

Prenatal stressful life events and multi-dimensional life success at age 30: Exploring associations and potential mediating childhood mechanisms in a prospective Australian cohort.

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Abstract

Prenatal stress and stressful life events are associated with health and behavioral adversity in adulthood. Using a life course approach, we analyse a prospective Australian dataset to expand this body of research by examining associations between prenatal stressful life events (PSLEs) and a multidimensional measure of life success at age 30 measuring (a) socio-economic success; (b) family life/stability; and (c) happiness/life satisfaction. Using multivariate regression, we find mothers reporting 4 or more PSLEs significantly predicts lower life success at age 30 among males during early pregnancy and among all respondents at birth. These associations are significant after controlling for a range of prenatal conditions, such as SES, smoking, and health of the mother. In mediation analysis, we find that child and factors such as living with both biological parents, adolescent depression, physical or sexual abuse, and maternal mental health significantly mediate associations between PSLEs and adult life success. From a life course perspective, our results demonstrate that PSLEs are linked with a successful transition into adulthood, with events in childhood and adolescence substantially mediating these associations. Our results have important implications for policy and understanding how adversity across stages of child development may impact adult life success.

Extended summary

Theoretical focus

Prenatal stress and stressful life events are associated with a range of conditions in adulthood, in cardiovascular disease, depression, lower cognition and behavioral problems. [1-4] While some evidence has found that prenatal stressors are linked to child outcomes and academic achievement [5, 6], broader research on a range of adult measures of wellbeing into adulthood, to our knowledge, have not been widely studied. Notably, a combination of a lack of prospective birth cohort studies with prenatal stress and adult outcome data, along with research incorporating the complexity of the life course has hampered research. For example, while the fetal programming hypothesis suggests that childhood stressors create disease and adversity in adulthood, it remains important to note that the majority of those exposed do not experience disadvantage,

but may be less resilient to adverse events [3, 7]. Using a life course perspective, we examine how prenatal stressful life events (PSLEs) are linked to multidimensional measure of adult life success, with potential adversities in early childhood and adolescence mediating these associations. Drawing on life course theory and the literature on the transition to adulthood, we interpret our findings to inform research and policy.

Data

We used data from the Mater Hospital-University of Queensland Study of Pregnancy (MUSP) to examine patterns among a cohort of children born to expectant mothers from 1981-1984 in Brisbane, Australia. From the original cohort of 7223 singleton births, we analyse 2312 children followed through age 30 with prenatal data. Our analyses include waves where mothers completed surveys prenatally, at birth, when children were age 5, and when children were age 14. We also include when children were themselves interviewed at age 30 for life success measures. Further information on the MUSP data can be found in MUSP cohort profiles. [8, 9]

Key Measures

Life success. The life success scale uses nine items to capture success on three dimensions (a) socio-economic success; (b) family life/stability; and (c) happiness/life satisfaction. Each indicator of life success was coded as '1', with all items being summed together for a total life success score of 0–9. The Cronbach's alpha (α) for the scale is 0.76. The full scale is described elsewhere. [10]

Prenatal Stressful Life Events. PSLEs items contain items such as death of a family/member friend, involvement with the law, and financial problems. Respondents are asked if any events occurs in the 6 months prior interview, with nine events during pregnancy and eight at birth. Items are examined individually and also summed at each wave. Individual PSLEs described elsewhere. [11]

Childhood Adversities. Childhood adversities include maternal depression and anxiety, adolescent behavioral problems, poverty, parental separation/divorce, and histories of physical and sexual abuse.

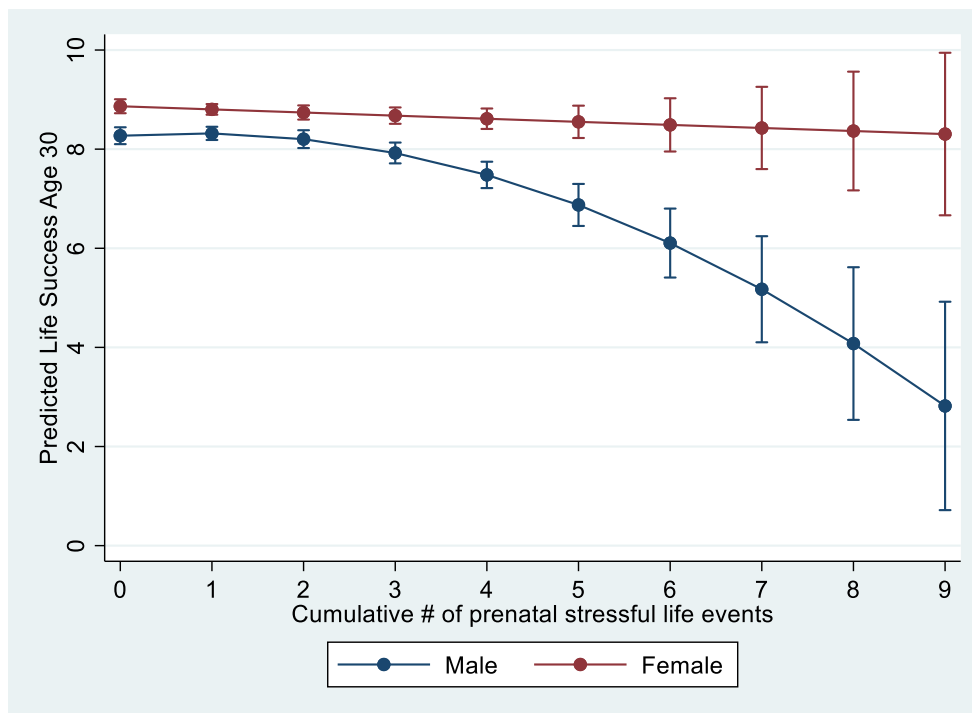
Research methods

We use multivariate regression to examine the association between PSLEs and life success to examine if patterns by gender and hold with a range of controls that may act as confounders. We use the mediation package 'medsem' available in STATA to conduct mediation analysis.

