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Pathways from parental trauma exposure to Syrian and Iraqi refugee youth mental health symptoms: a multi-level mediation analysis

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Abstract

Background Trauma experienced by one generation has potential to impact those that follow. Refugee youth in particular are vulnerable to trauma and its intergenerational effects. By examining trauma subtypes, the impact of parental trauma, and post-/pre-migration stressors, this study investigated pathways linking parental trauma to psychological symptoms in Syrian and Iraqi refugee youth.

Methods Participants included 165 minors from Syria and Iraq, and their 107 parents (56 mothers, 51 fathers), all of whom experienced forced migration due to war and resettled as refugees in southeast Michigan. Linear mixed-effects modeling and multi-level mediation analyses were employed to investigate pathways from parental trauma exposure to child symptoms (anxiety, depressive, and somatic), as well as possible explanatory mediators.

Results Maternal cumulative trauma and death threat trauma were associated with child depressive symptoms (cumulative: b = 1.64, p = .007; death threat: b = 2.70, p = .020) and somatic burden (cumulative: b = 0.56, p = .032; death threat: b = 1.04, p = .041). Anxiety models also revealed an association between maternal cumulative trauma and child anxiety (b = 1.79, p = .034). Maternal post-migration living difficulties fully mediated the observed association between maternal cumulative trauma and child depression, though this effect was trending in sensitivity analyses. No paternal trauma variables were associated with child symptoms.

Conclusion Findings indicate that maternal trauma exposure in particular—as well as elevated post-migration stressors for mothers—may contribute to mental health risk in refugee youth. These insights may be leveraged towards early identification of youth at high risk, and to direct focused intervention towards modifiable targets—including living difficulties (e.g., financial difficulties, access to health care and transportation) experienced by parents post-migration.

Clinical trial number Not applicable.

Keywords Refugees, Trauma, PTSD, Youth, Intergenerational trauma

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Introduction

The consequences of trauma are frequently intergenerational. Trauma experienced by parental units can subsequently affect children's mental health via several psychophysiological pathways-particularly due to their malleable developmental stage [1]. Families who have undergone forced migration and resettlement are especially vulnerable to trauma, leaving the children of refugees uniquely susceptible to these intergenerational effects and highlighting a need to study parental traumas and their potential consequences on their offspring [2]. In recent years, the global population of refugees has increased significantly, emphasizing the importance of understanding their specific mental health needs in order to address them. Notably, self-reported rates of PTSD and depression as high as 84% and 95%, respectively, have been documented in refugees [3]. PTSD prevalence amongst refugee youth between the ages of 16 to 18 averages up to 42% [4]—a notably higher proportion than the average reported 3.9% prevalence in adolescents aged 13 to 18 in the United States [5]. Despite this discrepancy and need, refugee populations in the U.S. are historically understudied and underrepresented in psychiatric research [6].

Understanding the specific aspects of trauma that are most predictive of PTSD and other trauma-related disorders can aid in directing prevention and early intervention efforts. It is valuable to take into account the unique family dynamics and pre- and post-migrational stress amongst refugees that might lead to elevated observed rates of PTSD in both parents and children. While cumulative trauma is often correlated with trauma-related symptoms, recent research has demonstrated that stratifying trauma by the specific type of event experienced may have stronger predictive value for psychological outcomes [7–10]. For instance, Arnetz et al. (2014) investigated specific trauma subtypes in Iraqi refugees. In data from 298 refugees within 6 months of arriving to the U.S., differences emerged regarding how various trauma subtypes contributed to PTSD and depression symptomsspecifically, 'physical trauma to self'-when compared to isolating cumulative effects [10]. Other studies have found comparable results [7, 11, 12].

Furthering this focus on dimensions of trauma, a study carried out by Contractor et al. (2020) classified specific trauma types within the Life Events Checklist for the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (LEC-5), creating a version of the measure that allows for fine-grained investigation into patterns of trauma exposure and their effects [13]. This analysis identified three distinct trauma subtypes: accidental/ injury traumas (e.g., transportation accidents, traumatic injury), victimization traumas (e.g., physical or sexual assault), and death threat traumas (e.g., threatened with a weapon, exposure to war-zone). Of the three subtypes, in adults, victimization was more strongly correlated with experiencing PTSD, depression, and negative emotion dysregulation [13]. Findings in refugee youth have also revealed distinctions between trauma subtypes: Hinchey et al. (2023) recently found significant refugee youth rates of PTSD symptoms, specifically among those who experienced death threat traumas, which could be mirrored in further studies [14]. Given the broad lack of data specific to refugee youth and their families [6], we aimed to expand upon prior findings by exploring whether observed patterns of differential impact of trauma subtypes on individuals extends to the impact of parental trauma on refugee children.

These and similar works provide evidence that distinct trauma subtypes are qualitatively different in regard to their associations with mental health symptoms—in other words, though a strictly quantitative approach (i.e., assessing cumulative trauma only) provides useful information, a subtype approach often improves predictive validity in trauma research. Though this has been wellestablished in various populations (e.g., refugee adults and youth, general samples, veterans) [7, 8, 10–14], data on the potential downstream effects of parental trauma subtype exposure on refugee children is less available.

