International Neuropsychiatric Interview for Children and Adolescents (MINI Kid 6.0 (*Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (DSM-IV)))[43] was used to gather information about symptoms of mental disorders in the subsample. The MINI Kid 6.0 was previously translated into Arabic for Lebanon via a standard process of forward and back translation and review by the MINI Kid author and local experts. Additional questions were drafted by an experienced clinical psychologist (T.B.) and used at the same appointment to gain sufficient information to assign DSM-5 diagnoses. All cases were reviewed in clinical supervision with T.B. and diagnoses agreed by consensus, taking into account contextual, cultural and linguistic factors that might impact the diagnostic process. A Clinical Global Impression–severity score (CGI-s) was assigned, capturing functional impairment and distress resulting from symptoms (range 1–7). Case criteria were (1) meeting DSM-5 criteria for mental disorder and (2) CGI-s score ≥4, indicating moderate to severe functional impairment and/or distress. See Supplementary Table 1 and (ref. [20]) for details and Supplementary Information section 1 for interrater reliability.

Mental health symptoms. Locally adapted and validated self-report and caregiver-report questionnaires were used to assess mental health symptoms in the full cohort at baseline and follow-up. Questionnaires were administered via interview, and visual aids were used to facilitate response. Mental health problems were measured using the Center for Epidemiological Studies Depression Scale for Children (CES-DC, abridged, self-report), the Screen for Child Anxiety Related Emotional Disorders (SCARED, abridged, self-report) and the Child PTSD Symptom Scale (CPSS, self-report), and externalizing behaviour disorders were measured using the Strengths and Difficulties Questionnaire (SDQ, licensed Arabic version, caregiver report) and a separate set of items reflecting CD and ODD criteria. See Supplementary Table 1 for a detailed description of measures and (ref. [40]) for information about validity in this cohort.

Risk factors. War exposure was measured using the War Events Questionnaire, a 25-item checklist of war events reported at baseline. To take multiple raters into account[44], child and caregiver responses were combined such that if either one reported that the child experienced an event, the event was considered to have occurred. The Perceived Refugee Environment Index (PREI) is a multidimensional measure, developed for this study, to assess the quality of the refugee environment. Nine subscales—Livelihood, Basic Needs, Housing, Family Environment, Learning Environment, Access to Services, Community Environment, Working Situation, and Future Mobility—and a total PREI score were used. Child maltreatment was measured using the International Society for the Prevention of Child Abuse and Neglect (ISPCAN) Child Abuse Screening Tool (ICAST, abridged). Caregiver–child conflict was measured using the Parent–Adolescent Conflict scale. Caregiver mental health was measured using the PTSD Checklist for DSM-5 (PCL-5), the anxiety subscale of the Depression, Anxiety and Stress Scale (DASS-21), the Center for Epidemiologic Studies Short Depression Scale (CES-D 10) and the Abbreviated Barratt Impulsiveness Scale (ABIS). See Supplementary Table 1 for detailed description of measures.

Data analysis

Point prevalence estimation. Cohort-specific cut-offs for each of the symptom scales were calculated using a subsample of the cohort ($n = 119$) with clinical interview data and contemporaneous questionnaire data. Each questionnaire was compared with DSM-5 diagnosis of the relevant disorder(s), and receiver operating characteristics (ROC) curve analysis was used to summarize overall diagnostic accuracy. The ROC curve was used to select a cut-off, and sensitivity, specificity, positive predictive value and negative predictive value were calculated at the cut-off (Supplementary Table 2).

Point prevalence of DSM-5 mental disorders was estimated in the subsample with clinical interview data and in the full cohort for depression, anxiety, PTSD and externalizing behaviour disorders using mental health symptom scales and cohort-specific cut-offs. Raw prevalence was calculated as the proportion of children scoring above cut-off on each scale. Prevalence was then adjusted for the proportion of false positives (based on the positive predictive value) and false negatives (based on the negative predictive value):

$$\text{Adjusted prevalence} = (\text{raw prevalence} \times \text{PPV}) + (1 - \text{raw prevalence} \times (1 - \text{NPV}))$$

Adjusted prevalence was calculated for the whole sample and then separately by gender, age (≤11 yr, >11 yr) and time since leaving Syria (<3 yr, ≥3 yr). The two-proportion z test was used to test for differences between groups. Prevalence estimation analysis was performed in SPSS (v.28.0.0.0 (190)) and Microsoft Excel 2019 (v.16.01).

