The impact of maternal adverse childhood experiences and prenatal depressive symptoms on foetal attachment: Preliminary evidence from expectant mothers across eight middle-income countries

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Manuscript Word Count: 4696

Number of Tables: 3

Number of Figures: 1

Abbreviations: Adverse Childhood Experiences (ACEs); High Income Countries (HIC); Middle- Income Countries (MIC)

Abstract

Background: Mothers from middle-income countries (MIC) are estimated to have higher rates of adverse childhood experiences (ACEs) and depression during pregnancy compared to mothers from high income countries. Prenatal depression can adversely impact on a mother's feelings towards her foetus and thus may be partially responsible for intergenerational transmission of risk associated with maternal ACEs. However, the extent to which prenatal depressive symptoms mediate the association between maternal ACEs and foetal attachment is unknown.

Methods: Data on foetal attachment, ACEs, and prenatal depression came from mothers in their third trimester of pregnancy (n = 1,185) located across eight MICs, participating in the prospective birth cohort Evidence for Better Lives Study – Foundational Research (EBLS-FR). Data were from the baseline measurement.

Results: Full-sample path mediation analyses, adjusting for relevant covariates, suggested a full mediating effect of prenatal depression. However, at the individual-country level, both positive and negative effects of ACEs on foetal attachment were observed after the inclusion of depressive symptoms as a mediator, suggesting cultural and geographical factors may influence a mother’s empathic development after ACE exposure.

Limitations: As no follow-up measurements of depressive symptoms or postnatal attachment were included in the analyses, the findings cannot be extrapolated to the postnatal period and beyond. Further, causality cannot be inferred as the study was observational.

Conclusions: The findings reinforce the importance of screening for prenatal depression during antenatal care in MICs. Addressing prenatal depression within maternal health care may support foetal attachment and contribute to reducing the intergenerational transmission of disadvantage.

KEYWORDS: Adverse Childhood Experiences; Maternal-Foetal-Attachment; Depressive Symptoms; Prenatal; Birth Cohort

It has long been postulated that the quality of caregiving a child receives, with its roots in the prenatal period, can shape attachment styles into adulthood (Bowlby, 1982), and may influence the child's future relationships and parenting skills (Antonucci et al., 2004). Foetal attachment can be defined as a mother's desire to understand, protect, nourish and care for her foetus (Müller & Mercer, 1993), and typically begins in early pregnancy (Brandon et al., 2009). This attachment typically intensifies during the second and third trimesters, strengthened by maternal representations of the foetus (Ammaniti et al., 2013), observing the foetus during uterine ultrasound scans (Sedgmen et al., 2006) and perceiving foetal movement in the womb (Güney & Uçar, 2019).

There is growing interest in understanding the short- and long-term psychosocial, cognitive and health benefits of foetal attachment. For example, stronger feelings of maternal foetal attachment are associated with increased pregnancy planning (Salisbury et al., 2003), improved maternal psychological wellbeing (Petri et al., 2018); and decreased maternal tobacco and alcohol consumption during pregnancy (Magee et al., 2014). The benefits of maternal foetal attachment appear to continue into the postnatal period. For example, evidence suggests that stronger attachment to the foetus is predictive of neonate bonding and the quality of care provided to the infant (Siddiqui et al., 2000; Foley & Hughes, 2018). Thus, foetal attachment may have an indirect influence on outcomes in early childhood, such as reaching important developmental milestones, improving infant temperament and decreasing colic (Nordahl et al., 2019; see Branjerdporn et al., 2017 for review). Given the potential importance of a mother's secure bond with her foetus for child outcomes, intervention strategies to support child development may benefit from identifying the factors that can undermine secure foetal attachment, such as maternal adverse childhood experiences (ACEs).

ACEs refer to exposures to any form of maltreatment (e.g., emotional, sexual and/or physical abuse, neglect, and commercial or other exploitation) which results in actual or

potential harm to the child's health, survival and development in the context of a relationship of responsibility, trust, or power (World Health Organisation, 2014). Evidence suggests that chronic early-life adversity may have deleterious effects, that can last into adulthood (Chapman et al., 2004). For example, previous research in expectant mothers reported that ACEs show a dose-response relationship with adult affective psychopathology, (Ångerud et al., 2018). Considering the potential pervasive negative effects of childhood adversity on later-life outcomes, it has been hypothesised that maternal ACEs may interfere with the quality of the maternal-foetal relationship (Sancho-Rossignol et al., 2018). For example, it has been proposed that a mother who has experienced enduring childhood maltreatment is liable to have poorer quality prenatal and postpartum attachment to her child (Berthelot et al., 2015). It is possible that these mothers have fewer emotional resources to cope with the challenges of raising children. This may make the mother feel unconnected to her foetus, potentially contributing to less emotional support to her child and more emotionally distant parenting behaviour (Savage et al., 2019). Further, recent work has identified indirect biological pathways between maternal ACEs and increased infant health risks, such as pregnancy health risks, potentially leading to suboptimal child development (Racine et al., 2018). Thus, the impacts of ACEs on maternal behaviour may put their offspring at increased risk of ACEs themselves (Crouch et al., 2019).

Prenatal depression is a known sequela of maternal ACEs (see Alvarez-Segura et al., 2014 for review) and is considered a major health problem in pregnant women (Le Strat et al., 2011). Pregnancy is believed to be a particularly vulnerable period in a woman's life, with hormonal fluctuations (Brummelte & Galea, 2010), neuro-endocrinological changes (DiPietro et al., 2003) and the experience of intense, complex and overwhelming emotions (Medjedović Marčinko et al., 2011) potentially contributing to prenatal depression. Compared with the age-matched female general population, women in their second and third

trimesters appear twice as likely to have clinically significant depressive symptoms (Bennett et al., 2004). Indeed, recent estimates indicate that between 20% and 25% of women will experience a depressive episode of mild to major severity during pregnancy (Gelaye et al., 2016), even if they have not been at risk previously (Nonacs & Cohen, 2002). As well as adverse effects on the mother (e.g., increased suicidality; Lindahl et al., 2005), prenatal depressive symptoms can have significant detrimental effects on the child. For example, while this view is contested (O'Donnell & Meaney, 2017), depressive symptoms during pregnancy have been found to be associated with HPA axis activation which may expose the foetus to high levels of cortisol, in turn adversely impacting on foetal development (Glover et al., 2010). Notably, depressive symptoms can adversely impact on the mother's behaviours and beliefs (e.g., more negative attitudes towards motherhood; Hart & McMahon, 2006), in turn negatively effecting foetal attachment (Smorti et al., 2019). Consistent with this, a recent review by Rollè et al (2020) found an association between prenatal depressive symptoms and poorer quality pre- and postnatal attachment across 33 of the 41 studies assessed.