Data in non-refugee populations has well-established the role of parental trauma exposure in impacting children's mental health [1]. The likelihood of intergenerational impact of trauma has emerged in regard to the children of Holocaust survivors, veterans, indigenous peoples, and other trauma-exposed groups [17]. Resultantly, conceptualization of the impact of trauma on children has expanded from investigations of primarily direct personal exposure, to exploration of networks of social, familial, and parenting-related factors [18]. Though less examined, comparable dynamics have been documented in refugee populations. Among children of Southeast Asian refugee mothers, for instance, indirect associations have emerged between maternal traumatic distress and depressive symptoms, antisocial behavior, and delinquent behavior in children who did not experience traumatic distress themselves [2]. Further, in children of Somali refugee mothers, while no direct association was found between maternal trauma and child well-being, maternal PTSD and depressive symptoms mediated the effect of maternal physical trauma (i.e., torture) on child adjustment [19]. Taken together, findings demonstrate a need to further examine intergenerational, trauma-related psychological and psychosocial distress in refugee youtheven when they themselves did not experience or witness a particular trauma. Particularly for mother-child dyads, prior trauma and post-migration living stressors likely interact to impact family functioning and thus the mental health of children.

When considering stress and trauma in refugees, prior investigations have well-documented the importance of simultaneously accounting for the effects of post-migration living stressors. For instance, across refugee populations from a variety of backgrounds, studies have found that post-migration stressors, such as reduced social integration, time-consuming barriers to resettlement, weakened social networks, and loss of support systems within a shared culture, are linked to negative mental health outcomes [2, 20-22]. Notably, stronger intergenerational trauma associations have emerged in foreignborn refugee youth, as compared to U.S.-born children of refugee parents, indicating both the salience of resettlement stress and post-migratory lifestyle dynamics on child mental health [2]. It is possible, for instance, that the increased cultural, linguistic, and social closeness to parents experienced by children born in the family's home country-while providing various adaptive cultural and family factors-may also increase closeness to parental trauma impact, in addition to the potentially increased age of children born in the home country and thus more likely to perceive the stress of their parents [2]. It is crucial to understand which effects of parental trauma impact their children most-whether by transmission of trauma-related symptoms or impairment of daily functions due to lifestyle stressors-in order to allocate resources and supports.

To date, much remains unknown regarding the specific mechanisms through which family trauma exposure within the context of forced migration and resettlement impacts refugee children-and the potentially differential role of specific trauma subtypes is even less explored. Prior data has indicated links between child exposure to specific trauma subtypes and child PTSD symptoms in Syrian and Iraqi refugees-though has been unable to explain a high prevalence of child anxiety (up to 40.3%, and often a more common outcome than PTSD in refugee youth) [8, 23] through child trauma exposure alone [14]. Possibly, analyses of parental trauma would offer greater insights into high levels of anxiety in refugee youth-an understudied trauma-related outcome in this population, when compared to PTSD. A greater understanding of the pre- and post-migration parental factors mediating any associations between parental trauma exposure and risk of psychological symptoms in refugee youth is also needed. The goal of the current project was to organize and examine the responses of trauma-exposed refugee parents by the classifications defined by Contractor et al. (2020) [13], as prior studies in refugee youth yielded variable findings regarding links between child trauma exposure and child anxiety, depressive, or somatic symptoms (for findings related to child PTSD, see Hinchey et al., 2023) [14]. This project, therefore, aims to extend this line of research by investigating pathways from parental trauma to child symptoms, to query identifiable risk factors for less-examined Syrian and Iraqi refugee youth mental health symptoms (as compared to child PTSD, for which there is more available data).

In sum, three conclusions directed this project: (1) trauma subtypes are often more predictive of psychological effects than cumulative trauma and thus inform our research design; (2) parental trauma has undeniable effects on children, including when the trauma is not experienced by children themselves; and (3) post-migration living stressors must be taken into account in addition to pre-migration trauma, as these domains represent the two key influences on refugee mental health [20]. Based on prior research, we hypothesize that (1) parental trauma exposure will be associated with child psychiatric symptoms, with parental trauma subtype exposure explaining more variance in child mental health symptoms than cumulative parental trauma exposure; (2) differential associations between specific parental trauma subtypes and child symptom outcomes will emerge-for instance, the victimization trauma cluster may have the largest effect on child symptoms, as prior findings indicated that victimization was associated with worse mental health outcomes than other subtypes in adult refugees [8, 10]; and (3) parental symptoms and/or post-migration living stressors will mediate significant associations between parental trauma exposure and child symptoms. By gaining insight into which trauma subtypes, symptoms, and stressors in parents are most predictive of childhood psychiatric symptoms, we aim to better direct future interventions, as well as allocation of resources and supports, to address the vast refugee mental health crisis

Methods

Participants and procedures

Participants included accompanied minors from Syria and Iraq (n = 165) and their parents (n = 107); mothers: n = 56; fathers: n = 51), all of whom had resettled as refugees in [blinded]. All participants had experienced forced migration due to war in their home countries and were part of an existing cohort from an ongoing longitudinal study of refugee mental health [24]. Families were recruited at a non-profit social service agency providing physical health screenings for refugees upon their arrival in the U.S., during which they were offered the opportunity to participate in a paid, voluntary research study. Interested families were introduced to bilingual, Arab-speaking researchers by their physician and provided with informed consent documents to review. All youth participants included in this analysis provided oral assent (ages 7-12) or written assent (ages 13-17); their parent/guardian provided written informed consent prior to any study procedures. For a detailed description

of participants and procedures, see [blinded]. Youth included in the present study were accompanied by at least one parent, and data used for this analysis was collected during the data collection phase occurring approximately two years after arrival in the U.S. All study procedures were carried out in accordance with the latest version of the Declaration of Helsinki and approved by the Institutional Review Board at [blinded].