Comorbidity. The rates of co-occurrence of disorders were determined by calculating the frequency of overlapping diagnoses assigned by clinical interview for the subsample and the cohort-specific thresholds for symptom scales in the whole sample at baseline and follow-up. Venn diagrams depicting co-occurrence patterns and respective prevalence rates were constructed. Odds ratios, with 95% CIs, were calculated to evaluate the degree of association between each pair of co-occurring disorders. Patterns of co-occurrence were also investigated separately by gender, age (≤11 yr, >11 yr) and time since leaving Syria (<3 yr, ≥3 yr). Comorbidity analyses were performed in R Studio 2022.02.2 (R v.4.2.2).

Predictors of mental health symptoms. To describe the associations between risk factors and mental health symptoms over time, LMMs were constructed. The total scores for children's depressive, anxiety, PTSD and externalizing symptoms assessed at baseline and follow-up were considered as independent outcomes. The LMMs were adjusted for subjects clustered by settlement (with random intercepts estimated for participants nested in settlements). This modelling strategy allowed us to describe associations across time while accommodating the complex covariance and unbalanced data structure[45].

Effect sizes with 95% CIs were calculated for each risk factor on each continuous symptom scale score. First, four multivariate LMMs were constructed, one with each symptom scale score as the outcome, with child age, gender and time since leaving Syria as predictors. These models allowed us to quantify the specific relations between demographic factors and outcomes, controlling for the other demographic factors. Following this, independent LMMs were constructed for each risk factor and outcome, including the demographic factors as covariates. In the models constructed to quantify the association between caregiver mental health and child's mental health symptoms, caregiver's age and time since leaving Syria were included as covariates. Sensitivity analyses including child age, gender and time since leaving Syria as covariates were also carried out for these models, as well as comprehensive sensitivity analyses for all models (including only cases with follow-up data; only cases with complete data; in subgroups defined by gender, age and time since leaving Syria) to ensure that results were robust. These are presented alongside detailed description of the models in Supplementary Information section 6. Predictors analyses were performed in R Studio 2022.02.2 (R v.4.2.2).

Reporting summary

Further information on research design is available in the Nature Portfolio Reporting Summary linked to this article.

Data availability

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to conditions of ethical approval and the risk of compromising participants' privacy.

Code availability

The R-markdown codes for the comorbidity and predictors analyses are available at https://github.com/cbiazoli/Predictors-of-mental-health-problems-in-Syrian-refugee-children-living-in-Lebanon.git. The codes for the prevalence analysis and accompanying data are available on request from the corresponding author.

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Author contributions

M.P., E.K. and J.F. were involved in the conceptualization of and funding acquisition for the BIOPATH study, and F.S.M. for the linked study on reliability and validity of the mental health measurement tools. F.S.M. and C.E.B. conducted analysis and drafted the manuscript. F.S.M., P.M. and M.P. were responsible for project administration and supervision, and T.B. for supervision of the clinical interviews. F.S.M., C.M.P, P.M. and T.B. curated and verified the data. All authors discussed the results, contributed to revision of the manuscript and approved the final version (other than J.F., who passed away during the study).

Competing interests

The authors declare no competing interests.

Additional information

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Correspondence and requests for materials should be addressed to Michael Pluess.

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Software and code

Policy information about availability of computer code

Data collection	REDCap electronic data capture tools hosted at Queen Mary University of London, Qualtrics (v2017-2019)
Data analysis	RStudio 2022.02..2, R 4.2.0, Microsoft Excel 2019 (v 16.01), SPSS (v28.0.0.0 [190])

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to conditions of ethical approval and the risk of compromising participants' privacy. Researchers interested in accessing data should contact Professor Michael Pluess at Queen Mary University of London, UK (e-mail: m.pluess@qmul.ac.uk).

