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RESEARCH ARTICLE

The Role of Childhood Adversity in the Development of Gestational Diabetes

Danielle A.J.M. Schoenaker, PhD,[1,2,3] Leonie K. Callaway, MBBS, PhD,[4,5] Gita D. Mishra, PhD[6]

Introduction: The influence of women's childhood psychosocial environment and subsequent preconception mental health on risk of developing gestational diabetes mellitus is unclear. This study examines this relationship.

Methods: Data from a population-based cohort study, the Australian Longitudinal Study on Women's Health, were used. A total of 6,317 women with no pre-existing diabetes were followed from 1996 (aged 18–23 years) until 2015. Gestational diabetes mellitus diagnosis was self-reported. Exposures to eight subcategories of adverse childhood experiences were recalled. Individual subcategories and total number of adverse childhood experiences were examined. Log-binomial regression models with generalized estimating equations were used to estimate RRs and 95% CIs. Analyses were adjusted for early life, preconception, and antenatal gestational diabetes mellitus risk factors. Effect modification by preconception mental health was tested using cross-product terms. Analyses were conducted in 2018.

Results: Among 11,556 pregnancies, 4.7% were complicated by gestational diabetes mellitus. Compared with women not exposed to adverse childhood experiences, exposure to any three adverse childhood experiences (6% of women, adjusted RR=1.73, 95% CI=1.02, 3.01) or four or more adverse childhood experiences (7%, adjusted RR=1.76, 95% CI=1.04, 2.99) was associated with elevated gestational diabetes mellitus risk in women with preconception depressive symptoms. Among the subcategories of adverse childhood experiences, physical abuse, and household substance abuse were associated with higher gestational diabetes mellitus risk. Adverse childhood experiences were not associated with gestational diabetes mellitus in women without depressive symptoms before pregnancy (p=0.01, for interaction).

Conclusions: These findings suggest that, in addition to primary prevention of childhood adversity, strategies to curb poor mental health trajectories among women exposed to adverse childhood experiences may contribute to prevention of gestational diabetes mellitus.

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INTRODUCTION

Prevention of gestational diabetes mellitus (GDM) is an important public health goal globally because GDM is an increasingly common complication of pregnancy[1,2] and has lifelong health consequences for both mothers and their children.[3,4] There is growing recognition that prevention of risk-enhancing exposures and behaviors from an early age may contribute to the prevention of GDM and that efforts to effectively reduce the prevalence of GDM should take a life course approach.[5–9]

From the [1]School of Medicine, Faculty of Science, Medicine and Health, University of Wollongong, Wollongong, New South Wales, Australia; [2]Illawarra Health and Medical Research Institute, Wollongong, New South Wales, Australia; [3]Discipline of Obstetrics and Gynaecology, Robinson Research Institute, University of Adelaide, Adelaide, South Australia, Australia; [4]UQ Centre for Clinical Research, Faculty of Medicine, University of Queensland, Brisbane, Queensland, Australia; [5]Obstetric Medicine, Royal Brisbane and Women's Hospital, Brisbane, Queensland, Australia; and [6]School of Public Health, Faculty of Medicine, University of Queensland, Brisbane, Queensland, Australia

Address correspondence to: Danielle A. J. M. Schoenaker, PhD, School of Medicine, Faculty of Science, Medicine and Health, University of Wollongong, Northfields Avenue Wollongong, New South Wales 2522, Australia. E-mail: danis@uow.edu.au.

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Exposure to adverse childhood experiences (ACEs)—including physical, emotional, and sexual abuse, and household dysfunction, such as parental substance abuse—is well recognized to have negative effects on lifestyle behaviors and physical and mental health across life.[10,11] The high prevalence of a diverse array of health problems and health-harming behaviors before and during early pregnancy among women exposed to ACEs, such as poor diet quality, physical inactivity, and obesity,[11–13] may place these women at a higher risk of GDM.[14–21] In addition, experimental and observational studies have indicated that early traumatic experiences may alter the development of nervous, endocrine, and immune systems,[22,23] which may link ACEs with GDM through physiologic pathways independent of poor lifestyle. Strong evidence also suggests that a stressful environment in childhood increases the risk of poor mental health in adulthood,[24,25] which may be a potential mediating pathway explaining a link with GDM risk. Alternatively, long-term exposure to stress through ACEs during childhood and adolescence, in combination with depressive symptoms or diagnosis in adulthood (before or during pregnancy), may have a cumulative effect on development of adverse health conditions such as GDM. Based on life course theory, as the number or duration of harmful exposures increase there is an increasing damage to biological systems,[26] thus, the presence of poor mental health during the preconception period may amplify the effect of traumatic experiences during childhood and adolescence.

