Impacts of Maternal Histories of Violence and Displacement on Offspring Health at the Thai-Myanmar Border

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Record-high forced displacement constitutes a global public health emergency where women and children face disproportionate health risks. Studying how displacement experiences shape perinatal outcomes provides key insights for improving maternal and child health for displaced populations and furthermore elucidates how common, yet understudied, patterns of stress over the life-course contribute to health disparities. For instance, how do maternal histories of war-related instability and trauma before birth affect offspring health? And to what degree are these effects mitigated or exacerbated by women's post-displacement circumstances in the perinatal period, e.g., housing quality, working conditions, or deportation risks? I investigate these questions using survey data I collected from 375 maternal-child pairs at the Thai-Myanmar border including maternal life events and child birthweight and anthropometry for children born between 2011 and 2015. Preliminary study results suggest that low birth weight risk is significantly influenced by maternal stressors both pre- and post-displacement.

BACKGROUND

Global forced displacement is at record highs, continues to rise, and poses grave health concerns for the vulnerable populations affected, and for future global health needs more broadly. The effects of displacement remain woefully understudied, particularly among those in non-Western and more protracted situations who represent the majority of those displaced and who disproportionately face chronic and toxic stress related to poor social reception and lack of legal protections or social provisions in host countries. Studying displacement-related stressors and their health impacts furthermore has the potential to provide key insights into how the lived experiences of displacement are understood and how related stressors are embodied.

Below, I setup the current study by briefly reviewing how patterns of displacement result in stress patterns of interest, how maternal stress can influence adverse birth outcomes and offspring health, and why the Shan people at the Thai-Myanmar border constitute an important study population for investigating these processes more closely.

I. Patterns of displacement and patterns of stress

Stressors occur in every environment, but pose distinct challenges to an individual or group depending on their nature (e.g., predictability or controllability), frequency or duration, proximity (how recent), and intensity (acute or chronic). These defining features of stressors dramatically shape human responses and adaptations to stress, both advantageously and disadvantageously (Koolhaas et al 2016). Theories of how stressors contribute to individual health depend on which dimension(s) are emphasized and tend to fall the following different, sometimes overlapping, models.

Cumulative toxic stress: McEwen and McEwen's (2017) toxic stress model synthesizes biosocial pathways from poverty and social stratification to differential health outcomes via stress mechanisms. Past trauma, repeated adverse life events, and chronic social disadvantages are all stimuli that contribute to the buildup of toxic stress in the body and can overload the body's ability to maintain allostasis: the optimally balanced regulation of the body's stress responses via the HPA axis (McEwen 1998, McEwen and McEwen 2017).

Severe trauma: Personal histories of acute violence or war-related trauma, such as experiences of forceful evacuation by a militia or direct exposure to overt violence can pose distinct health risks beyond the buildup of daily stressors. Studies linking trauma to health outcomes partially overlap with the toxic stress literature, but tend to focus more on posttraumatic reactions that involve mental health disorders and maladaptive coping behaviors (Schnurr and Green 2004). Acute trauma can also trigger or accelerate hyperactivity or shutdown of the biological stress responses reviewed above (McEwen and McEwen 2017).

Specific forms of oppression: *Everyday violence*—such as prolonged military occupation,

police surveillance, and other daily threats posed to marginalized groups—could also pose unique health risks. However, empirical studies examining this link remain sparse. Theorized health pathways involve: (1) a heightened state of anxiety or unrest in response to the uncertainty, lack of security, and feelings of powerlessness around what will happen (Duschinski 2009; Goldsmith 2009; Romero and Serag 2004; Weitzer and Tuch 2002); and (2) the normalization of such threats or actual violence as a coping mechanism that can be internalized in ways harmful to one's health and wellbeing (Gee et al 2012; Green 1994; Thoits 2010).

Vulnerability, Resilience, or Adaptation: The health implications of social stressors not only depend on the intensity and nature of any given stressor, but also on the patterns of social stressors and responses over the life-course, as well as individual variability. Past, current, and ongoing exposures to different social stressors can lead to immediate and long-term individual stress responses and adaptations, which are also shaped by other stressors, individual characteristics, and social support—leading to social patterns of vulnerability or resilience.