Measures

All self-report measures were administered by bilingual research assistants and clinicians and were available in both Arabic and English. Preparation of questionnaires involved translation by a native speaker from English to Arabic, back-translation by a different Arabic speaker to ensure accuracy, and final approval by external review. A demographic questionnaire was used to obtain participant characteristics.

Adult measures

Trauma exposure was assessed using the LEC-5, which prompts respondents to report level of exposure to 16 potentially traumatic events. The LEC-5 is widely used, valid, and reliable across cultures [25, 26]. Participants indicate whether they (a) directly experienced an event, (b) witnessed it, (c) learned about it, or (d) experienced it as part of their job, by responding "yes" or "no." To avoid confusion in interpreting results due to vague definitions of trauma (e.g., the potential for large variation regarding the context of learning about or witnessing an event), only direct exposure was examined. Consequently, the sum of "yes" responses to the 16 items related to directly experiencing an event was calculated to derive a cumulative trauma score, along with continuous scores within each trauma subtype category [13].

The PTSD Checklist based on the DSM-V (PCL-5) was used to assess severity of PTSD-related symptoms [27, 28]. The 20-item PCL-5 generates a sum score, with higher scores indicating greater symptom severity. This measure has well-documented validity across multiple types of trauma exposure, populations, and cultures [29, 30], and demonstrated high reliability in the current sample (α = 0.95).

Symptoms related to anxiety and depression were measured using the 25-item Hopkins Symptom Checklist (HSCL-25). Mean scores were separately calculated for 10 items related to anxiety, as well as 15 items related to depression, with higher scores signifying greater symptom severity [31]. Prior works have attested to the validity of the HSCL-25 in refugee populations [32], and reliability for the anxiety ($\alpha = 0.87$) and depression ($\alpha = 0.91$) subscales was excellent in this sample.

An adapted version of the Post-Migration Living Difficulties checklist (PMLD) was used to assess exposure to common post-migratory stressors during the past 12 months. Content for the PMLD was originally determined based on conversations with refugee and immigrant communities [33], and transcultural validity has since been documented [34, 35]. Items are related to isolation/separation from community, financial/employment challenges, access to health services, and other likely stressors. Respondents are prompted to rate these items using a Likert scale ranging from '0' ("no problem at all") to '4' ("very serious problem"); items are then summed to calculate a composite score. Prior to use in the current sample, two items (prompts "problems with landlord" and "problems with neighbors") were removed, as early data collection revealed they engendered confusion in the present population, seemingly due to their broad nature and the variety of participant living situations. Cronbach's alpha indicated good reliability in this sample ($\alpha = 0.78$).

Youth measures

Anxiety symptom severity was queried using the 41-item Screen for Child Anxiety-Related Emotional Disorders (SCARED). The SCARED prompts respondents to indicate the extent to which each item is true for them, with the sum of all items comprising a scale score [36]. The SCARED is valid and reliable across multiple cultures, and demonstrated excellent reliability in the youth sample ($\alpha = 0.93$).

The 33-item Mood and Feelings Questionnaire (MFQ) was used to assess severity of depressive symptoms. The MFQ solicits the extent to which various items are true for respondents, and is designed specifically for use in youth populations [37]. The MFQ is valid across many cultures, symptom levels, and populations [38–40], and internal reliability in this sample was also excellent ($\alpha = 0.92$).

Severity of somatic symptoms—i.e., somatic burden was measured using the 8-item Somatic Symptom Scale (SSS-8). The SSS-8 is a valid tool to assess the presence and severity of somatic symptoms, a contruct operationalized by summing item scores to produce a scale score with higher values representing greater somatic burden [41, 42]. In the current sample, reliablity was high ($\alpha = 0.78$).

Statistical analyses

A power analysis using Monte Carlo simulations was conducted in R version 1.4.1106, demonstrating that the sample of 165 children is powered at 80.5% at an alpha level of 0.05 to detect conservative, small-to-medium effect sizes in associations between parental trauma and child symptoms. Descriptive and main analyses were conducted in SPSS version 29.0. Descriptive statistics were evaluated to assess distributional properties, missing data, and adherence to model assumptions. First, person-median responses on symptom scales were used to impute missing data at the item level when 5 or fewer responses were missing on the MFQ, PCL-5, and SCARED, and when 2 or fewer responses were missing on the SSS-8; surveys with higher rates of item-level missingness were considered missing at scale level. Data screening yielded no significant deviations from normality, as evidenced by skewness and kurtosis values. Univariate outliers were detected using median absolute deviation (MAD) and corrected using winsorization. Pairwise plots were generated to evaluate linearity, homoskedasticity, and normality of residuals, for which no assumptions were violated. Pairwise correlations revealed no issues of multicollinearity (r < .9 for all), nor demographic control variables (using r > .3 as cut off). Age and sex were controlled in subsequent analyses based on evidence from prior literature [43]. Percentages of missing data were generally low, with the exception of PMLD scale scores (<6% for symptom scales; <17% for trauma variables; 36.4% for PMLD) and MCAR for both youth and adult samples (Little's $x^2 = 253.95$ and 357.77, respectively). Prior to main analyses, all adult measures were coded separately for mothers and fathers. A significance level of p > .05 was used, with subsequent Bonferroni correction for multiple comparisons.