Current evidence on the potential impact of childhood adversity on women's risk of developing GDM is limited,[27] and further exploration of modifiable early life and preconception factors that may modify the potential impact of ACEs on GDM risk is needed. Therefore, this study aims to examine the following research questions: Are ACEs associated with risk of developing GDM? Does mental health before or during pregnancy modify or mediate this association?

METHODS

Study Population

This study used data from the 1973–1978 cohort of the Australian Longitudinal Study on Women's Health, an ongoing population-based cohort study. The study was established in 1996, when 41% of women aged 18–23 years were randomly selected from the national Medicare health insurance database. A total of 14,247 women who responded to the first survey in 1996 completed follow-up questionnaires every 3–4 years, with the most recent survey conducted in 2015 (n=7,186, 50%). Full details of the study have been published previously[28,29] and are available online (www.alswh.org.au). Informed consent was obtained from all participants at each survey and the study was approved by the Human Research Ethics Committees at the Universities of Newcastle and Queensland, Australia.

Data on pregnancies were collected through Surveys 4 (2006, age 28–33 years), 5 (2009, age 31–36 years), 6 (2012, age 34–39 years), and 7 (2015, age 37–42 years); women who did not respond to any of these follow-up surveys could not be included in the current analysis (n=4,088). Women were excluded if they did not report a pregnancy during the study period (1996–2015; n=1,980), had a diagnosis of Type 1 or 2 diabetes before pregnancy (n=129), had no data on GDM (n=899), or were pregnant at the time of any survey (n=834). The sample for analysis included 6,317 women who reported on 11,556 pregnancies (Appendix Figure 1, available online).

Measures

Data for GDM were ascertained from self-reported physician diagnosis reported from Survey 4 onwards for each pregnancy that resulted in a live birth (including pregnancies before Survey 4) using the following question: *Were you diagnosed or treated for gestational diabetes?* A reliability study among a subgroup of women from New South Wales, Australia (n=1,914), demonstrated high agreement of 91% between self-reported GDM diagnosis in the study and administrative data records.[30]

At Survey 7, women were asked to recall ACEs using a set of questions that were adapted from the original ACEs checklist.[10] A set of 18 questions assessed exposure to eight subcategories of adverse events (of ten subcategories in the original ACEs checklist) experienced when aged <18 years (Appendix Table 1, available online). Individual subcategories of ACEs were examined and a summary score was created to examine the degree of childhood adversity (range, 0–8). ACEs were categorized as no exposure (zero ACEs), low (one to two ACEs), moderate (three ACEs), and severe (four or more ACEs) exposure, in line with previous studies.[11]

At the first survey, self-reported information was collected on country of birth, parents' highest educational qualification, and self-described weight during childhood (at age 10 years). Across different surveys, information was available on birth weight (Survey 2), age at menarche (Survey 2), diagnosis of polycystic ovary syndrome (Survey 4), family history of diabetes, and family history of depression or anxiety disorder (Survey 7).

At baseline and follow-up surveys, time-varying data were available on women's own highest educational qualification completed, alcohol consumption, illicit drug use, smoking status, physical activity levels, BMI, violence, and physician diagnosis or treatment of depression and anxiety disorder. Perceived stress was examined using an 11-item scale including items on specific life domains such as stress related to health, work, relationships, and motherhood.[31] Social functioning (i.e., the extent to which physical or emotional problems interfered with normal social activities) and emotional well-being (i.e., the extent to which emotional problems influenced the ability to do work or other regular activities as usual) were assessed at each survey using the short form-36 scale (possible range, 0–100).[32] Depressive symptoms were measured using the validated ten-item Center for Epidemiologic Studies Depression Scale.[33] This standardized scale is constructed based on self-reported responses to ten questions on whether, over the past week, women experienced symptoms associated with depression, such as worrying, sleeping problems, and difficulty relaxing (range, 0–30). A score of ≥10 was used to define depressive symptoms at the survey before pregnancy (referred to as preconception depressive symptoms).[33] Dietary intake was