II. Maternal stress and adverse birth outcomes

Existing research has uncovered several pathways through which maternal life stressors translate into differential offspring health and development in the perinatal period, each of which likely influences links between displacement, stress, and birth outcomes in the current study. The many different pathways can be generally characterized as follows:

Environmental and social stressors during pregnancy: Maternal physiological stress responses during pregnancy, when overstimulated, can pose immediate harm to fetal health. Maternal psychosocial distress and maternal mental disorders during pregnancy significantly impede fetal growth, likely mediated through maternal cortisol dysregulation (Wadhwa 1993, Lewis et al 2016, Thomson 2013). Stress reactivity is also linked to immune and inflammatory processes during pregnancy, which can lead to premature birth and longer term health complications for offspring (Culhane et al, 2001, Christian 2012).

Preconception stressors, allostatic load, and pregnancy health: An additional avenue

linking maternal stress to adverse birth outcomes is through the preconception wear and tear, or allostatic load (McEwen, 1998), on the mother's body that can lead to forms of premature aging, or "weathering", that can cause suboptimal fetal environments during pregnancy, such as poor vascular health and maladaptive stress and immune responses (Geronimus, 1992; Wadhwa 2005). Additionally, it is very possible that the mechanisms linking maternal stress responses during pregnancy to fetal development could be critically initiated preconception.

Epigenetic pathways: Maternal stressors can also influence fetal health and development via epigenetic pathways involving DNA methylation and histone modifications in mothers and infants. Animal studies have provided the clearest demonstrations of such effects via manipulations of maternal traits or environments that lead to divergent offspring health and development, including experimental manipulations of psychosocial stress before and during pregnancy (Elliott et al., 2010; Weaver et al., 2004; Meaney et al., 2007).

III. The Thailand-Myanmar Border: A Critical Study Setting

This study is based at the Thai-Myanmar border, specifically between the Shan State in Myanmar and Chiang Mai Province in Thailand, because its population is particularly well suited for comparing patterns of displacement, stress, and health due as follows.

First, dominant drivers of displacement out of conflict-ridden Myanmar have led to insightful comparison groups defined by markedly varied personal histories of displacement and stress at the Thai side of the border. These groups contrast from each other along critical stressor dimensions over the life-course. These stress patterns originate out of the essential randomness in how violence is structured in the different villages in the Shan State (Myanmar), from which many Shan women now residing at the Thai side of the border came (Grundy-Warr 2004). The similarly situated Shan women born in Thailand provide an additional comparison group of the same ethnic and cultural background without any direct exposure to the Myanmar conflict or displacement-related stressors. A cluster analysis of maternal historical events in the study sample uncovers configurations of pre-displacement events as either dominated by little to no direct exposure to conflict or military forces ("low military violence"); surveillance and taxation

(“military occupation”), severe deprivation, evacuation, and forced labor (“deprivation/ evacuation”); or more severe violence associated with military invasion (“severe military violence”).

Second, Thailand’s social and political inclusion and exclusion of certain minority and migrant groups from Myanmar has been inconsistent across years and entry points, resulting in distinctly different post-displacement contexts. For instance, Shan migrants meeting the UNHCR definition of refugee can be found in post-displacement settings that range from UN-managed refugee camps, to remote villages, to urban construction sites (Mekong Migration Network 2012). Similarly, individuals have rather arbitrarily received different legal documentation that affects their daily personal safety, ability to work, and human rights protection (Grundy-Warr 2004). A cluster analysis in the study sample of life events and circumstances on the Thai side of the border uncovers configurations of Thai-side (or post-displacement) contexts related to these factors that can be characterized as relatively high or low threats to livelihood related to specific cases of work-related exploitation, mobility restrictions, and risks of arrest or deportation.

STUDY HYPOTHESES

Study hypotheses draw from the theories reviewed above to better understand dominant pathways linking maternal stress patterns reflected in historical displacement to birth outcomes. Consider a simplified illustration with comparison groups defined by pre- and post-displacement contexts. These patterns of displacement can be thought of as stressor trajectories: high-to-high (H-H), low-to-low (L-L), high-to-low (H-L), and low-to-high (L-H). Their comparisons can reveal underlying stress-related processes as follows:

1. Cumulative Stress/Disadvantage (with or without interaction). The negative effects of toxic stress presumably accumulate over the life-course based on the duration and intensity of past and ongoing stressors. In this case, the L-L group would experience the highest health risk, adjusting for other risk factors, and the H-H the lowest. The magnitudes of association related to pre- and post-displacement could be additive (non-interactive) or they could be synergistic, e.g., pre-displacement stressors could result in an exaggerated physiological stress response to subsequent stress (i.e.,

post-displacement), possibly due to overstimulation or failed shutdowns.