When considered together, maternal ACEs and prenatal depression are likely to exert complex effects on child outcomes. Children of mothers who had both a history of ACEs and depression during pregnancy show the highest levels of childhood adversity (Plant et al., 2013). In contrast, offspring of mothers who only experienced childhood maltreatment or only depression during pregnancy appear no more vulnerable to ACEs compared to children of mothers without ACEs or depression (Plant et al., 2013). Path analyses have also identified a significant indirect effect of maternal ACEs on later child functioning (McDonnell & Valentino, 2016) and behavioural difficulties (Cooke et al., 2019) via their effects on maternal depression. Thus, these adverse factors may result in a cascade of risk for the child, in turn potentially facilitating the intergenerational transmission of adversity.

Unfortunately, findings on the nature of the interplay between prenatal depression and maternal ACEs remain scant. In particular, to the best of our knowledge no previous studies have examined whether depressive symptoms mediate the relation between maternal ACEs and foetal attachment. Moreover, existing research on prenatal attachment has been largely restricted to high-income countries (HIC; Rollè et al., 2020), with only a minority of studies conducted in middle-income countries (MICs; e.g., Hughes et al., 2017). Living in MICs may be associated with poorer access to health services, difficulty in accessing contraception (and thus high rates of unwanted pregnancy), increased exposure to violence and higher risk of child maltreatment (Herba et al., 2016). Exposure to ACEs and rates of prenatal depression in mothers located in MIC are higher than for mothers in HIC (Ward et al., 2016), indicating a need for research on the impact of these exposures on foetal attachment in pregnant mothers from MIC.

To address this gap, the current study investigated the relationship between maternal ACEs and foetal attachment and the potential mediating role of prenatal depressive symptoms in a sample of women in their third trimester of pregnancy, recruited across eight culturally diverse upper- and lower-MICs. Our main hypothesis was that prenatal depressive symptoms would be negatively associated with foetal attachment and partially mediate an inverse relationship between maternal ACEs and foetal attachment. This was explored using data collected from eight culturally distinct sites, offering an opportunity to explore the context specificity of associations between ACEs, prenatal depression and foetal attachment.

Method

Study Design and Population

The current sample was derived from the ongoing Evidence for Better Lives Study – Foundational Research (EBLS-FR) birth cohort study (Valdebenito et al., 2020) which aims

to examine the environmental, societal, familial and biological factors that influence child development from conception. The EBLS-FR followed 1,200 pregnant women from their third trimester of pregnancy with a gestational age ranging from 29 to 40 weeks (baseline measurement) to when the child was between two and six months old (follow-up measurement). In order to reflect the heterogeneity of social and cultural conditions in major world regions, eight research sites across the Latin-American and Caribbean region (Kingston, Jamaica, Europe (Cluj-Napoca, Romania), Africa (Worchester, South Africa and Koforidua, Ghana), the Indian Subcontinent (Tarlai Kalan, Pakistan and Ragama, Sri Lanka) and Southeast Asia (Hue, Vietnam and Valenzuela, Philippines) participated in the EBLS-FR study. All countries were either lower-middle income (i.e., Sri Lanka, Pakistan, Ghana, Vietnam, Philippines) or upper-middle income (i.e., Romania, South Africa and Jamaica). Mothers were recruited from local health centres during antenatal check-ups and were included in the study if they satisfied the following criteria; i) they were in the third trimester of pregnancy, ii) were above the age of 18 and iii) their residence was within the study's defined geographical locations. Both primiparous and multiparous mothers were eligible for participation. A total of 1,473 mothers were approached with 1,208 agreeing to take part, giving a participation rate of 82.0%. All data used in the current study were taken from the baseline measurement.

Procedure

All data were collected between February and December 2019. Mothers were approached by either trained research assistants or clinicians at health centres and the project aims explained. Those who expressed an interest in participating were then screened for eligibility, provided an information sheet that was read to them and invited to give informed consent. When written consent was not possible, the mother's thumbprint or audio recordings were taken. Participants were enrolled until the required sample size of 150 per site was

reached. All materials were translated by the research team into the most common language spoken by the mothers, using an adapted version of the World Health Organisation guidelines (World Health Organisation, 2014). These languages were as follows; Urdu, Afrikaans, IsiXhosa, Romanian, Tagalog, Sinhala, Tamil, Vietnamese and Twi. The interviews were conducted in private settings at the health centres by local trained interviewers via Computer-Aided Personal Interviews (CAPI) and, for sensitive information (e.g., adverse childhood experiences), Computer-Assisted Self-Interviewing (CASI). All mothers were offered compensation for travel expenses and a token of appreciation for participating.

Measures

Patient Health Questionnaire (PHQ-9).

Depressed mood was measured using the PHQ-9 (Kroenke et al., 2001). The PHQ-9 is a widely administered screening-tool of depressive symptom severity experienced in the last 2 weeks. The scale is composed of questions operationalising the nine DSM-IV criteria for depressive illness (e.g., "Little interest or pleasure in doing things") and are rated on a 4-point Likert scale, from 0 (Not at All) to 3 (Nearly Every Day). Scores from the measure have shown good internal consistency in MIC settings ($\alpha = .790$; Kohrt et al., 2016), with the current study finding a similar result ($\alpha = .760$). Scores range from 0 to 27, with higher scores indicative of more severe depressive symptoms.

Prenatal Attachment Inventory-Revised (PAI-R).

Foetal attachment was measured using the PAI-R. The PAI-R (Pallant et al., 2014) is an 18-item shortened version of the PAI, originally developed by Müller and Mercer (1993). As some of the subfactors in the original measure typically showed poor internal consistency, the revised version is recommended over the original (Pallant et al., 2014). The measure consists of three subscales; "Anticipation" (e.g., pertaining to the mother's fantasies and

future plans for the infant), “Interaction” (e.g., the mother’s feelings towards her infant) and “Differentiation” (e.g., the mother’s beliefs about baby’s personality). Previous studies have identified good internal consistency in the total measure scores (α = .810; Müller and Mercer, 1993). Total PAI-R scores in the current study were found to have excellent internal consistency (α = .930). The PAI-R is rated on a 5-point Likert scale, with scores ranging from 18 to 90. Higher scores are indicative of higher quality foetal attachment.

Adverse Childhood Experiences – International Questionnaire (ACE-IQ).

ACEs were measured with the ACE-IQ (WHO, 2016), which has 29 items that assess the experiences of childhood adversity (e.g., “Did a parent, guardian or other household member spank, slap, kick, punch or beat you up?” and, “Did you live with a household member who was depressed, mentally ill or suicidal?”). In the current study, an abridged 19-item version was administered in order to reduce participant burden (see Supplemental Table S1). ACE-IQ scores were found to have good internal consistency in the current study (α = .810), similar to previous investigations in MICs (α = .890; Reyes et al., 2018). The ACE-IQ scores can be the sum of each type of ACE, regardless of frequency, or by frequency (i.e., sum of the number of instances of each type of ACE). In the current study, the binary method of scoring was used for the main analysis. Binary items were computed by coding items rated, “a Few Times”, “Many Times” and “Once” as 1, and items rated as “Never” as 0 and summed to give binary ACE-IQ scores. Scores ranged from 0 to 19.