assessed using a validated 101-item food frequency questionnaire at Surveys 3 and 5.[34] Findings from a previous Australian Longitudinal Study on Women's Health analysis demonstrated that higher adherence to a preconception Mediterranean-style diet identified using factor analysis was associated with a lower risk of GDM.[14] These factor scores were divided into tertiles and, for the current analysis, categorized as unhealthy diet (bottom tertile of factor scores) and healthy diet (top two tertiles). Diet reported at the most recent survey before pregnancy (Survey 3 or 5) was used in the analysis.

For each pregnancy reported during the study, self-reported information was collected on parity, maternal age at the time of delivery, antenatal depression (*Were you diagnosed or treated for antenatal depression*?), and antenatal anxiety (*Were you diagnosed or treated for antenatal anxiety*?).

Statistical Analysis

Characteristics of women were described according to number of ACEs and development of GDM. All descriptive analyses were weighted by area of residence to account for the intentional oversampling of women from rural and remote areas.

Log-binomial regression analysis with generalized estimating equations, which accounted for correlations in repeated preconception characteristics and pregnancies contributed by a single woman,[35] were used to estimate RRs and 95% CIs for associations between ACEs and development of GDM between Survey 1 (age 18–23 years) and 7 (age 37–42 years). Covariates were identified based on a prior knowledge of common causes for ACEs and GDM, as well as known adulthood preconception and antenatal risk factors for GDM. Covariates were included in the model if they were significantly related to both ACEs and GDM based on univariate analysis (Tables 1, 2, and Appendix Table 2, available online). Demographic and childhood measures were fixed over time, and updated time-varying covariates were used where relevant: preconception BMI, diet, and depression diagnosis; and symptoms reported at the closest survey before the index pregnancy, parity, maternal age, and antenatal depression diagnosis at the same survey as the index pregnancy were included (Appendix Table 3, available online). Preconception depressive symptoms, preconception depression diagnosis, and antenatal depression diagnosis were examined as separate factors because not all women with a diagnosis also experience symptoms and vice versa. To determine the influence of a potential bidirectional relationship between depression and GDM across pregnancies, an additional analysis was performed restricting the sample to first pregnancies only. Multiple imputation by chained equations was used to handle missing data on ACEs and covariates (Appendix Table 4, available online).[36]

Effect modification was evaluated to identify potential differences in the association between individual subcategories and the total number of ACEs and GDM risk in subgroups of women according to preconception and antenatal mental health–related characteristics. Cross-product terms were included in the final model for preconception and antenatal diagnosis of depression or anxiety, for preconception depressive symptoms and violence, and for a combination of preconception depression diagnosis or symptoms. To account for multiple comparisons, *p*-values for interaction from the model including all individual subcategories were adjusted using the Bonferroni method.[37] Results showed significant subgroup differences by preconception depressive symptoms in the relationship between the total number of ACEs and GDM risk (p=0.01, for interaction), whereas all other cross-product terms were not statistically significant (p>0.20, for interaction). Stratified analyses were therefore performed according to preconception depressive symptoms.

In an additional analysis, the product of coefficients mediation method was used to quantify the contributions of mediators to the association between ACEs and GDM risk in the first pregnancy reported during the study period using the binary_mediation command in Stata.[38,39] Only preconception and antenatal risk factors that were not identified as effect modifiers were tested as a mediator, as mediation assessments assume no interaction between the exposure and the intermediate.[40] All mediation models were adjusted for family history of diabetes. The binary_mediation command does not account for missing data; therefore, these analyses were performed for a subset of women with complete data (n=3,154).

Statistical analyses were conducted in 2018 using Stata, version 15.0. Statistical significance was set at p<0.05.

RESULTS

Moderate or severe exposure to childhood adversity was reported by 6% and 7% of women, respectively (Table 1). Women who reported one adverse event most often experienced parental separation or divorce or sexual abuse, whereas household criminal behavior and physical abuse most often co-occurred in combination with three or more other ACEs (data not shown). Compared with women with no preconception depressive symptoms, women with depressive symptoms were on average twice as likely to have experienced any of the eight subcategories of adverse events (Appendix Table 1, available online).

