

**Examining Whether Maternal Distress And Pregnancy Complications May Be
Viewed As Environmental Sensitivity Factors In A Cohort Of Syrian Refugee
Children**

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Abstract

This study assesses whether maternal psychological distress and pregnancy complications experienced while in-utero may be viewed as Environmental Sensitivity factors. Environmental Sensitivity theory broadly states that a child's earliest experiences combine with their genes to make them more attuned ('sensitive') to their environment. It is thought that strongly positive or strongly negative early experiences may lead to a child being more environmentally sensitive. Highly sensitive children are expected to thrive more in positive environments but to suffer more in negative environments. These children may be most likely to perform worse academically or develop a mental illness in harsh circumstances, but have the capacity to achieve beyond and beyond their peers in supportive circumstances.

This study examines the effect of We Love Reading, a shared book reading intervention implemented with Syrian refugee children aged between 4-8 in Jordan. I assessed whether this intervention had a different effect on the study children based on their experiences of complications in-utero or maternal psychological distress, in line with Environmental Sensitivity theory. Survey and direct assessment data was collected at three timepoints, T1 (pre-intervention), T2 (endline) and T3 (post-endline). Intervention outcome was observed with the Holistic Assessment of Learning and Development Outcomes - literacy scale at T1 and T2. I ran two multiple regressions to test whether experience of pregnancy complications affected the impact of the intervention, and whether experience of maternal distress affected the impact of the intervention. To examine whether the effect of the intervention on literacy was mediated by maternal psychological distress, I added a treatment status * maternal psychological distress interaction term. The interaction effect was non-significant ($p = 0.801$). To examine whether the effect of the intervention on literacy was mediated by pregnancy complications, I added a treatment status * pregnancy complications interaction term. This interaction effect was also non-significant ($p = 0.55$). Future studies examining pregnancy complications and child outcomes may wish to focus on specific complications in pregnancy and their

relation to child outcomes. Future studies examining maternal psychological distress and child outcomes may wish to focus on specific facets of maternal psychological distress.

Introduction

Last year nearly 520,000 Syrian refugees inhabited Jordan, with close to half this population comprising children (UNHCR, 2026). 23.4% of Syrian refugee children have symptoms of one or more mental health issues, including depression, anxiety and PTSD (Polack et al., 2020). As of 2019, only 3% of Syrian refugee adolescents in Jordan had completed third level education (UNHCR, 2019). Jordan continues to endure limited economic growth and Syrian refugees in Jordan are currently facing a reduction in humanitarian services and assistance combined with barriers to medical treatment and education (UNHCR, 2026). We Love Reading was established in Jordan as a shared book-reading intervention in response to educational needs identified by the local community (Hadfield et al., 2024). The Family Intervention for Empowerment through Reading and Education (FIERCE) project examined the effect of this intervention while gathering data on many other variables relating to family, demographic, child wellbeing and cognitive-related factors. Although maternally-rated child attitudes towards reading increased as a result of this intervention, child literacy was not significantly improved.

Research on mental health issues in refugee populations should consider how resilience factors may protect against, or risk factors may lead to, individuals developing mental health issues (Popham et al., 2023). One prevailing theory in this area is Environmental Sensitivity. This broadly states that some people are more sensitive to their surrounding environment than others. In positive circumstances these individuals thrive, but in negative circumstances these individuals may suffer especially (Pluess et al., 2023). Ellis and Boyce (1995) state that highly positive or

highly negative early experiences may predispose children to be more sensitive to their environments. This would provide an advantage to the child either gaining more benefit from the positive enriching environment or being more sensitive to negative aspects of a potentially threatening environment. In the context of this study, if children that have been exposed to certain early negative experiences benefit more from the shared book-reading intervention than their peers that have not been exposed to such experiences, then these experiences may be proven to make individuals more Environmentally Sensitive. Future interventions may then target children who have experienced these Environmental Sensitivity factors, as they would particularly benefit from an enriched environment. These interventions may especially benefit the children who are at a heightened risk for the development of mental illness (May et al., 2024).