Covariates

In a recent review by Tichelman et al (2019), maternal age, education level, number of previous pregnancies, duration of gestation at assessment (weeks) and if the pregnancy was wanted (0 = “No”, 1 = “Yes”) were found to be significantly associated with foetal attachment in expectant mothers. Therefore, these variables were included as covariates in the

later analyses. Furthermore, maternal socioeconomic status (SES) has been found to adversely influence foetal attachment (Rollè et al., 2020). In the current study, SES was assessed using two measures. First, the MacArthur Scale of Subjective Social Status scale (Adler et al., 2000), which has been found to be a reliable assessment of perceived social status in previous investigations (Goodman et al., 2001). The measure is rated on a 10-point Likert scale, presented to participants as a visual 'ladder', on their perceived ranking in the social hierarchy. The score ranged from 1 (lowest ranking) to 10 (highest ranking). The second measure of SES was the total number of household possessions (radio, television, mobile phone, computer, internet access, refrigerator, toilet, access to water, watch, house telephone, bicycle, scooter, car and/or bank account) owned by the mother or others in the household. Items were scored either "Yes" or "No" to give a score range of 0 to 14.

Data Analysis

Descriptive analyses were conducted using SPSS 24.0. Mediation analyses on the observed composite variables were then conducted in R statistical software using the 'lavaan' package (Rosseel, 2012) to test the direct (c') effects of the predictor (maternal adverse childhood experiences; ACE-IQ) on the outcome (foetal attachment; PAI-R), and the indirect effect (c) through the mediator (current depressive symptoms; PHQ-9). A multi-group model was used to explore whether there were differences between the countries in the hypothesised direct and indirect effects. Two variants of the model were fit. First, a multi-group model where all parameters were free to vary across countries was fit. This facilitated a descriptive comparison of the hypothesised relations across groups. Second, a multi-group model in which the direct and indirect effects of ACEs on foetal attachment were fixed equal across all countries was fit. This allowed us to estimate the overall effects when pooled across countries. In order to assess the effects of other risk factors on the outcome variable, these models were fit first without covariates and then repeated with the covariates inserted into the

model. Covariate effects were free to vary across countries in all models that included covariates. As the freed-parameter model was just-identified, it could not be compared with the constrained-parameter model (Lei & Wu, 2007). To assess if the mediation effect was significant, 95% confidence intervals of the standard error were bootstrapped with 5,000 iterations (Preacher & Hayes, 2008). Mediation by PHQ-9 scores was considered significant when the bias corrected and accelerated confidence intervals of the indirect effect did not include zero. Full information maximum likelihood (FIML) estimation was used to address missing data in the mediation models (Enders & Bandalos, 2001).

Data Cleaning

The initial sample size of mothers was N = 1,208. To prepare the dataset for the main analysis, the following exclusion rules were implemented; i) mothers who were less than 28 weeks of pregnancy at the time of study participation and ii) mothers who did not participate in all of the psychometric measures, were excluded from the dataset. Twelve mothers were in their second trimester of pregnancy (between 20 and 27 weeks pregnant) and were removed from the dataset. Furthermore, seven mothers did not participate in any of the three psychometric measures, with a further four participating in one to two of the measures. These mothers were also excluded giving a final sample size of n = 1,185.

Results

Sample Characteristics

The average age of the mothers tested was 28.32 (*SD* = 5.77), with a range of 18 to 48. Most of the mothers tested had experienced pregnancy before (69.4%), had a minimum of secondary school education (85.1%) and had pregnancy that was wanted (74.0%). A further 57.5% of the sample rated themselves between five and ten on the MacArthur Scale of Subjective Social Status scale (Table 1). In order to identify individuals who have

experienced a marked number of ACEs, a binary score of >4 has been previously used (e.g., Hughes et al., 2017). A total of 444 (39.2%) mothers had an ACE-IQ score above 4. Furthermore, PHQ-9 cut-off scores have been proposed by Kroenke et al (2001), where a score of 0-4 denotes minimal, 5-9 denotes mild, 10-14 denotes moderate, 15-19 denotes moderately severe and 20+ denotes severe depressive symptoms. Using these, it was found 428 (36.1%) mothers had minimal, 457 (38.6%), had mild, 183 (15.4%) had moderate, 78 (6.6%) had moderately severe and 22 (1.9%) had severe depressive symptoms. A full overview of the total sample can be seen in Table 1 and score distributions from each of the individual countries can be seen in Supplementary Materials (Tables S1 to S8).

Correlations Between Key Variables

Bivariate correlations were first conducted in order to confirm significant correlations. Significant positive correlations were identified between ACE and depressive symptoms ($r = .299$, $p < .001$) and foetal attachment ($r = .094$, $p = .002$) scores. Additionally, a significant inverse relationship was found between depressive symptom and foetal attachment scores ($r = -.135$, $p < .001$). Next, partial correlations were run to test the same relationships, taking the covariates into account. On controlling for the external factors, significant positive correlations were identified between ACE and depression ($r = .279$, $p < .001$) and foetal attachment ($r = .129$, $p < .001$) scores. Likewise, a significantly negative correlation was identified between depressive symptoms and foetal attachment scores ($r = -.068$, $p = .029$).

Multi-Group Mediation Models with parameters freely varying across countries

The freed parameter mediation models with paths free to vary across countries were first estimated without covariates. On inspection of the results (see Table 2), no significant direct effects of ACEs, nor indirect of depressive symptoms, were identified in the data from Jamaica, Ghana, Romania, Sri Lanka, and Vietnam. However, a full negative mediating

effect of depressive symptoms were identified in both the Philippines (B = -.165, p = .028, 95%CI [-.313, -.018]) and South Africa (B = -.080, p = .021, 95% CI [-.485, -.039]) data. The direct effects of ACEs were non-significant in these mediation models (B = .345, p = .102, 95% CI [-.069, -.759]; B = -.153, p = .527, 95% CI [-.628, .322], respectively). In contrast, an exclusive positive direct effect of ACEs on foetal attachment was observed in the Pakistan data (B = .935, p = .017, 95%CI [-.170, 1.69]), and an exclusive negative direct effect of ACEs on foetal attachment was observed in the Vietnam data (B = -.681, p = .030, 95% CI [-1.29, -.067]). No significant indirect effects of depression were observed in the models (B = .052, p = .442, 95%CI [-.080, .184]; B = -.262, p = .021, 95% CI [-.045, -.039], respectively).