To account for violation of the assumption of independence necessary for standard regression models, linear mixed-effects modeling (LMM) was performed with data from youth nested within families to test Hypotheses 1 and 2. LMM is a robust statistical technique for nonindependent data, while accounting for inter-individual variation of baseline symptoms and handling missing data suitably using maximum likelihood estimation [44]. Six models were developed to examine symptoms of depression (Model 1), anxiety (Model 2), and somatic burden (Model 3) as outcome variables, controlling for age and sex. For each outcome investigated, A models test cumulative trauma score as a predictor, while B models include the three trauma subtype variables as predictors, yielding the following: Models 1 A, 1B, 2A, 2B, 3 A, and 3B. Marginal and conditional pseudo-R² values were used to assess variance explained in final models [45]. For each model, youth age, youth sex, maternal trauma variables, and paternal trauma variables were entered as fixed effects. Intercepts were allowed to randomly vary across families, to account for possible unobserved family-level differences.

Multi-level mediation analyses were subsequently conducted to assess potential explanatory variables driving any significant associations between parental trauma variables and child symptoms identified by LMM (Hypothesis 3). Analyses were performed using the 'lavaan' structural equation modeling (SEM) package in R version 1.4.1106. SEM as a statistical approach to multilevel mediation handles missing data well using Full Information Maximum Likelihood (FIML) estimation, while allowing for nested individual data within families [46]. Parental mental health symptoms (i.e., PTSD, anxiety, and depression) and severity of post-migration living difficulties (PMLDs) were investigated as potential mediators of any significant associations between parental trauma exposures and child symptoms identified in LMM. Multilevel mediation analysis was implemented in 'lavaan' by modeling data at two levels: Level 1 (withinfamily) representing child-level data (e.g., child anxiety), and Level 2 (between-family) representing parent-level data (e.g., maternal PTSD, anxiety, depression). Family ID number was used as the grouping variable to account for the nesting of children within families. Mediation effects were tested using FIML to handle missing data and provide robust parameter estimates.

Results

Descriptive statistics

Sample characteristics are summarized in Table 1. The mean age of youth participants was 12.59 (*SD* = 2.91; range = 6 to 19) and roughly half were female (46.7%). 95.2% of youth reported Syria as their country of origin, with 3.2% reporting Iraq and 1.6% reporting "Other." 98.0% of youth were of Arab ethnicity and 2% were Kurdish. In youth, the average severity of symptoms related to depression (M = 11.03, SD = 9.21) and somatic burden (M = 4.56, SD = 4.33) was low-to-moderate, while anxiety symptom severity was more severe, with a mean approaching the diagnostic cut-off (≥ 25) [37] for a probable anxiety disorder (M = 24.29, SD = 14.46). Of the youth sample, 47.4%, 21.6%, and 0% had mothers who reported at least one death threat trauma, accident/injury trauma, and/or victimization trauma, respectively. 52.9%, 42.8%, and 11.6% of youth's fathers reported at least one death threat trauma, accident/injury trauma, and/or victimization trauma. The average number of cumulative trauma exposures reported by mothers was 1.31 (SD = 1.72), with fathers reporting 1.93 (SD = 1.98). Maternal and paternal PTSD symptoms were low-to-moderate (maternal: M = 24.88, SD = 18.88; paternal: M = 22.51, SD = 19.30). Symptoms related to anxiety (maternal: M = 1.73, SD = 0.56; paternal: M = 1.65, SD = 0.55) and depression (maternal: M = 1.84, SD = 0.59; paternal: M = 1.61, SD = 0.55) were more severe and close to the cut-off score for probable diagnoses on the HSCL (≥ 1.75); [12].

Parental trauma exposure and child symptoms

A series of random-intercepts LMM analyses were conducted to test possible associations between parental trauma variables and child symptoms (i.e., anxiety, depression, and somatic burden; Hypotheses 1 and 2),

Table 1	Demographic	characteristics	and descri	iptive stati:	stics of
vouth sa	mple				

Table 2	Results	of final	linear	mixed-	effects	models	predicti	ng
child der	oression	sympto	om sev	veritv				

	Range	М	SD
Age	6-19	12.59	2.91
Female, %		46.7	
Country of origin, %			
Syria		95.2	
Iraq		3.2	
Other		1.6	
Ethnicity, %			
Arab		98.0	
Kurdish		2.0	
Anxiety Sxs	0-53.5	24.29	14.46
Depression Sxs	0-30	11.03	9.21
Somatic Sxs	0-13.5	4.56	4.33
Maternal			
Anxiety Sxs	1-2.9	1.73	0.56
PTSD Sxs	0-64.5	24.88	18.88
Depression Sxs	1-2.93	1.84	0.59
Accident/Injury	0-3	0.39	0.84
Victimization	0-0	0	0
Death threat	0-4	0.84	1.12
Cumulative trauma	0-7	1.31	1.72
Paternal			
Anxiety Sxs	1-2.9	1.65	0.55
PTSD Sxs	0-64.5	22.51	19.30
Depression Sxs	1-2.93	1.61	0.55
Accident/Injury	0-4	0.76	1.07
Victimization	0-1	0.12	0.32
Death threat	0-4	0.96	1.10
Cumulative trauma	0-8	1.93	1.98
Maternal Anxiety Sxs PTSD Sxs Depression Sxs Accident/Injury Victimization Death threat Cumulative trauma Paternal Anxiety Sxs PTSD Sxs Depression Sxs Accident/Injury Victimization Death threat Cumulative trauma	1-2.9 0-64.5 1-2.93 0-3 0-0 0-4 0-7 1-2.9 0-64.5 1-2.93 0-4 0-1 0-4 0-8	1.73 24.88 1.84 0.39 0 0.84 1.31 1.65 22.51 1.61 0.76 0.12 0.96 1.93	0.56 18.88 0.59 0.84 0 1.12 1.72 0.55 19.30 0.55 1.07 0.32 1.10 1.98