2. Post-traumatic shock and legacy effects. A greater health disadvantage related to the trauma of witnessing or experiencing severe violence, or both that goes beyond other background stressors. In this case, experiencing acute trauma (for this study, it would be war trauma pre-displacement) would be a critical factor for both H-H and H-L groups that could put both groups at similarly high risk.
3. Resilience: Short-term Stress Memory. Resilience to historical stress could be considered short-term stress memory, i.e., individuals would be sensitive to immediate stress environments (post-displacement contexts) but would not show long-lasting effects of historical stress environments (pre-displacement contexts). Here, the L-H and H-H groups would experience similarly higher risks relative to L-L and H-L.

APPROACH

In this study, I use novel data from surveys I conducted of women who gave birth between 2011-2015 and who live in study villages on the Thai side of the Myanmar border. The villages represent different histories of displacement from the Shan State, Myanmar, to Thailand and I compare women's birth outcomes—birthweight specifically—are compared to investigate the following:

1) How do different displacement histories, defined by related stressors, influence women's subsequent risk of giving birth to a low birth weight infant?
2) How do personal historical patterns of pre- and post-displacement contexts—i.e. interactions between these contexts—influence women's risk of giving birth to a low birth weight infant?

Data: Maternal and Child Health Survey at the Chiang Mai-Shan State Border

The final analytical sample for this is drawn from an original survey conducted in 2015-2017 in two border sub-districts that are primarily ethnic Shan. The original survey sample includes 815 mother-child pairs. All women who gave birth between 2011-2015 in selected villages were sampled (99% participation). A subset of the sample is used for the preliminary analyses presented here, where all of the mother's and child's information are complete (261; 32%). Multiply imputed data will be explored for the final analysis.

None of the women in analytical sample were pregnant when surveyed.

Table 1.

Study socio-demographic characteristics, with means and standard deviations (sd), or percentages.

	Mean/ Percent	**sd**
Child Health Outcomes		
Low Birth Weight	15.7%	
Stunting (WHO; length-for-age)	17.4%	
Underweight (WHO; weight-for-age)	9.3%	
Wasting (WHO; mid-upper arm circumference)	9.3%	
Maternal-reported child health fair/poor	48.3%	
Child infection/illness	16.3%	
Neonatal diarrhea	4.1%	
Migration History (Pre-Displacement Context)		
Born in Thailand	33.1%	
Migrant – Low Military Violence (M-LMV)	44.2%	
Migrant – High Military Exposure (M-MO/ M-SVDE)	22.7%	
Ethnic minority	89.5%	
Thailand (Post-Displacement) Context		
Thailand: Low Threats	48.8%	
Thailand: High Threats	51.2%	
Legal documentation		
Citizen/ Legal resident	55.2%	
Legal documents: Passport/ work permit	30.2%	
Legal documents: None	14.5%	
Residence Type		
Residence: Village	72.1%	
Residence: Worksite	26.7%	
Residence: Camp	1.2%	
Any Health Insurance	92.4%	
Child Age (years)	1.8	1.4
Maternal Age at Birth	26.7	6.1
Firstborn	38.4%	

Measures

Histories of displacement and related stress patterns: Maternal patterns of displacement

(and related stressors) constitute the study's primary comparison groups and are measured as group membership to different categories determined by a previous analysis not shown, a joint multiple correspondence analysis (MCA) and cluster analysis that identified common configurations of maternal reported life events, stratified by pre- and post-displacement. Group memberships are coded as binary indicator variables and each study subject is a member of a single pre-displacement context group and a single post-displacement context group (see sample sizes in Table 2):

Pre-displacement contexts (Myanmar):

a) *Migrant – High Military Violence* (M-HMV): Migrants coming from settings of moderate to severe violence associated with military invasion and occupation, severe deprivation, evacuation, or forced labor.

b) *Migrant – Low Military Violence (M-LMV)*: Migrants who left low violence settings, with few adverse life events before coming to Thailand but still often reporting having felt oppressed in Myanmar because of their ethnicity or religion.

c) *Born in Thailand (T):* Women born in Thailand (control group), including ethnic Thais and Thai ethnic minorities.