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Behavioural & social sciences study design

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Study description	A quantitative observational prospective longitudinal cohort.
Research sample	A population-based sample of Syrian refugee families living in informal tented settlements in Lebanon. Families with children aged 8-16 years at recruitment and displaced by the civil war for less than 4 years were included (age = 11.44 +/- 2.44 years, 52.6% female). The sample is representative of war-exposed refugee children living in humanitarian settings. This sample was selected due to the recent war exposure and current displacement. A wide age range was selected in order to be able to consider developmental questions.
Sampling strategy	A purposive cluster sampling approach was used to select localities with varying levels of vulnerability in the Bekaa region of Lebanon and n=77 settlements were visited. No statistical methods were used to pre-determine sample size for the analyses reported in this paper; however, the cohort sample size was calculated to ensure sufficient power to conduct analyses the cohort was specifically designed for (e.g., DNA methylation analyses, not reported here). Within each settlement, all households were approached and all eligible families were invited to participate.
Data collection	Children and caregivers were interviewed separately using standardised questionnaires translated into Arabic. Questionnaires had been translated into Arabic using a standard forward and back translation protocol, with review by local experts, before piloting and further refinement. Data collection was conducted using electronic tablets and the secure platforms, REDCap and Qualtrics. Children and caregivers were interviewed simultaneously, but separately by different interviewers and other family members were asked to leave the tent. Where possible, interviews were conducted in different rooms to try to ensure privacy, or at far ends of the same room if only one room was available. Visual aids were used to support verbal use of the Likert scale response format. Interviewers were blind as to the study hypotheses. A subsample selected for clinical interview completed the MINI Kid 6.0: children less than 12 years old were typically interviewed together with one or both parents, and children 12 years or older were typically interviewed on their own and their parent interviewed afterwards (decisions about the interview were made with each family and depended on the comfort level of the child). These interviews took place either in participants' tents or in a private room at a clinic.
Timing	Recruitment and baseline data collection were completed between October 2017 and January 2018. Follow-up was completed 1 year later, between October 2018 and January 2019. A subsample completed a structured clinical interview between December 2018 and August 2019.
Data exclusions	Data from nine families were completely excluded at baseline and from nine families at follow-up, giving a final sample size of n = 1591 dyads at baseline and n = 1,000 at follow-up. Data were excluded for the following reasons: data missing because of tablet failure during the interview; child was found to be <8 years old and clearly not able to understand questions; family was not from ITS; family participated twice; genetic data suggested that a different child had participated at follow up. Reasons for exclusion included pre-established criteria (e.g., different child took part at follow up) and technical problems (e.g., tablet failure meaning that data was not saved).
Non-participation	At baseline, 77 ITSs were visited and N = 2282 families approached, n = 1600 (70.1%) of whom were eligible, consented to participate, and completed data collection. At the follow-up, n = 1438 families across 70 ITSs were contacted, n = 1009 of whom consented to participate and completed data collection (re-participation rate 63%).
Randomization	Participants were not allocated to experimental or intervention groups as the study was observational.

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☒	☐ Dual use research of concern

Methods

n/a	Involved in the study
☒	☐ ChIP-seq
☒	☐ Flow cytometry
☒	☐ MRI-based neuroimaging

Human research participants

Policy information about studies involving human research participants

Population characteristics	See above.
Recruitment	All eligible families from each settlement were invited to participate and one child was randomly selected from each family. However, older children, child-headed families and unaccompanied minors were less likely to be included. Moreover, families with caregivers with impairment due to general and mental health problems and children with problems that made obtaining assent difficult were also less likely to be included, resulting in a bias away from more vulnerable families.
Ethics oversight	Institutional Review Board of the University of Balamand/Saint George Hospital University Medical Center, Lebanon (ref: IRB/O/024-16/1815). The study was also reviewed by the Lebanese National Consultative Committee on Ethics and approved by the Ministry of Public Health.

Note that full information on the approval of the study protocol must also be provided in the manuscript.