Note. Ranges refer to the range of sample, not possible range of scores on measures (youth: *n*=165; parents: *n*=107). LEC-5 items included in each subtype category are as follows: (1) accident/injury (items 1-4 and 12); (2) victimization (items 6, 8, and 9); and (3) death threat (items 5, 7, 10, 11, and 13-16; Contractor, 2020). Abbreviations: Symptoms (SxS)

controlling for age and sex and nesting individuals within families. The depression models (1 A and 1B; see Table 2) vielded positives relation between maternal cumulative trauma (b = 1.64, SE = 0.59, t = 2.78, p = .007, LLCI = 0.46, ULCI = 2.83) and the maternal death threat trauma subtype (b = 2.70, SE = 1.13, t = 2.40, p = .020, LLCI = 0.44,ULCI = 4.95) on child depressive symptoms. Marginal R^2 values specified that fixed effects explained 8.4% of the variance in symptoms in Model 1 A and 9.6% in Model 1B. Per conditional R^2 values for Models 1 A and 1B, 30.5% and 30.8% of the variance was explained by both fixed and random effects, respectively. The anxiety models (2 A and 2B; see Table 3) revealed a positive association between maternal cumulative trauma and child anxiety symptom severity (b = 1.79, SE = 0.82, t = 2.18, p = .034, LLCI = 0.14, ULCI = 3.45). Here, 10.6% of the variance was explained by fixed effects (marginal R^2), with fixed and random effects accounting for 30.9% of the variance in child anxiety (conditional \mathbb{R}^2). The trauma

	Est/Beta	SE	95% CI	t	p		
Cumulative Trauma Model (1 A)							
Intercept	11.05	3.52	4.08-18.03	3.14	0.002		
Female	0.82	1.46	-2.08-3.73	0.56	0.575		
Age	-0.15	0.25	-0.65 - 0.34	-0.61	0.545		
Cumulative Trauma (maternal)	1.64*	0.59	0.46-2.83	2.78	0.007		
Cumulative Trauma (paternal)	-0.46	0.49	-1.44 - 0.53	-0.94	0.352		
Trauma Subtypes N	lodel (1B)						
Intercept	11.37	3.52	4.41-18.34	3.24	0.002		
Female	0.66	1.48	-2.28- 3.60	0.45	0.657		
Age (Time 1)	-0.14	0.25	-0.64 - 0.35	-0.58	0.565		
Death Threat (maternal)	2.70*	1.13	0.44– 4.95	2.40	0.020		
Accident/Injury (maternal)	0.42	1.58	-2.76-3.61	0.27	0.790		
Victimization (paternal)	1.53	3.52	-5.55- 8.61	0.43	0.666		
Death Threat (paternal)	-1.57	1.15	-3.87 - 0.74	-1.37	0.178		
Accident/Injury (paternal)	0.32	1.19	-2.08- 2.72	0.268	0.790		
Random Effects							
Cumulative Trauma N		Variance	SE				
Residual		55.97	8.91				
Intercept (Family)		17.82	8.88				
Trauma Subtypes Mc	del						
Residual		56.73	8.85				
Intercept (Family)		17.35	8.48				
Model fit							
Cumulative Trauma N	Nodel						
Pseudo-R ²			Marginal	Conditional			
			0.084	0.305			
Trauma Subtypes Mc	del						
Pseudo-R ²			Marginal	Conditional			
			0.096	0.308			

Note. Participants were nested within families to account for nonindependence of observations. Abbreviations: Random effects (RE); Fixed effects (FE). Pseudo-R² values were calculated using SPSS version 29.0 software via methods described in Nakagawa & Schielzeth (2013). *p <.05

subtypes model yielded no significant results and was rejected in favor of the cumulative trauma model. Finally, the somatic models (3 A and 3B) indicated positive associations between maternal cumulative trauma (b = 0.56, SE = 0.26, t = 2.20, p =.032, LLCI = 0.05, ULCI = 1.07) and maternal death threat trauma (b = 1.04, SE = 0.50, t = 2.09, p =.041, LLCI = 0.04, ULCI = 2.04) on child somatic burden (Table S1). Pseudo R^2 values indicated that 6.8% of the variance in somatic burden was explained by fixed effects in Model 3 A and 8.4% in Model 3B; fixed and random effects combined explained 21.7% and 21.3% of the