(Insert Table 2)

Next, the mediation models with parameters freely estimated across countries were rerun with covariates added (see Table 3). While the negative indirect effect of depressive symptoms became non-significant in the South Africa data, the complete mediating effect of depressive symptoms was still observed in the Philippines data (B = -.140, p = .049, 95% CI [-.279, -.001]). Likewise, the unique positive direct effect of ACEs on foetal attachment in Pakistan (B = 1.16, p = .004, 95% CI [-.362, 1.96]) and negative direct effect of ACES on foetal attachment in Vietnam (B = -.648, p = .036, 95% CI [-1.26, -.042]) remained when covariates were included in the analysis.

(Insert Table 3)

Multi-Group Mediation Models with Parameters Fixed Equal Across Countries

The multi-group model was rerun with the parameters fixed equal across the countries. In the unadjusted model with no covariates inserted, a significant negative mediation effect of depressive symptoms (B = -.099, p <.001, 95% CI [-.148, -.050]), but no significant direct effects of ACEs on foetal attachment (B = -.030, p = .712, 95% CI [-.191,

.131]) was observed. Similar results were found when the fixed parameter model was rerun with covariates, with a full mediating effect of depressive symptoms (B = -.084, p = .001, 95% CI [-.132, -.036]) but no significant direct effects of ACES on foetal attachment (B = -.042, p = .612, 95% CI [-.204, .120]). See Table 4 for a summary of the findings.

(Insert Table 4)

Discussion

A considerable body of work has indicated that poor mental health in pregnancy is associated with poorer outcomes for infants (see Slomian et al., 2019 for review). Indeed, previous investigations have pointed to numerous negative impacts of prenatal depressive symptoms on the foetus, including heightened foetal cortisol and norepinephrine levels (Field et al., 2004) and increased risk of exposure to alcohol, caffeine and/or tobacco via maternal substance use (Field et al., 2010). In line with these past studies, symptoms of prenatal depression emerged as the strongest predictor of poor-quality foetal attachment in the current study. In contrast, on taking prenatal depressive symptoms into account, the association between ACEs and foetal attachment diminished. This suggests that depressive symptoms may account for a large proportion of the relationship between ACEs and foetal attachment. That is, ACEs may impact foetal attachment by predisposing mothers to a psychological vulnerability towards mental health difficulties during pregnancy. Consistent with this view, past studies have reported a non-significant relationship between ACEs and later-life sequelae once effects of depressive symptoms were adjusted for (e.g., Briggs & Price, 2009).

The direct effect of ACEs on foetal attachment was not replicated in all of the eight countries of the current study and in some cases different patterns of relations were observed. For example, findings from the Filipino mothers replicated the results from the total EBLS-FR sample analyses, with prenatal depression fully mediating the relationship between

maternal ACEs and foetal attachment. In contrast, maternal ACEs directly and negatively impacted on foetal attachment in Vietnamese mothers, and their potential prenatal depression did not significantly affect this relationship. Most notably however, there was a significant positive effect of ACEs on foetal attachment in Pakistani mothers, indicating that ACEs may be associated with post-traumatic growth in this context (Tranter et al., 2020). Here, post-traumatic growth refers to the positive personal growth and psychological development that can follow from experiences of trauma and adversity (Tedeschi et al., 1998). For example, childhood adversity may foster an individual's compassion and prosocial behaviours (Greenberg et al., 2018). Indeed, individuals with a history of ACEs have been found to have increased concern for the welfare of others when compared to those with no history of ACEs (Staub & Vollhardt, 2008). The view that ACEs may have positive effects on later-life empathic abilities is; however, controversial and requires further study (e.g., Narvey et al., 2020). Exploration of the factors that differentiate those who achieve post-traumatic growth from those who do not will be particularly valuable. Likewise, given that negative, positive, and nonsignificant effects of ACEs on foetal attachment were observed across the mothers, exploration of cultural and other broader contextual factors that play a role in this association is an important area for future research.

Overall, our findings provide partial support for the hypothetical cycle of risk transmission across generations (see Figure 1). As expected, depressive symptoms during pregnancy were negatively associated with mothers' prenatal attachment to the foetus. Likewise, it is possible that a mother's lack of emotional bonding with her child evokes and further exacerbates the mother's symptoms of depression. The fact that experiences of adversity did not significantly directly influence maternal-foetal-attachment with the inclusion of depression as a mediator suggests that this is likely to be an important mechanism by which the effects of ACEs become transmitted to the next generation. By

targeting a mother's current symptoms of poor mental health, the transmission of risk from mother to child may be reduced. This is an important finding given that previous research suggests that prenatal depression can be targeted by interventions using methods that are feasible in low resource settings (Field, 2017). Our finding that the relations between ACEs, depression, and attachment varied across contexts also underlines the importance of robust locally-relevant evidence to inform local policies, rather than assuming that evidence gathered in one context is generalisable to others.

Strengths and Limitations

The current study had several notable strengths. To our knowledge, this study is the first to explore the relationships between ACEs, prenatal depression and foetal attachment in a sample of expectant mothers in MIC settings. As discussed previously, individuals living in MIC are more likely to be exposed to adverse events and experiences compared to individuals from HIC (Herba et al., 2016). Here, it was found 39.2% of the mothers interviewed had a history of four or more ACEs, and slightly under a quarter (23.9%) had at least moderate depressive symptoms. Thus, depressive symptoms, ACEs and cultural diversity were adequately represented in the sample.

However, a number of study limitations deserve note. First, the psychometric measures required translation into the local languages from English. There is some evidence that the constructs and items involved may have had different meanings across the languages, therefore, differences in the relations between constructs may partly reflect this (Foley et al., 2020, manuscript under review). However, the summed scores of all the translated versions of the measures have good internal consistency (e.g., ACE-IQ; $\alpha = .930$), suggesting they were psychometrically reliable versions of the original measures within each country. Second, as the EBLS-FR birth cohort study administered a large number of additional

assessments beyond the measures utilized here, several items from the ACE-IQ measure were removed in order to reduce participant burden. Despite this, the scores had good internal consistency suggesting the version administered remained a robust measure of ACEs. Third, no follow-up measurements of depressive symptoms or postnatal attachment were included in the analyses. It therefore remains to be established whether the negative effect of prenatal depression on foetal attachment lasted postnatally and beyond. Similarly, given EBLS-FR's first wave of data collection was completed in 2018, sufficient time may have not elapsed to accurately assess the adversity experienced by the mothers' children. Consequently, the intergenerational transmission of risk was not directly assessed in the current study and thus the theory that maternal ACEs can increase her child's risk of experiencing ACEs themselves remains speculative. While recent work has pointed towards this (Narayan et al., 2021), it would be advantageous to continue tracking the mothers' children throughout their development in order to confirm this notion. Fourth, the number of mothers from each of the individual countries (i.e., n = 134 to n = 154) was comparatively small, compared to the total EBLS-FR sample (i.e., n = 1,185). Given this, additional work is required to replicate the mediation models with larger sample sizes, with the statistical power to detect smaller effects than the current study was powered to detect. Fifth, as the sample was recruited opportunistically and consisted of mothers who were motivated to participate in the birth cohort, extrapolating the findings to the wider population in the EBLS-FR sites may be limited. Sixth, it is possible that there was a causal relationship between prenatal depressive symptoms on a mother's ACE score. In other words, mothers who had heightened depressive symptoms may have been more likely to ruminate on their negative life events, thus biasing their recall of their ACE exposure (Reuben et al., 2016). As suggested by Reuben et al (2016), it may be beneficial for future research to use both self-reported and objective outcome measures of ACEs in order to potentially circumvent this issue. Lastly, as post-