Women with a higher number of ACEs were more likely to have a family history of diabetes, an early age at menarche (≤11 years), and a diagnosis of polycystic ovary syndrome (Table 1). Before pregnancy, these women had lower education, more often reported having depressive symptoms, and were more likely to be obese and have an unhealthy diet. Women with a greater number of ACEs were younger at the time of their first pregnancy and had a higher prevalence of antenatal depression. These characteristics (except education and preconception depressive symptoms) were in turn associated with development of GDM (Table 2).

Among the 6,317 women who reported 11,556 pregnancies between age 18–23 and 37–42 years, 4.7% of pregnancies were complicated by GDM (8.0% of women). Prevalence of GDM was more than twofold for women with severe ACEs (17%) compared with no ACEs (7%) among women with preconception depressive symptoms (p=0.008); however, this difference was less pronounced among women with no preconception depressive symptoms (9% and 7%, respectively; p=0.37; Appendix Figure 2, available online).

Among women with preconception depressive symptoms, moderate (generalized estimating equations Model 1:

Table 1. Characteristics of the Overall Population According to Number of Adverse Childhood Experiences[a]

Characteristics[b]	Overall, % (N=6,317)	Number of adverse childhood experiences					*p*-value[c]
		Zero, % (55.6%) (*n*=3,512)	One, % (20.2%) (*n*=1,276)	Two, % (11.1%) (*n*=701)	Three, % (6.2%) (*n*=392)	Four to eight, % (6.9%) (*n*=436)	
Family history of diabetes	29.2	26.6	28.7	32.8	33.6	41.5	**<0.0001**
Early age at menarche (≤11 years)	12.1	11.3	12.2	12.5	12.7	17.2	**0.01**
Polycystic ovary syndrome	7.6	6.8	7.0	7.6	9.5	12.6	**0.006**
Nulliparous at baseline	88.7	91.2	87.9	86.2	81.4	78.5	**<0.0001**
Age at first pregnancy during the study, mean (SD)	29.7 (5.0)	30.2 (4.6)	29.7 (4.9)	29.5 (5.2)	28.5 (5.8)	27.0 (5.6)	**<0.0001**
Highest qualification completed							**<0.0001**
Up to year 12	21.4	18.6	21.1	25.9	25.2	38.0	—
Trade, certificate, or diploma	21.5	19.8	21.6	26.0	26.1	25.4	—
(Higher) university degree	57.1	61.6	57.4	48.1	48.8	36.5	—
Preconception unhealthy diet[d]	29.6	27.2	31.7	29.9	34.9	38.0	**0.008**
Preconception BMI							**0.001**
Underweight, <18.5 kg/m^2	4.9	4.7	4.4	6.3	5.7	5.4	—
Normal weight, 18.5–24.9 kg/m^2	63.8	66.0	63.1	58.9	60.0	58.1	—
Overweight, 25.0–29.9 kg/m^2	21.2	20.8	21.8	22.8	20.6	19.4	—
Obese, ≥30 kg/m^2	10.1	8.6	10.7	12.0	13.8	17.1	—
Preconception depressive symptoms (CESD-10 score), mean (SD)	5.7 (4.7)	5.1 (4.2)	5.8 (4.7)	6.6 (5.2)	7.8 (5.8)	7.9 (5.4)	**<0.0001**
Preconception depressive symptoms (CESD-10 score ≥10)	18.0	14.2	17.6	23.5	34.9	30.4	**<0.0001**
Antenatal depression	4.0	2.7	2.9	6.1	8.8	9.6	**<0.0001**

Note: Boldface indicates statistical significance ($p<0.05$).
[a]n=6,317.
[b]Preconception characteristics at Survey before the first birth reported during the study (1996–2015).
[c]p-values from chi-squared test (binary and categorical variables) or ANOVA (continuous variables).
[d]Based on adherence to a Mediterranean-style dietary pattern identified using factor analysis. Unhealthy diet was defined as dietary pattern scores in the bottom tertile.
CESD, Center for Epidemiologic Studies Depression Scale.