Post-displacement contexts (Thailand):

a) *Low Threats to Livelihoods (LT):* Reports very few instances adversity of feeling unsafe at work, with moneylenders, during travel, or with police or military.

b) *High Threats to Livelihoods (HT):* Reports more threats to livelihood involving work or employers (e.g., not having enough work to afford food, being threatened or taken advantaged of at work) and mobility or the Thai police (e.g., fearing travel outside of one's village, having been arrested or fearing arrest). More moderate threats include mobility- and work-related threats based on housing and migrant legal status.

Table 2. Subgroups by Pre- and Post-Displacement Contexts

Patterns of displacement in light of pathways from pre- to post-displacement contexts used for sub-group comparisons, as counts with row percent in parentheses (the

percent of women within each pre-displacement group that lands in a given post-displacement group).

Migration/ Pre-Displacement Circumstances	Subsequent Post-Displacement Context: n (row percent) Low Threat	High Threat	Row Totals
Born in Thailand (T)	63 (76.8%)	19 (23.2%)	82
Migrant – Low Military Violence (M-LMV)	28 (25.9%)	80 (74.1%)	108
Migrant – High Military Violence/Exposure (M-HMV)	22 (31.0%)	49 (69.0%)	71
Column Totals	113	148	261

Birth outcome: Maternal reported low birthweight (LBW; below 2,500 grams) is the primary outcome I use to reflect fetal development and health at birth. Reported birthweights were typically based on hospital birth records, using comparable scales at hospital facilities.

Other covariates: I adjust for maternal age at birth, child age in years, and whether the child is the mother's firstborn (binary).

Analysis

I perform a two-part analysis. First, I stage main effects models with pre- and post-displacement context group membership added sequentially in order to look at average, non-interactive associations between odds of LBW and pre- and post-displacement stressors, as specified in the fully adjusted regression equation:

$$\text{Log (odds of LBW)} = \beta_0 + \beta_1(\text{M-LMV}) + \beta_2(\text{M-LMV}) + \beta_3(\text{HT}) + \beta_4(X_1) + \ldots + \beta_n(X_n)$$

where the β's are logistic regression coefficients, the X_j (j=1 to n) are covariates, and the intercept represents mothers born in Thailand and living in LT post-displacement contexts.

Second, I compare subgroups defined jointly by individuals' pre- and post-displacement contexts (i.e., patterns of displacement), using margins standardization based on the following equation:

$$\text{Log (odds of LBW)} = \alpha_0 + \alpha_1(\text{M-LMV}) + \alpha_2(\text{M-HMV}) + \alpha_3(\text{HT}) + \alpha_4(\text{M-LMV*HT}) + \alpha_5(\text{M-HMV *HT}) + \alpha_6(X_1) + \ldots + \alpha_n(X_n)$$

where here the α's are logistic regression coefficients and α_4 and α_5 are the interaction terms between pre-displacement contexts and post-displacement context. For subgroup predicted standardized prevalence, I use adjusted predictive margins in Stata 15.

PRELIMINARY RESULTS

Results from the staged regressions (Table 3) show children of migrant mothers are, on average, at higher odds of experiencing LBW—with low violence migrants at a 30% higher odds, and high violence migrants at a 66% higher odds, of LBW than non-migrants (not statistically significant at the $p<0.05$ level). These differences are completely attenuated after accounting for living in a HT post-displacement setting. Living in a HT setting post-displacement is associated with an average odds ratio (OR) of 1.77 compared to a LT setting (not statistically significant) in the fully adjusted model.

Table 3. Staged regression models: Low Birth Weight (LBW)

Estimated odds ratios based on staged logistic regression models of LBW. *p<0.05, **p<0.01, ***p<0.001