traumatic resilience was not assessed in the current study, the notion that some mothers experienced resilience via ACEs is speculative. Thus, it would also be beneficial to replicate the current study by additionally administering a measure such as the Connor-Davidson Resilience Scale (Connor & Davidson, 2003) or the Benevolent Childhood Experiences scale (BCEs; Narayan et al., 2018) to further assess the effect of resilience on the complex relationships between ACEs, foetal attachment and prenatal depression.

Conclusion

The current study found evidence that prenatal depressive symptoms, in general, adversely impact on foetal attachment in a cross-cultural sample of mothers. While ACEs did not have a direct effect on foetal attachment overall, they may predispose mothers to later-life mental health difficulties. As there was variability in the effect of ACEs on foetal attachment across the countries assessed, future research should explore potential cultural influences on a mother's trajectory of post-trauma development. Furthermore, results highlight the need for screening for prenatal depressive symptoms and appropriate interventions during antenatal services, which may contribute to prevention of intergenerational transmission of risk.

Adler, N. E., Epel, E. S., Castellazzo, G., & Ickovics, J. R. (2000). Relationship of subjective and objective social status with psychological and physiological functioning: preliminary data in healthy white women. *Health Psychology, 19,* 586-592. https://doi.org/10.1037/0278-6133.19.6.586

Alvarez-Segura, M., Garcia-Esteve, L., Torres, A., Plaza, A., Imaz, M. L., Hermida-Barros, L., San, L., & Burtchen, N. (2014). Are women with a history of abuse more vulnerable to perinatal depressive symptoms? A systematic review. *Archives of Women's Mental Health, 17,* 343-357. https://doi.org/10.1007/s00737-014-0440-9

Ammaniti, M., Tambelli, R., & Odorisio, F. (2013). Exploring maternal representations during pregnancy in normal and at-risk samples: The use of the interview of maternal representations during pregnancy. *Infant Mental Health Journal, 34,* 1-10. https://doi.org/10.1002/imhj.21357

Ångerud, K., Annerbäck, E. M., Tydén, T., Boddeti, S., & Kristiansson, P. (2018). Adverse childhood experiences and depressive symptomatology among pregnant women. *Acta Obstetricia et Gynecologica Scandinavica, 97,* 701-708. https://doi.org/10.1111/aogs.13327

Antonucci, T., Akiyama, H., & Takahashi, K. (2004). Attachment and close relationships across the life span. *Attachment & Human Development, 6,* 353-370. https://doi.org/10.1080/1461673042000303136

Bennett, H. A., Einarson, A., Taddio, A., Koren, G., & Einarson, T. R. (2004). Prevalence of depression during pregnancy: systematic review. *Obstetrics & Gynecology*, *103*(4), 698-709. https://doi.org/10.1097/01.AOG.0000116689.75396.5f

Berthelot, N., Ensink, K., Bernazzani, O., Normandin, L., Luyten, P., & Fonagy, P. (2015). Intergenerational transmission of attachment in abused and neglected mothers: The

role of trauma-specific reflective functioning. *Infant Mental Health Journal, 36,* 200-212. https://doi.org/10.1002/imhj.21499

Bowlby, J. (1982). Attachment and loss: retrospect and prospect. *American Journal of Orthopsychiatry, 52,* 664-678.

Brandon, A. R., Pitts, S., Denton, W. H., Stringer, C. A., & Evans, H. M. (2009). A history of the theory of prenatal attachment. *Journal of Prenatal & Perinatal Psychology & Health: 23,* 201-222.

Branjerdporn, G., Meredith, P., Strong, J., & Garcia, J. (2017). Associations between maternal-foetal attachment and infant developmental outcomes: a systematic review. *Maternal and Child Health Journal, 21,* 540-553. https://doi.org/10.1007/s10995-016-2138-2

Briggs, E. S., & Price, I. R. (2009). The relationship between adverse childhood experience and obsessive-compulsive symptoms and beliefs: the role of anxiety, depression, and experiential avoidance. *Journal of Anxiety Disorders, 23,* 1037-1046. https://doi.org/10.1016/j.janxdis.2009.07.004

Brummelte, S., & Galea, L. A. (2010). Depression during pregnancy and postpartum: contribution of stress and ovarian hormones. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 34,* 766-776. https://doi.org/10.1016/j.pnpbp.2009.09.006

Chapman, D. P., Whitfield, C. L., Felitti, V. J., Dube, S. R., Edwards, V. J., & Anda, R. F. (2004). Adverse childhood experiences and the risk of depressive disorders in adulthood. *Journal of Affective Disorders, 82,* 217-225. https://doi.org/10.1016/j.jad.2003.12.013

Connor, K. M., & Davidson, J. R. (2003). Development of a new resilience scale: The Connor-Davidson resilience scale (CD-RISC). *Depression and Anxiety, 18,* 76-82. https://doi.org/10.1002/da.10113

Cooke, J. E., Racine, N., Plamondon, A., Tough, S., & Madigan, S. (2019). Maternal adverse childhood experiences, attachment style, and mental health: pathways of transmission to child behavior problems. *Child Abuse & Neglect, 93*, 27-37. https://doi.org/10.1016/j.chiabu.2019.04.011

Crouch, E., Radcliff, E., Strompolis, M., & Srivastav, A. (2019). Safe, stable, and nurtured: protective factors against poor physical and mental health outcomes following exposure to adverse childhood experiences (ACEs). *Journal of Child & Adolescent Trauma*, *12*, 165-173. https://doi.org/10.1007/s40653-018-0217-9

DiPietro, J. A., Millet, S., Costigan, K. A., Gurewitsch, E., & Caulfield, L. E. (2003). Psychosocial influences on weight gain attitudes and behaviors during pregnancy. *Journal of the American Dietetic Association*, *103*, 1314-1319. https://doi.org/10.1016/S0002-8223(03)01070-8

Enders, C. K., & Bandalos, D. L. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural Equation Modeling, 8,* 430-457. https://doi.org/10.1207/S15328007SEM0803_5

Field, T. (2017). Prenatal depression risk factors, developmental effects and interventions: a review. *Journal of Pregnancy and Child Health, 4*, 301-326. https://doi.org/10.4172/2376-127X.1000301