Table 2. Characteristics According to the Development of GDM[a]

Characteristics[b]	GDM, % (8.0%) (*n*=505)	No GDM, % (92.0%) (*n*=5,812)	*p*-value[c]
Family history of diabetes	49.1	27.0	**<0.0001**
Early age at menarche (≤11 years)	17.4	11.6	**<0.0001**
Polycystic ovary syndrome	14.3	7.2	**<0.0001**
Nulliparous at baseline	86.0	82.7	**0.01**
Age at first pregnancy during the study, mean (SD)	29.3 (5.4)	28.1 (5.2)	**<0.0001**
Highest qualification completed	—	—	0.12
Up to year 12	26.0	27.0	—
Trade, certificate, or diploma	25.3	23.0	—
(Higher) university degree	48.8	50.1	—
Preconception unhealthy diet[d]	38.2	32.9	**0.003**
Preconception BMI	—	—	**<0.0001**
Underweight, <18.5 kg/m^2	4.4	4.9	—
Normal weight, 18.5–24.9 kg/m^2	48.6	65.5	—
Overweight, 25.0–29.9 kg/m^2	25.7	20.7	—
Obese, ≥30 kg/m^2	21.3	8.9	—
Preconception depressive symptoms (CESD-10 score), mean (SD)	6.2 (5.2)	5.7 (5.0)	**0.04**
Preconception depressive symptoms (CESD-10 score ≥10)	22.8	19.1	0.08
Antenatal depression	6.5	3.6	**0.001**

Note: Boldface indicates statistical significance ($p<0.05$).
[a]*n*=6,317.
[b]Preconception characteristics at Survey before the first birth reported during the study (1996–2015).
[c]*p*-values from chi-squared test (binary and categorical variables) or *t*-test (continuous variables).
[d]Based on adherence to a Mediterranean-style dietary pattern identified using factor analysis. Unhealthy diet was defined as dietary pattern scores in the bottom tertile.
CESD, Center for Epidemiologic Studies Depression Scale; GDM, gestational diabetes mellitus.

RR=1.84, 95% CI=1.06, 3.18) and severe ACEs (RR=1.82, 95% CI=1.11, 3.01) were associated with a higher risk of developing GDM after adjustment for family history of diabetes (Table 3). These findings were only slightly weakened after further adjustments for age at menarche, polycystic ovary syndrome, preconception risk factors, and antenatal depression (generalized estimating equations Model 4: RR=1.73, 95% CI=1.02, 3.01, for moderate ACEs; RR=1.76, 95% CI=1.04, 2.99, for severe ACEs). These findings were confirmed in mediation analyses that showed that the association between moderate and severe ACEs compared with no ACEs was only partly mediated through preconception and antenatal GDM risk factors. Proportions mediated through individual risk factors ranged from −2% for maternal age to 15% for antenatal depression, and when including all potential mediators together in the model to account for their interrelationships, these risk factors accounted for 18% of the relationship (data not shown). ACEs were not associated with risk of GDM among women without preconception depressive symptoms (Table 3).

Results from analyses on the restricted sample of first pregnancy only were comparable and conclusions did not change (RR=1.91, 95% CI=0.89, 3.14 and RR=1.15, 95% CI=0.30, 2.55, for exposure to four or more ACEs versus no exposure to ACEs for women with and without preconception depressive symptoms, respectively).

Among individual subcategories of ACEs, physical abuse (RR=1.7, 95% CI=1.14, 2.43), and household substance abuse (RR=1.52, 95% CI=1.01, 2.03) were associated with risk of developing GDM among women with preconception depressive symptoms, but not among women without depressive symptoms before pregnancy (Figure 1).

DISCUSSION

Findings from this study suggest that exposure to moderate or severe childhood adversity is associated with higher risk of developing GDM in women who report depressive symptoms before pregnancy, but not in women without preconception depressive symptoms. In addition to a higher number of ACEs, individual subcategories of physical abuse and household substance abuse are associated with higher GDM risk in women with preconception depressive symptoms.