Maternal Distress

Maternal mental illness has a substantial effect on child outcomes. In middle childhood, this can be observed in children as development of mental illness themselves (Goodman & Garber, 2017). Children of mothers with depression are more likely to be diagnosable with a psychiatric disorder themselves at ages six and ten (Priel et al., 2019). Children of mothers with depression are twice as likely to display developmental delays, with a particular effect on literacy-related domains (Utami et al., 2026). A recent study of Syrian refugee children has identified that maternal anxiety may serve as an Environmental Sensitivity factor in middle childhood, meaning that children whose mothers display symptoms of anxiety may be more highly attuned to both the positive and negative aspects of their environment than their peers (May et al., 2025). This study made use of the Highly Sensitive Child scale, which is a 12-item self-report scale intended to measure Environmental Sensitivity in children (Pluess et al., 2018). As a self-reported measure, this scale is open to some issues such as response bias and contextual influence (Weyn et al., 2021). For the current study, direct assessment of literacy

outcomes has been chosen to evaluate response to intervention as a measure of Environmental Sensitivity.

The first hypothesis is that maternal psychological distress is an Environmental Sensitivity factor. This is determined by examining maternal distress and pre-intervention literacy scores alongside treatment status as potential predictors of literacy scores post-intervention. Literacy is measured directly as opposed to previous studies which have used a self-reported measure. If treatment status and maternal distress interact to predict literacy scores post-intervention, then it may be that maternal distress is an experience that makes a child more environmentally sensitive. This would have implications for the prevention of mental illness in vulnerable populations, as children whose mothers display symptoms of mental distress or mental illness could be targeted for intervention. These children may be more susceptible to mental illness themselves and sensitive to developmental delay in less enriching environments, but especially receptive to interventions which may help them to thrive (Pluess & Boniwell, 2015).

Pregnancy Complications

Complications during pregnancy have long-lasting effects on the developing child. Maternal diabetes during pregnancy is associated with lower cognitive ability in the developing child (Fraser et al., 2014). Maternal depression during pregnancy is related to higher negative affect in three-month old children (Sperati et al., 2025). Maternal stress may cause disruption of stress hormones which may be transmitted to the developing fetus, altering lifelong stress regulation in the infant (Bosquet Enlow et al., 2018). According to this fetal programming hypothesis, prenatal experiences may allow the infant to prepare for their postnatal environment via altered stress response mechanisms (Hartman & Belsky, 2018). Infants who experience adversity in utero may emerge as more sensitive to both the positive and negative aspects of their future environment.

Pre-term birth and low birth weight are two common markers of prenatal adversity, and have been examined in association with Environmental Sensitivity. It is often thought that pre-term birth and low birth weight are the mechanisms by which early adversity may take effect on the developing infant (Dunkel Schetter, 2011). ‘Mild Perinatal Adversities’ (encompassing both pre-term birth and low birth weight) are seen to act as markers of Environmental Sensitivity in response to a literacy intervention in a randomised control trial (van der Kooy-Hofland et al., 2012). It has been observed that maternal stressful life events during pregnancy may be a predictor of lower cognitive ability and altered temperament in developing infants, independently of low birth weight or pre-term birth status (Zhu et al., 2014). The current study seeks to discover whether complications during pregnancy may emerge as an Environmental Sensitivity factor, separately to low birth weight or pre-term birth status.

The second hypothesis is that pregnancy complications are an Environmental Sensitivity factor. This is determined by examining pregnancy complications alongside literacy scores pre-intervention and treatment status as potential predictors of literacy scores post-intervention. If treatment status and pregnancy complications interact to predict literacy scores post-intervention, then it may be that complications in utero make a child more Environmentally Sensitive. This would have implications for the prevention of mental illness in vulnerable populations as children who experienced complications in utero could be targeted for intervention. These children may be more susceptible to mental illness and developmental delays, but would be especially receptive to interventions which may help them to thrive.