Field, T., Diego, M., Dieter, J., Hernandez-Reif, M., Schanberg, S., Kuhn, C., Yando, R. & Bendell, D. (2004). Prenatal depression effects on the fetus and the newborn. *Infant Behavior and Development, 27,* 216-229. https://doi.org/10.1016/j.infbeh.2003.09.010

Field, T., Diego, M., & Hernandez-Reif, M. (2010). Prenatal depression effects and interventions: a review. *Infant Behavior and Development, 33,* 409-418. https://doi.org/10.1016/j.infbeh.2010.04.005

Foley, S., & Hughes, C. (2018). Great expectations? Do mothers' and fathers' prenatal thoughts and feelings about the infant predict parent-infant interaction quality? A meta-analytic review. *Developmental Review, 48,* 40-54. https://doi.org/10.1016/j.dr.2018.03.007

Foley, S., Hughes, C., Murray, A.L., Baban, A., Fernando, A.D., Madrid, B., Osafo, J., Sikander, S., Abbasi, F., Walker, S., Thang, V.V., Bao, Y.L.T., Tomlinson, M., Fearon, P., Ward, C.L., Valdebenito, S., & Eisner, M. (2020). Prenatal attachment: using measurement invariance to test the validity of comparisons across eight culturally diverse countries. *Manuscript under review*.

Gelaye, B., Rondon, M. B., Araya, R., & Williams, M. A. (2016). Epidemiology of maternal depression, risk factors, and child outcomes in low-income and middle-income countries. *The Lancet Psychiatry, 3,* 973-982. https://doi.org/10.1016/S2215-0366(16)30284-X

Glover, V., O'Connor, T. G., & O'Donnell, K. (2010). Prenatal stress and the programming of the HPA axis. *Neuroscience & Biobehavioral Reviews, 35,* 17-22. https://doi.org/10.1016/j.neubiorev.2009.11.008

Goodman, E., Adler, N. E., Kawachi, I., Frazier, A. L., Huang, B., & Colditz, G. A. (2001). Adolescents' perceptions of social status: development and evaluation of a new indicator. *Pediatrics, 108,* e31-e31. https://doi.org/10.1542/peds.108.2.e31

Greenberg, D. M., Baron-Cohen, S., Rosenberg, N., Fonagy, P., & Rentfrow, P. J. (2018). Elevated empathy in adults following childhood trauma. PLoS One, 13, 1-13. https://doi.org/10.1371/journal.pone.0203886

Güney, E., & Uçar, T. (2019). Effect of the fetal movement count on maternal–fetal attachment. *Japan Journal of Nursing Science*, *16*, 71-79. https://doi.org/10.1111/jjns.12214

Hart, R., & McMahon, C. A. (2006). Mood state and psychological adjustment to pregnancy. *Archives of Women's Mental Health, 9,* 329-337. https://doi.org/10.1016/S2215-0366(16)30148-1

Herba, C. M., Glover, V., Ramchandani, P. G., & Rondon, M. B. (2016). Maternal depression and mental health in early childhood: an examination of underlying mechanisms in low-income and middle-income countries. *The Lancet Psychiatry, 3,* 983-992. https://doi.org/10.1016/S2215-0366(16)30148-1

Hughes, K., Bellis, M. A., Hardcastle, K. A., Sethi, D., Butchart, A., Mikton, C., Jones, L. & Dunne, M. P. (2017). The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. *The Lancet Public Health, 2,* 356-366. https://doi.org/10.1016/S2468-2667(17)30118-4

Kohrt, B. A., Luitel, N. P., Acharya, P., & Jordans, M. J. (2016). Detection of depression in low resource settings: validation of the Patient Health Questionnaire (PHQ-9) and cultural concepts of distress in Nepal. *BMC Psychiatry*, *16*, 58. https://doi.org/10.1186/s12888-016-0768-y

Lei, P. W., & Wu, Q. (2007). Introduction to structural equation modeling: Issues and practical considerations. *Educational Measurement: Issues and Practice, 26,* 33-43. https://doi.org/10.1111/j.1745-3992.2007.00099.x

Le Strat, Y., Dubertret, C., & Le Foll, B. (2011). Prevalence and correlates of major depressive episode in pregnant and postpartum women in the United States. *Journal of Affective Disorders, 135*, 128-138. https://doi.org/10.1016/j.jad.2011.07.004

Lim, D., & DeSteno, D. (2016). Suffering and compassion: The links among adverse life experiences, empathy, compassion, and prosocial behavior. *Emotion, 16,* 175-182. https://doi.org/10.1037/emo0000144

Lindahl, V., Pearson, J. L., & Colpe, L. (2005). Prevalence of suicidality during pregnancy and the postpartum. *Archives of Women's Mental Health, 8*, 77-87. https://doi.org/10.4172/2376-127X.1000401

Lindgren, K. (2001). Relationships among maternal–fetal attachment, prenatal depression, and health practices in pregnancy. *Research in Nursing & Health, 24*, 203-217.

Magee, S. R., Bublitz, M. H., Orazine, C., Brush, B., Salisbury, A., Niaura, R., & Stroud, L. R. (2014). The relationship between maternal–fetal attachment and cigarette smoking over pregnancy. *Maternal and Child Health Journal, 18*, 1017-1022. https://doi.org/10.1007/s10995-013-1330-x.

McDonnell, C. G., & Valentino, K. (2016). Intergenerational effects of childhood trauma: evaluating pathways among maternal ACEs, perinatal depressive symptoms, and infant outcomes. *Child Maltreatment, 21*, 317-326. https://doi.org/10.1177/1077559516659556

Medjedović Marčinko, V., Marčinko, D., Đorđević, V., & Orešković, S. (2011). Anxiety and depression in pregnant women with previous history of spontaneous abortion. *Collegium Antropologicum, 35,* 225-228.

Müller, M. E., & Mercer, R. T. (1993). Development of the prenatal attachment inventory. *Western Journal of Nursing Research, 15,* 199-215. https://doi.org/10.1177/019394599301500205

Narayan, A. J., Lieberman, A. F., & Masten, A. S. (2021). Intergenerational transmission and prevention of adverse childhood experiences (ACEs). *Clinical Psychology Review, 85,* 101997. https://doi.org/10.1016/j.cpr.2021.101997

Narayan, A. J., Rivera, L. M., Bernstein, R. E., Harris, W. W., & Lieberman, A. F. (2018). Positive childhood experiences predict less psychopathology and stress in pregnant women with childhood adversity: A pilot study of the benevolent childhood experiences (BCEs) scale. *Child Abuse & Neglect, 78,* 19-30. https://doi.org/10.1016/j.chiabu.2017.09.022

Narvey, C., Yang, J., Wolff, K. T., Baglivio, M., & Piquero, A. R. (2020). The interrelationship between empathy and adverse childhood experiences and their impact on juvenile recidivism. *Youth Violence and Juvenile Justice,* 1541204020939647. https://doi.org/10.1177/1541204020939647

Nonacs, R., & Cohen, L. S. (2002). Depression during pregnancy: diagnosis and treatment options. *The Journal of Clinical Psychiatry, 63,* 24-30.