Cumulative Tra					
cumulative mat	ima wodei	(2 A)			
Intercept	30.36	5.21	20.06– 40.66	5.83	<0.001
Female	5.23*	2.22	0.84- 9.62	2.36	0.020
Age	-0.78*	0.38	-1.520.03	-2.07	0.041
Cumulative Trau- ma (maternal)	1.79*	0.82	0.14-3.45	2.18	0.034
Cumulative Trau- ma (paternal)	-0.59	0.72	-2.04 - 0.86	-0.82	0.415
Trauma Subtype	es Model (2	B)			
Intercept	29.90	5.17	19.66– 40.14	5.78	<0.001
Female	4.99*	2.22	0.59– 9.39	2.25	0.027
Age (Time 1)	-0.76*	0.37	-1.490.02	-2.04	0.044
Death Threat (maternal)	2.03	1.66	-1.29– 5.36	-0.49	0.226
Accident/Injury (maternal)	1.13	2.33	-3.55- 5.81	0.49	0.629
Victimization (paternal)	-2.60	5.32	-13.29-8.09	-0.49	0.627
Death Threat (paternal)	-0.72	1.73	-4.18- 2.75	-0.41	0.680
Accident/Injury (paternal)	0.32	1.76	-3.21- 3.86	0.184	0.855
Random Effects					
Cumulative Traur	na Model			Variance	SE
Residual				134.42	20.32
Intercept (Family))			39.54	18.92
Trauma Subtype	es Model				
Residual				133.96	20.08
Intercept (Family))			39.47	18.64
Model fit					
Cumulative Trau	ıma Model				
Pseudo-R ²			Marginal	Conditional	
			0.106	0.309	
Trauma Subtype	es Model				
Pseudo-R ²			Marginal 0.103	Conditional 0.307	

Table 3 Results of final linear mixed-effects models predicting child anxiety symptom severity

Note. Participants were nested within families to account for nonindependence of observations. Abbreviations: Random effects (RE); Fixed effects (FE). Pseudo-R² values were calculated using SPSS version 29.0 software via methods described in Nakagawa & Schielzeth (2013). *p <.05

variance, respectively. Across all models, paternal trauma variables yielded no significant associations with any child symptoms.

Bonferroni correction for multiple comparisons at the p > .008 level (0.05/6 models) indicated that the association between maternal cumulative trauma and child depressive symptoms (p = .007) was the most reliable finding.

 Table 4
 Results of multi-level mediation analysis predicting

 child depression symptom severity

	Est/Beta	SE	z	р			
Direct Effects (Predictor > Outo	ome)						
Age> Child Depression	-0.06	0.25	-0.25	0.804			
Female> Child Depression	-0.53	1.49	-0.36	0.722			
Cumulative Trauma (M)> PTSD (M)	4.51*	0.81	5.57	<0.001			
Cumulative Trauma (M)> Anxiety (M)	0.11*	0.03	4.19	<0.001			
Cumulative Trauma (M)> De- pression (M)	0.10*	0.03	3.61	<0.001			
Cumulative Trauma (M)> PMLD (M)	2.96*	0.52	5.69	<0.001			
Cumulative Trauma (M)> Child Depression	0.44	0.57	0.78	0.438			
PMLD (M)> Child Depression	0.21*	0.11	1.97	0.049			
PTSD (M)> Child Depression	0.05	0.05	0.87	0.383			
Anxiety(M)> Child Depression	-2.21	2.32	-0.95	0.342			
Depression (M)> Child	1.09	1.95	0.56	0.576			
Depression							
Indirect Effects (on Child Depression)							
PTSD (M)	0.02	0.03	0.67	0.502			
Anxiety (M)	-0.97	1.64	-0.59	0.553			
Depression (M)	0.48	1.08	0.44	0.657			
PMLD (M)	0.09	0.10	0.87	0.384			
Total	7.30*	1.34	5.46	< 0.001			

Note. Participants were nested within families to account for nonindependence of observations. Unstandardized estimates are reported. Abbreviations: Random effects (RE); Fixed effects (FE); Maternal (M); Post-migration living difficulties (PMLD)

Mediators of maternal trauma and child symptoms

Multilevel-mediation analyses were then performed to investigate potential mediators of any significant associations observed in LMM analyses (Hypothesis 3). Potential mediating effects of maternal PTSD, anxiety, and depression symptoms, as well as maternal selfreported PMLDs were queried. The first model revealed a direct effect of cumulative maternal trauma on maternal PMLDs (b = 2.96, SE = 0.52, z = 5.69, p < .001), a direct effect of maternal PMLDs on child depressive symptoms via (*b*=0.21, *SE*=0.11, *z*=1.97, *p*=.049; Table 4; Fig. 1), and a non-significant relation between cumulative maternal trauma and child depression, such that maternal PMLDs fully mediated the previously observed relation. Individual indirect effects were non-significant, however (Table 4). Maternal symptoms were not identified as significant mediators. A subsequent model predicting child anxiety symptoms indicated that maternal PTSD and anxiety symptoms fully mediated the relation between maternal cumulative trauma and child anxiety (see Table S2; Fig. 1). A significant positive indirect effect of maternal PTSD (b = 0.23, SE = 0.07, z = 3.10, p = .002) and a significant negative effect of maternal anxiety (b=-7.34), SE = 3.54, z = -2.02, p = .044) emerged. Indirect effects were



Fig. 1 Multilevel mediation analysis indicating: (A) Maternal post-migration living difficulties as a mediator of the relation between cumulative maternal trauma and child depression symptoms, and (B) Maternal PTSD symptoms and maternal anxiety symptoms as mediators of the relation between cumulative maternal trauma and child anxiety symptoms. *p < .05. **p < .01.

again non-significant. In both models, no indirect effects of maternal death threat trauma on child symptoms through other variables were identified. Additionally, no evidence of mediation was found related to child somatic symptoms. To assess the robustness of significant findings, sensitivity analyses were conducted by rerunning the analyses with bootstrapping (1000 samples). All prior associations survived to at least a trending significant level (p = .067 for relation between maternal PMLDs and child depression), with the exception of the negative effect of maternal anxiety on child anxiety (p=.11), thus supporting the stability of the results across different estimation methods. Given that FIML is robust for use with complex, multilevel mediation in data that meets assumptions of normality, results from original analyses are presented with sensitivity analyses noted.