Methodology

This study is based on secondary data accessed from the FIERCE project. For the FIERCE project, a cluster randomised control trial involved fieldworkers collecting

data from Syrian refugee children (between 4-8 years old, mean age 6.3 years) and their mothers in Jordan. The We Love Reading intervention as developed by the Taghyeer foundation was implemented in treatment clusters, with measures pertaining to demographic and family factors as well as cognition, executive function, and literacy taken at T1 (baseline), T2 (endline) and T3 (post-endline). 284 Mothers completed the Kessler 6-item Scale for Psychological Distress at T1 (baseline). These participants were based in the Amman and Za'atari refugee camps. 102 Mothers answered a question about pregnancy complications at T3 (post-endline). These participants were based in the Amman refugee camp only. HALDO child literacy levels were measured directly at T1 and T2. The current study has been pre-registered on the Open Science Foundation.

The first hypothesis is that maternal psychological distress will emerge as an Environmental Sensitivity factor. A multiple linear regression was run with the continuous independent variables of maternal psychological distress and literacy scores at T1, the dichotomous variable treatment group, and the continuous outcome of literacy at T2. Child age and child sex were included as covariates. The regression was repeated with the addition of an interaction term for maternal psychological distress * treatment group. If maternal psychological distress is an Environmental Sensitivity factor, then treatment status and maternal psychological distress would interact to predict literacy scores at T2.

The second hypothesis is that pregnancy complications will emerge as an Environmental Sensitivity factor. A multiple linear regression was run with the dichotomous independent variables of pregnancy complications and treatment/control status, the continuous independent variable literacy scores at T1, and the continuous outcome of literacy at T2. Child age and child sex were included as covariates. The regression was repeated with an interaction term for pregnancy complications * treatment group. If complications during pregnancy are an Environmental Sensitivity factor, then treatment status and pregnancy complications would interact to predict literacy scores at T2.

Results

For the first hypothesis, two multiple linear regressions were run. For the first multiple linear regression, maternal psychological distress, literacy scores at T1 and treatment group were included as predictor variables. Literacy score at T2 was the outcome variable, and child age and sex were included as covariates. This resulted in a significant model, $F(7,317) = 9.445$, $p < 0.001$, (adjusted) $R^2 = 0.154$. A second multiple regression analysis was conducted with an interaction term for treatment status * maternal psychological distress. This also resulted in a significant model, $F(8,316) = 7.808$, $p < 0.001$, (adjusted) $R^2 = 0.401$. The interaction term between treatment status and maternal psychological distress was non-significant, $p = 0.801$. As such the first hypothesis, that maternal psychological distress is an Environmental Sensitivity factor, cannot be accepted.

For the second hypothesis, a further two multiple linear regressions were run. For the first multiple linear regression, pregnancy complications, literacy scores at T1 and treatment group were included as predictor variables. Literacy score at T2 was the outcome variable, and child age and sex were included as covariates. This resulted in a significant model, $F(8, 316) = 7.808$, $p < 0.001$, (adjusted) $R^2 = 0.144$. The second multiple regression analysis was conducted with an interaction term for treatment group * pregnancy complications. This also resulted in a significant model, $F(9, 315) = 6.967$, $p < 0.001$, (adjusted) $R^2 = 0.142$. The treatment status * pregnancy complications interaction term was non-significant, $p = 0.55$. As such the second hypothesis, that pregnancy complications are an Environmental Sensitivity factor, cannot be accepted.