Nordahl, D., Høifødt, R. S., Bohne, A., Landsem, I. P., Wang, C. E. A., & Thimm, J. C. (2019). Early maladaptive schemas as predictors of maternal bonding to the unborn child. B*MC Psychology, 7,* 23. https://doi.org/10.1186/s40359-019-0297-9.

O'Donnell, K. J., & Meaney, M. J. (2017). Fetal origins of mental health: the developmental origins of health and disease hypothesis. *American Journal of Psychiatry, 174*, 319-328. https://doi.org/10.1176/appi.ajp.2016.16020138

Pallant, J. F., Haines, H. M., Hildingsson, I., Cross, M., & Rubertsson, C. (2014). Psychometric evaluation and refinement of the Prenatal Attachment Inventory. *Journal of Reproductive and Infant Psychology*, *32*, 112-125. https://doi.org/10.1080/02646838.2013.871627

Petri, E., Palagini, L., Bacci, O., Borri, C., Teristi, V., Corezzi, C., Faraoni, S., Antonelli, P., Cargioli, C., Banti, S., Perugi, G. & Mauri, M. (2018). Maternal–foetal attachment independently predicts the quality of maternal–infant bonding and post-partum psychopathology. *The Journal of Maternal-Fetal & Neonatal Medicine*, *31*, 3153-3159. https://doi.org/10.1080/14767058.2017.1365130

Plant, D. T., Barker, E. D., Waters, C. S., Pawlby, S., & Pariante, C. M. (2013). Intergenerational transmission of maltreatment and psychopathology: the role of antenatal depression. *Psychological Medicine, 43*, 519-528. https://doi.org/10.1017/S0033291712001298

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879-891. https://doi.org/10.3758/BRM.40.3.879

Racine, N., Plamondon, A., Madigan, S., McDonald, S., & Tough, S. (2018). Maternal adverse childhood experiences and infant development. *Pediatrics, 141*, e20172495. https://doi.org/10.1542/peds.2017-2495

Reuben, A., Moffitt, T. E., Caspi, A., Belsky, D. W., Harrington, H., Schroeder, F., Hogan, S., Ramrakha, S., Poulton R., & Danese, A. (2016). Lest we forget: comparing

retrospective and prospective assessments of adverse childhood experiences in the prediction of adult health. *Journal of Child Psychology and Psychiatry, 57*, 1103-1112. https://doi.org/10.1111/jcpp.12621

Reyes, M. E. S., Buac, K. M. M., Dumaguing, L. I. B., Lapidez, E. D., Pangilinan, C. A., Sy, W. P., & Ubaldo, J. S. (2018). Link between adverse childhood experiences and five factor model traits among Filipinos. *Journal of Psychology & the Behavioral Sciences, 4*, 71. https://doi.org/10.22492/ijpbs.4.2.06

Rollè, L., Giordano, M., Santoniccolo, F., & Trombetta, T. (2020). Prenatal attachment and perinatal depression: a systematic review. *International Journal of Environmental Research and Public Health,* 17, 2644. https://doi.org/10.3390/ijerph17082644.

Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling and more. Version 0.5–12 (BETA). *Journal of Statistical Software, 48,* 1-36.

Salisbury, A., Law, K., LaGasse, L., & Lester, B. (2003). Maternal-fetal attachment. *Journal of the American Medical Association, 289,* 1701-1701. https://doi.org/10.1001/jama.289.13.1701

Savage, L. É., Tarabulsy, G. M., Pearson, J., Collin-Vézina, D., & Gagné, L. M. (2019). Maternal history of childhood maltreatment and later parenting behavior: A meta-analysis. *Development and Psychopathology*, *31*, 9-21. https://doi.org/10.1016/j.chiabu.2011.11.005

Sancho-Rossignol, A., Schilliger, Z., Cordero, M. I., Rusconi Serpa, S., Epiney, M., Hüppi, P., & Ansermet, F., & Schechter, D. S. (2018). The association of maternal exposure to domestic violence during childhood with prenatal attachment, maternal-fetal heart rate, and infant behavioral regulation. *Frontiers in Psychiatry*, *9,* 1-10. https://doi.org/10.3389/fpsyt.2018.00358

Sedgmen, B., McMahon, C., Cairns, D., Benzie, R. J., & Woodfield, R. L. (2006). The impact of two-dimensional versus three-dimensional ultrasound exposure on maternal–fetal attachment and maternal health behavior in pregnancy. *Ultrasound in Obstetrics & Gynecology*, *27*, 245-251. https://doi.org/10.1002/uog.2703

Siddiqui, A., & Hägglöf, B. (2000). Does maternal prenatal attachment predict postnatal mother–infant interaction?. *Early Human Development*, *59*, 13-25. https://doi.org/10.1016/S0378-3782(00)00076-1

Slomian, J., Honvo, G., Emonts, P., Reginster, J. Y., & Bruyère, O. (2019). Consequences of maternal postpartum depression: A systematic review of maternal and infant outcomes. *Women's Health, 15,* 1745506519844044. https://doi.org/10.1177/1745506519844044

Smorti, M., Ponti, L., & Tani, F. (2019). Maternal depressive symptomatology during pregnancy is a risk factor affecting newborn's health: a longitudinal study. *Journal of Reproductive and Infant Psychology*, 1-9. https://doi.org/10.1080/02646838.2019.1581919

Staub, E., & Vollhardt, J. (2008). Altruism born of suffering: The roots of caring and helping after victimization and other trauma. *American Journal of Orthopsychiatry, 78*, 267-280. https://doi.org/10.1037/a0014223

Tedeschi, R. G., Park, C. L., & Calhoun, L. G. (Eds.). (1998). *Posttraumatic growth: Positive changes in the aftermath of crisis.* London, UK: Routledge.

Tichelman, E., Westerneng, M., Witteveen, A. B., Van Baar, A. L., Van Der Horst, H. E., De Jonge, A., Berger, M.Y., Schellevis, F.G., Burger, H., & Peters, L. L. (2019). Correlates of prenatal and postnatal mother-to-infant bonding quality: A systematic review. *PloS One, 14,* e0222998. https://doi.org/10.1371/journal.pone.0222998

Tranter, H., Brooks, M., & Khan, R. (2020). Emotional resilience and event centrality mediate posttraumatic growth following adverse childhood experiences. *Psychological Trauma: Theory, Research, Practice, and Policy. Published online.* https://doi.org/10.1037/tra0000953

Valdebenito, S., Murray, A., Hughes, C., Băban, A., Fernando, A. D., Madrid, B. J., Ward, C., Osafo, O., Dunne, M., Sikhander, S., Walker, S.P., Thang, V.V., Tomlinson, M., Fearon, P., Shenderovich, Y., Marlow, M., Chathurika, D., Taut, D., & Eisner, M. (2020). Evidence for Better Lives Study: a comparative birth-cohort study on child exposure to violence and other adversities in eight low-and middle-income countries-foundational research. *BMJ Open, 10,* e034986. https://doi.org/10.1136/bmjopen-2019-034986.