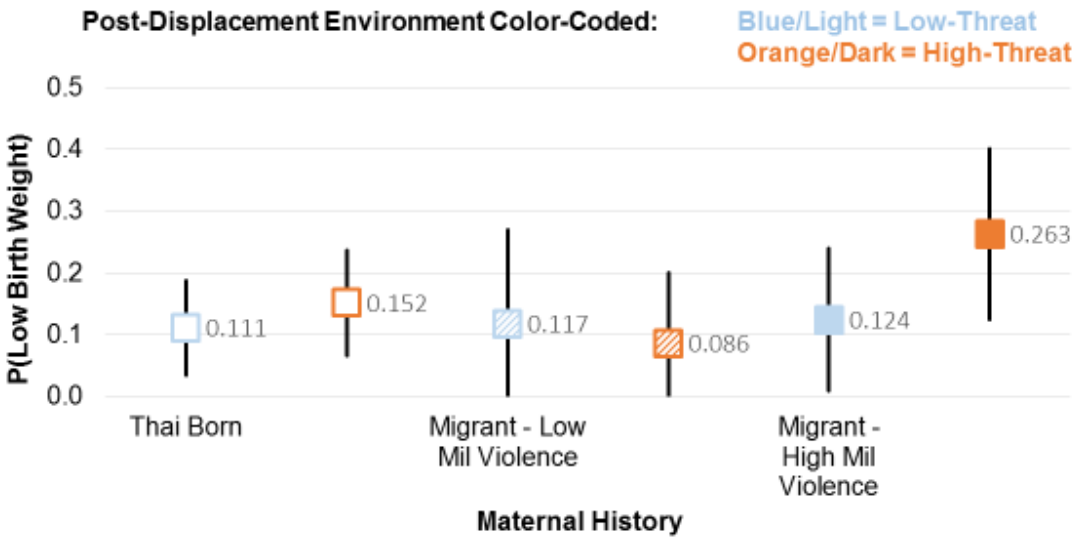
	LBW: Mod1	LBW: Mod2	LBW: Mod3	LBW: Mod4
Migration History (Pre-Displacement Context)				
Born in Thailand	(Ref)	(Ref)	(Ref)	(Ref)
Migrant – Low Military Violence (M-LMV)	1.305	1.010	1.039	1.111
Migrant – High Military Exposure (M-MO/M-SVDE)	1.663	1.305	1.349	1.133
Thailand (Post-Displacement) Context				
Thailand: Low Threat		(Ref)	(Ref)	(Ref)
Thailand: High Threat		1.716	1.735	1.773
Legal documentation				
Citizen/ Legal resident			(Ref)	(Ref)
Legal documents: Passport/ work permit			0.991	1.106

	LBW: Mod1	LBW: Mod2	LBW: Mod3	LBW: Mod4
Legal documents: None			0.574	0.642
Residence Type				
Residence: Village			(Ref)	(Ref)
Residence: Worksite			0.943	0.943
Any Health Insurance				0.605
Observations	239	239	239	236

The subgroup comparisons based on the fully adjusted model and marginal standardization are displayed in Figure 1. The single most stressed subgroup (M-HMV and HT) stands out with the greatest risk of LBW compared to all other subgroups, at 0.26 (95% confidence interval [CI]=0.12, 0.40), compared to other estimated probabilities between 0.09 and 0.12).

Figure 1. Subgroup Comparisons: LBW

Subgroup comparisons for LBW predictive marginal probabilities (point estimates and 95% CI), based on pre-displacement (bar fill patterns) and post-displacement contexts (colors), and adjusted for birth year (continuous), first births (binary), and maternal age (continuous).



Evidence of paths linking maternal displacement stressors to birth outcomes

Preliminary findings suggest that LBW risk is affected by both pre- and post-displacement maternal contexts (but this is not detectable as statistically significant), with a substantially elevated risk of LBW among mothers that have experienced both high stress migration histories and also have been in HT situations post-displacement. This agrees with a cumulative disadvantage conceptual model of social stressors, with potential interactions between pre- and post-displacement (i.e., more distal and proximate) stressors.

Additional analyses to be performed

Final analyses will look more closely at additional child health outcomes measured in the survey—including stunting and wasting—and what could be driving the study findings, including the potential role of maternal health status and access to health services. Additional analyses will be performed to investigate the robustness of study results as well. First, differently specified groups will be used to compare pre- and post-displacement stressors, sensitivity analyses will be performed to examine exposures to different stressors during more specific perinatal periods, and missing data will be imputed in order to utilize more of the original sample (815 mother-child pairs). This study is still limited by being a retrospective, cross-sectional study with potential selection bias. Sources of potential bias will be investigated more closely, but I expect all to be dominated by factors that attenuate observable measures of association.

This study is a single piece in the greater research needed on displacement, social and environmental stressors, and maternal and child health outcomes. More research is still needed to understand mechanisms through which migrant women and child can achieve better and more equitable health in their host countries. Interventions to address migrants' and refugees' current living situations as well as lasting effects of historical stress should be studied more carefully, such as through cross-national comparisons of policies toward migrants and refugees.

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