Discussion

This study investigated pathways from parental exposure to various trauma subtypes, reported post-migration living difficulties, and psychological symptoms, to anxiety, depressive, and somatic symptoms in 165 accompanied refugee youth. Additionally, analyses sought to clarify whether stratifying parental trauma exposure by subtype, as compared to cumulative trauma scores, would better predict youth outcomes.

Initial LMM analyses revealed that maternal cumulative trauma and maternal death threat trauma predicted both child depressive symptoms and child somatic burden. Cumulative maternal trauma also predicted child anxiety, though no significant relations emerged between maternal trauma subtypes and child anxiety symptoms. Additionally, no paternal trauma variables were associated with any child symptoms; thus, paternal trauma factors were excluded from subsequent analyses. Therefore, Hypotheses 1 and 2 were partially supported.

Multi-level mediation analysis was employed to investigate potential mediators of any significant relations, indicating partial support for Hypothesis 3. Using a Baron and Kenny approach to interpret findings, maternal PMLDs were found to fully mediate the relation between mothers' cumulative trauma and child depressive symptoms, based on significant direct effects and non-significance of the previously observed relation between cumulative maternal trauma and child depression (Fig. 1) [47]. Notably, the indirect effect of maternal PMLDs was not significant in this model; possibly, this contradiction was likely due to a smaller sample size. This finding should therefore be considered preliminary. Similarly, maternal PTSD and anxiety symptoms fully mediated the association between mothers' cumulative trauma and child anxiety symptoms based on a Baron and Kenny interpretation, though the unexpected negative effect of maternal anxiety did not survive sensitivity analyses.

No mediation effects were identified regarding relations between maternal death threat trauma and child anxiety or depressive symptoms; nor did any significant mediating factors emerge between maternal traumas and child somatic burden.

Findings indicated that children with mothers who were exposed to pre-migration trauma had both psychiatric and somatic impact. As earlier research has clearly established, the refugee community has had on average a higher rate of exposure to trauma [2, 3]. These results, however, indicate that this exposure not only contributes to PTSD, depression, anxiety, and other somatic symptoms in those exposed, but that the impact of such events may extend throughout the family unit. This may be particularly relevant considering certain circumstances of parental trauma-namely, maternal death threat traumas and cumulative maternal trauma-that predicted child depressive and somatic symptoms (a dynamic not observed following the accident/injury trauma subtype). Additionally, the hypothesized role of PMLDs as a potential pathway through which the consequences of trauma manifest into mental health impact on youth was supported, as severity of PMLDs fully mediated the relation between maternal cumulative trauma and youth depressive symptoms. The ability to analyze victimization trauma and its related outcomes would have strengthened this study, and the lack of reporting may lead to hypotheses regarding an underreporting of this specific trauma.

Overall, our expectation that trauma subtypes would demonstrate predictive utility over cumulative trauma was partially supported (Hypothesis 1). Cumulative trauma was associated with every child symptom category examined. In fact, in the case of child anxiety, the most severe symptom in this cohort, cumulative trauma was the only trauma measure with predictive value. This is in line with findings from Hinchey et al. (2023) [14], linking cumulative trauma in refugee youth to youth anxiety symptoms; notably, that analysis did not examine child depression or somatic symptoms using child trauma exposure and highlighted a need for deeper exploration of these youth outcomes. Subsequently, the current study furthered extant research by explaining factors that may lead to child anxiety, depression, and somatic symptoms using parental trauma exposure and mediators as predictors. The death threat subtype as experienced by youth themselves has also previously been linked to youth PTSD symptoms [14]; interestingly, death threat was also the only maternal trauma subtype that predicted child depressive and somatic symptoms herein. It is important to note, however, that no victimization trauma was reported by mothers in this sample (possibly due to underreporting, which is common in refugee populations) [6]—therefore no conclusions were possible regarding the impact of maternal victimization on child symptoms.

The lack of paternal impact on predicting child symptoms represents another valuable finding. This suggests that, within the refugee family dynamic, the maternal unit is notably more impactful to children—possibly as mothers often spend more time with the children and form more emotional relationships that shape child development. Future studies may wish to examine whether that varies based on sex of the child; though our sample was roughly even (46.7% female minors).