Ward, C., Sanders, M. R., Gardner, F., Mikton, C., & Dawes, A. (2016). Preventing child maltreatment in low-and middle-income countries. *Child Abuse & Neglect, 54,* 97-107. https://doi.org/10.1080/00207594.2012.737467

World Health Organization. (2014). *Process of translation and adaptation of instruments.* https://www.who.int/substance_abuse/research_tools/translation/en/

Table 1.

Sample characteristics (N = 1,185).

Metric	N (%)
Mother's age	
18 – 24	322 (27.2)
25 – 34	687 (57.9)
35 – 44	172 (14.5)
45+	4 (.34)
Missing	*0 (0.0)*
Country of residence	
Jamaica	152 (12.8)
Sri Lanka	152 (12.8)
Ghana	145 (12.2)
Pakistan	134 (11.3)
Philippines	154 (13.0)
Romania	150 (12.7)
South Africa	148 (12.5)
Vietnam	150 (12.7)
Missing	*0 (0.0)*
Highest educational attainment	
No/incomplete primary education	91 (7.8)
primary school educated	83 (7.1)
secondary school educated	563 (48.0)
Vocational/technical school educated	86 (7.3)
University educated	247 (21.0)
Other	102 (8.7)
Missing	*13 (.60)*
Prior pregnancies	
0	363 (30.6)
1 – 2	546 (46.1)
3 – 4	214 (18.1)
5+	62 (5.2)
Missing	*0 (0.0)*
Weeks pregnant	
28 – 30	316 (26.6)
31 – 33	333 (28.1)
34 - 36	308 (26.0)
37 – 39	195 (16.4)
40+	33 (2.8)
Missing	*0 (0.0)*
Unwanted pregnancy	
Yes	305 (25.7)
No	877 (74.0)
Missing	*3 (.3)*
Household possessions	

1-5				103 (8.7)
6-10				609 (51.4)
11-15				426 (36.0)
Missing				*47 (4.0)*
MacArthur Scale of Subjective Social Status score				
0 – 2				100 (8.5)
3 – 5				612 (51.7)
6 – 8				402 (33.8)
9 – 10				60 (5.1)
Missing				*11 (.90)*
	Mean	**SD**	**Range**	**Missing (%)**
PHQ-9	6.82	4.76	0 – 25	*17 (1.44)*
ACE-IQ	4.39	3.35	0 – 17	*53 (4.48)*
PAI-R	52.72	11.41	18 – 72	*28 (2.37)*

Note. PHQ-9: Patient Health Questionnaire – 9, ACE-IQ: Adverse Childhood Experiences – International Questionnaire, Prenatal Attachment Inventory – Revised.

Table 2.

Unadjusted mediation analysis with parameters free to vary across countries.

	Direct effect of ACES			Indirect effect of ACES via depressive symptoms		
Country	Estimate	Lower CI (95%)	Upper CI (95%)	Estimate	Lower CI (95%)	Upper CI (95%)
Jamaica	.047	-.396	.489	-.097	-.245	.051
Ghana	.112	-.375	.599	-.063	-.185	.059
Pakistan	.935*	.170	1.69	.052	-.080	.184
Philippines	.345	-.069	.759	-.165*	-.313	-.018
Romania	-.314	-.724	.095	-.087	-.199	.025
South Africa	-.153	-.628	.322	-.262*	-.485	-.039
Sri Lanka	-.046	-.369	.276	-.080	-.182	.021
Vietnam	-.681*	-1.29	-0.67	-.018	-.222	.187

Note. *p <.05, **p <.01. CI: Confidence Intervals.

Table 3.

Adjusted mediation analysis with parameters freely varying across countries.

	Direct effect of ACES			Indirect effect of ACEs via depressive symptoms		
Country	Estimate	Lower CI (95%)	Upper CI (95%)	Estimate	Lower CI (95%)	Upper CI (95%)
Jamaica	.116	.331	-.190	-.094	-235	.047
Ghana	-.129	-.345	.603	-.078	-.203	.046
Pakistan	1.16**	.362	1.96	.050	.073	.173
Philippines	.262	-.163	.686	-.140*	-.279	-.001
Romania	-.312	-.736	.112	-.096	-.220	.029
South Africa	.226	-.708	.256	-.212	-.433	.008
Sri Lanka	-.077	-.400	.246	-.060	.155	.035
Vietnam	-.648*	-1.26	-.042	.039	.168	.246

Note. *p <.05, **p <.01. CI: Confidence Intervals.

Table 4.

Summary of findings.

Research site	n	Direct effect of ACEs on foetal attachment (B)	Mediating effect of depressive symptoms (B)
Mediating model with parameters freed across countries, adjusted for covariates			
Jamaica	152	n.s	n.s
Ghana	145	n.s	n.s
Pakistan	134	1.16**	n.s
Philippines	154	n.s	-.140*
Romania	150	n.s	n.s
South Africa	148	n.s	n.s†
Sri Lanka	152	n.s	n.s
Vietnam	150	-.648*	n.s
Mediating model with parameters fixed across countries, adjusted for covariates			
Total sample	1185	n.s	-.084***

Note. n.s: non-significant. *p<.05, **p <.01, ***p <.001. †Non-significant after adjusting for covariates.

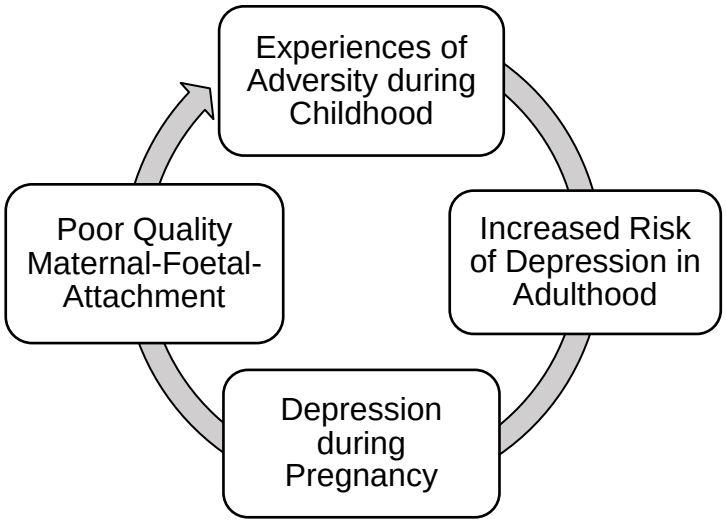

Figure 1. Hypothetical cycle of risk transmission across the generations.