Expected findings

In preliminary analysis, we have analyzed the individual items and scales to determine patterns between PSLEs and life success. Comparing the individual items and the number of PLSEs, we find that the number of PSLEs predict life success at age 30. This can be seen in Figure 1, where plot life success (9-item scale) for male and female respondents during pregnancy, with a quadratic moderation significant at $p < 0.01$.

Figure 1: Number of Prenatal Stressful Life Events at first clinic visit and life success at age 30, by child's gender



Notes: The number of prenatal stressful life events occur in the 6 months prior to first clinic visit, with a mean gestational age of 17.8 weeks at the first clinic visit. Figure is based on the quadratic sex moderation and are significant at ($p < 0.01$)

We then conduct separate analyses to evaluate the robustness of these associations to a range of potential confounders during pregnancy or birth, such as prenatal maternal smoking, prenatal depression and anxiety, prenatal BMI, and child birth weight, and maternal education. We find these associations hold with these potential confounders.

We then conduct mediation analyses to see the extent to which the association between the number of PSLEs and life success. Below, in Table 1, we list potential mediators, the proportion of the total effect explained for PSLEs and life success, and significance of the moderation. We note that these moderators are commonly recognized as potential adversities that impact outcomes in adulthood. Some mediators do not significantly mediate the association, while other adversities like divorce/separation at age 5 or physical abuse explain 23-34% of the association between the number of PLSEs and life success. We note that the number of adverse childhood experiences, a known predictor of health and psychosocial outcomes, explains 43% of the effect during pregnancy and over one-half of the effect at birth.

Table 1. Select mediation effects for the association between the number of prenatal stressful life events and life success at age 30.

Mediator	PSLE, Pregnancy		PSLE, Birth	
	% Mediated	p-value	% Mediated	p-value
Child birth weight	0%	0.989	0%	0.815
Parental separation/divorce, age 5	23%	0.003	24%	0.002
Childhood physical abuse	23%	<0.000	34%	<0.001
Maternal anxiety, age 5	13%	0.008	14%	0.004
Chronic poverty under age 5	7%	0.166	9%	0.087
Delinquency age 14	15%	0.014	32%	<0.001
# of adverse childhood experiences	43%	<0.001	54%	<0.001

References

- Entringer S, Buss C, Wadhwa PD: **Prenatal stress, development, health and disease risk: A psychobiological perspective—2015 Curt Richter Award Paper.** *Psychoneuroendocrinology* 2015, **62**:366-375.
- Van den Bergh BR, van den Heuvel MI, Lahti M, Braeken M, de Rooij SR, Entringer S, Hoyer D, Roseboom T, Räikkönen K, King S: **Prenatal developmental origins of behavior and mental health: The influence of maternal stress in pregnancy.** *Neuroscience & Biobehavioral Reviews* 2020, **117**:26-64.
- Cohen S, Murphy ML, Prather AA: **Ten surprising facts about stressful life events and disease risk.** *Annual review of psychology* 2019, **70**(1):577-597.
- Robinson M, Mattes E, Oddy WH, Pennell CE, Van Eekelen A, McLean NJ, Jacoby P, Li J, De Klerk NH, Zubrick SR: **Prenatal stress and risk of behavioral morbidity from age 2 to 14 years: The influence of the number, type, and timing of stressful life events.** *Development and psychopathology* 2011, **23**(2):507-520.
- Torche F: **Prenatal exposure to an acute stressor and children's cognitive outcomes.** *Demography* 2018, **55**(5):1611-1639.
- Aizer A, Stroud L, Buka S: **Maternal stress and child outcomes: Evidence from siblings.** *Journal of Human Resources* 2016, **51**(3):523-555.
- Hougaard KS, Andersen MB, Kjær SL, Hansen ÅM, Werge T, Lund SP: **Prenatal stress may increase vulnerability to life events: comparison with the effects of prenatal dexamethasone.** *Developmental Brain Research* 2005, **159**(1):55-63.
- Najman JM, Alati R, Bor W, Clavarino A, Mamun A, McGrath JJ, McIntyre D, O'Callaghan M, Scott J, Shuttlewood G: **Cohort profile update: the Mater-University of Queensland study of pregnancy (MUSP).** *International journal of epidemiology* 2015, **44**(1):78-78f.
- Najman JM, Bor W, O'Callaghan M, Williams GM, Aird R, Shuttlewood G: **Cohort profile: the Mater-University of Queensland study of pregnancy (MUSP).** *International journal of epidemiology* 2005, **34**(5):992-997.
- Roettger ME, Tan J, Houle B, Najman JM, McGee T: **Adolescent behavioral problems, preterm/low birth weight children and adult life success in a prospective Australian birth cohort study.** *Preventive Medicine* 2024, **185**:108061.
- Betts KS, Williams GM, Najman JM, Scott J, Alati R: **Exposure to stressful life events during pregnancy predicts psychotic experiences via behaviour problems in childhood.** *Journal of psychiatric research* 2014, **59**:132-139.