Discussion

The interaction between treatment status and maternal distress was non-significant, meaning that the impact of the intervention on literacy was not affected by the child's mother exhibiting psychological distress. This goes against the May et al., (2025) paper, which identified maternal anxiety as an Environmental Sensitivity factor. This also goes against the Utami et al., (2026) paper, which found that literacy-related domains of development were affected by maternal depression. It may be that maternal mental illness/psychological distress have no effect on child outcomes. However, the original study of this intervention did not find a significant effect on literacy (Hadfield et al., 2024). It is possible that an interaction effect was not found due to the lack of statistical power. It may be that maternal psychological distress was not identified as an Environmental Sensitivity factor due to the cumulative effect of adverse experiences preventing resilient responses from emerging (Reuben & Shaw, 2015). It is possible that this cohort of Syrian refugee children in Jordan were exposed to multiple and varied stressors that prevented potentially environmentally sensitive children from being able to thrive and benefit properly from this intervention.

Although a previous study identified maternal anxiety as an environmental sensitivity factor in a similar cohort of Syrian refugee children, this study was carried out with the Highly Sensitive Child Scale and did not examine response to enriched environment or make use of direct assessment (May et al., 2025). The authors of this study did outline the pitfalls of the use of linear models when examining Environmental Sensitivity theory, which is a major limitation of the current study. It is possible that a more sophisticated statistical approach may have yielded a different result. Reductions in maternal depression over time mediate improvements in child problem behaviours (Shaw et al., 2009). It may be that maternal anxiety was more acute prior to data collection in the May et al. (May et al., 2025) paper (due to the timing of the 2011 Syrian civil war, with data collection occurring between 2017 and

2019) and that child outcomes were mediated by maternal anxiety but not in a manner consistent with Environmental Sensitivity theory. Finally, maternal psychological distress as measured by the Kessler-6 scale for psychological distress is far broader than maternal anxiety as identified in the May et al., (2025) study. It is possible that maternal anxiety alone is an Environmental Sensitivity factor, while maternal depression or maternal psychological distress are not.

The interaction between treatment status and pregnancy complications was non-significant, meaning that the impact of the intervention on literacy was not affected by the child experiencing complications in utero. This is in contrast to the literature on 'Mild Perinatal Adversities', where adversities like pre-term birth and low birth weight are identified as markers of Environmental Sensitivity (van der Kooy-Hofland et al., 2012). It may be that pre-term birth and low birth weight are Environmental Sensitivity factors, but complications in utero are not. The literature does not currently make meaningful distinctions between types of pregnancy stressors for consequences for offspring (Gartstein & Skinner, 2018). However, a major limitation of this study is the dichotomous nature of the data pertaining to pregnancy complications. It is possible that some facets of complications during pregnancy may serve as Environmental Sensitivity factors (ie., stress during pregnancy; (Hartman & Belsky, 2018)), but that this was masked because all complications were included together for analysis. Future studies may seek to examine specific pregnancy complications and their relation to offspring outcomes. Further, mothers were asked about pregnancy complications at the time of their child being aged 4-8 years. This may lead to a bias in recall, or difficulty in remembering the pregnancy as it was. Linear models as used here may not be the most appropriate for use when examining Environmental Sensitivity, a major limitation of this analysis also. Again, as the intervention alone was found to have no significant effect on literacy (Hadfield et al., 2024), it may be that complications in pregnancy are an Environmental Sensitivity factor but that this intervention did not constitute an enriching environment.

Conclusion

No significant effect of maternal psychological distress was found on the impact of the We Love Reading intervention. Future studies may wish to examine specific maternal mental illnesses and their relation to child outcomes. Interventions aimed at uplifting children who have experienced adversity may wish to focus on more well established Environmental Sensitivity factors. No significant effect of pregnancy complications was found on the impact of the We Love Reading intervention. Future studies may wish to examine more specific complications in pregnancy and their relation to child outcomes in line with Environmental Sensitivity theory. Interventions focused on assisting children who have experienced early adversity may wish to identify those who have experienced pre-term birth or low birth weight instead. Further research into Environmental Sensitivity theory may examine positive responses to intervention in the context of cumulative risk.

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