The observed salience of PMLDs in regard to intergenerational trauma transmission is aligned with many studies indicating the role of PMLDs in refugee mental health [2, 20-22]; our findings extend upon this by clarifying the influence of post-migration stress in mediating maternal trauma exposure's impact on depression in refugee youth. Studies across populations have indicated the likelihood for trauma exposure to exacerbate the impact of later stressors-regarding both neurobiological and psychological mechanisms (e.g., altered stress reactivity; changes to stress coping) [48]. A worthy aim of future study may include further examining this pathway; for instance, perhaps dyregulated stress coping due to prior trauma impacts parenting style, parent availability, and/ or overall household stress-thereby contributing to child depressive symptoms. This specific significance of PMLDs also provides direction for future advocacy: while local public health interventions for refugee communities cannot limit or prevent trauma occurring prior to migration, understanding that PMLDs-such as lack of community supports, language barriers, and loss of social networks-following maternal trauma contribute to depression in youth could guide family-based support and advocacy efforts geared towards mitigating the impact of intergenerational trauma [20–22]. Further, such interventions may be most effective if targeted towards mothers, as culturally they are more involved in childrearing and statistically their experiences are associated with youth outcomes. Future studies may also compare these findings to pathways of symptom development in unaccompanied refugee youth, to gain insight into latent parental protective factors [49].

Findings from the current study must be considered alongside several limitations. Initially, despite a moderately sized youth sample (n = 165), parental samples were smaller (mothers: n = 56; fathers: n = 51), as siblings with the same parents were recruited. This may explain lack of significant indirect effects, despite observed mediation based on other metrics. Generalizability is therefore limited; larger samples are needed to corroborate these findings. Both family and trauma dynamics also vary depending on cultural and ethnic background, indicating that findings in one cultural group may not generalize across populations [1, 50]. Given the underrepresentation of persons of Middle Eastern descent in psychiatric research, population-specific analyses remain essentialthough caution should be taken regarding applying findings related to family dynamics in one culture to another. Further, data for the current study relied on self-report from both parents and youth, introducing risk of underreporting, particularly considering trauma-related events and symptoms. This may be particularly prevalent in refugee populations [3, 6] and in regard to reporting of assault-based traumas [51]. In other words, this limitation may have contributed to the lack of assault-based traumas reported by mothers in the current sample. As victimization (i.e., physical and sexual assault) has been strongly linked to trauma symptomatology in both refugee and non-refugee populations-including in Syrian and Iraqi refugee groups [7, 52, 53]-the lack of reported exposure to assault-related events (whether due to a true lack of exposure or underreporting) limits investigation into this significant dimension of trauma exposure. Additionally, though data collection procedures were broadly the same in adults and youth, some measures differed between the two groups. For instance, the SCARED was used to assess anxiety in youth, while the HSCL-25 was used to assess anxiety in adults-as is recommended for these age groups. Though symptom constructs were not measured identically across youth and parents, as youth symptoms were the variables of interest it is unlikely that this influenced results. Finally, as this analysis did not involve an examination of the effect of children's own exposure to trauma-exposure that is necessary for symptom outcomes to be considered PTSD-related-it was not empirically supported to argue that parental trauma could cause true PTSD symptoms in children. Further, in this cohort, we have previously recorded much higher prevalence of possible anxiety disorders (up to 57%) than PTSD (up to 9%) [54], making internalizing symptoms a priority for analysis.

Ultimately, the current findings indicate that maternal death threat traumas have particular predictive value regarding child depressive and somatic symptoms; maternal PMLDs may explain links between maternal cumulative trauma and child depression; maternal trauma is significantly predictive of child symptoms, whereas paternal trauma is not; and cumulative maternal trauma is ultimately most predictive of youth symptoms. Notably, all relations refer to child outcomes two years postresettlement-indicating the long-term impact of trauma on displaced families, even years after arrival in the host country. These insights have practical implications for addressing the lived experiences of refugee families and how mental health impact may subsequently manifest. It is fair to conclude that refugee youth mental health is thus a family issue—and one that can likely be effectively addressed through family-centered interventions and advocacy. Future research investigating possible pathways between maternal trauma, maternal PMLDs, and child symptoms would be a worthy aim. In other words, without adequately considering maternal pre-migration trauma or challenges experienced by refugee families post-migration, root causes of the refugee youth mental

Supplementary Information

health crisis will remain unaddressed.

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Supplementary Material 1

Supplementary Material 2

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Author contributions

Shirley ElFishawy: Conceptualization, Writing– Original Draft, Writing -Reviewing and Editing, Liza Hinchey: Conceptualization, Methodology, Writing– Original Draft, Writing - Reviewing and Editing, Formal Analysis Rachel Morrison: Writing– Original Draft; Mahmood Sanad: Writing– Original Draft; Arash Javanbakht: Writing - Reviewing and Editing, Funding Acquisition, Investigation, Supervision.

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Data availability

Wayne State University requires data use agreements to be drafted and approved prior to any data sharing. If investigators are interested in accessing data, agreements will need to be drafted and approved between institutions and investigators in order to protect these data. Therefore, data cannot be made publicly available at this time, however, data can be made available by request to the authors and institutional approval with an appropriate data use agreement.

Declarations

Ethics approval

All study procedures were carried out in accordance with the latest version of the Declaration of Helsinki and approved by the Institutional Review Board at Wayne State University—IRB #012416B3F.

Consent to participate

Participants and their parents were given the opportunity to join a paid, voluntary research study during health screenings at primary care clinics during their first month of resettlement. Interested parties were introduced to the research group by their physician and provided with informed consent documents. All youth participants included in this analysis provided oral

assent (ages 7–12) or written assent (ages 13–17); their parent/guardian provided written informed consent prior to any study procedures.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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