No previous study has examined the impact of multiple ACEs on risk of developing GDM. Mason and colleagues[27] examined the associations of single indicators

Table 3. Association of ACEs With Development of GDM[a]

	Preconception depressive symptoms (*n*=2,239)				No preconception depressive symptoms (*n*=9,317)			
Model	**0 ACEs (42.6%) (*n*=954)**	**1–2 ACEs (34.8%) (*n*=779)**	**3 ACEs (10.4%) (*n*=233)**	**4–8 ACEs (12.2%) (*n*=273)**	**0 ACEs (59.2%) (*n*=5,516)**	**1–2 ACEs (29.9%) (*n*=2,786)**	**3 ACEs (5.4%) (*n*=503)**	**4–8 ACEs (5.5%) (*n*=512)**
GDM cases, *n* (%) of pregnancies	48 (5.0)	41 (5.20)	21 (9.00)	28 (10.20)	237 (4.3)	118 (4.30)	25 (5.00)	29 (5.70)
Univariate model	ref	1.08 (0.73, 1.60)	**1.87 (1.08, 3.23)**	**2.09 (1.28, 3.42)**	ref	0.98 (0.75, 1.28)	1.14 (0.73, 1.77)	1.24 (0.68, 2.26)
Model 1[b]	ref	1.02 (0.69, 1.51)	**1.84 (1.06, 3.18)**	**1.82 (1.11, 3.01)**	ref	0.98 (0.75, 1.27)	1.04 (0.67, 1.62)	1.16 (0.63, 2.12)
Model 2[c]	ref	0.99 (0.67, 1.46)	**1.79 (1.03, 3.12)**	**1.77 (1.07, 2.92)**	ref	0.97 (0.74, 1.25)	1.01 (0.65, 1.56)	1.13 (0.61, 2.07)
Model 3[d]	ref	0.99 (0.67, 1.47)	**1.73 (1.01, 3.00)**	**1.76 (1.04, 2.97)**	ref	0.97 (0.75, 1.26)	1.06 (0.68, 1.64)	1.20 (0.66, 2.21)
Model 4[e]	ref	0.99 (0.67, 1.48)	**1.73 (1.02, 3.01)**	**1.76 (1.04, 2.99)**	ref	0.97 (0.75, 1.26)	1.06 (0.68, 1.64)	1.20 (0.65, 2.20)

Note: Boldface indicates statistical significance ($p<0.05$).
[a]*n*=11,556 pregnancies; 6,317 women.
[b]Adjusted for family history of diabetes.
[c]Additionally, adjusted for age at menarche and polycystic ovary syndrome.
[d]Additionally, adjusted for preconception BMI, unhealthy diet, parity, and maternal age.
[e]Additionally, adjusted for antenatal depression.
ACE, adverse childhood experiences; GDM, gestational diabetes mellitus.

of ACEs with GDM risk among 45,550 women participating in the Nurses' Health Study II, showing that physical abuse and forced sexual activity during childhood or adolescence were associated with a 42% and 30% higher GDM risk, respectively. Similar to findings from this study, these associations were not explained by overweight status in early adulthood or before pregnancy.[27]

These findings also build upon the growing evidence that ACEs predict Type 2 diabetes among nonpregnant populations.[11,41,42] Based on a recent meta-analysis including data from more than 120,000 study participants from the U.S., England, Saudi Arabia, and Philippines, exposure to four or more ACEs was associated with a 52% higher risk of developing Type 2 diabetes (pooled odds ratio=1.52; 95% CI=1.23, 1.89) after accounting for sociodemographic factors such as age, sex, ethnicity, adulthood education, employment, and income.[11] Previous findings on the influence of individual subcategories of adverse events have been inconclusive. Some studies indicate that both physical and sexual abuse equally increase the risk of Type 2 diabetes,[42–44] whereas others suggest that either physical abuse[45] or sexual abuse[42,46] may be a stronger predictor of diabetes. These differences across studies may be explained by the intensity, frequency, and timing of ACEs, which have not been taken into account in most studies. Collectively, current evidence suggests that although associations with diabetes may not be uniform across different subcategories of ACEs, exposure to multiple ACEs is strongly linked with diabetes risk regardless of the type of adverse event.

There are a number of potential explanations for why exposure to ACEs may increase GDM risk. The strong dose–response relationships between exposure to a higher number of ACEs and poorer health and lifestyle behaviors in adulthood found in other studies[11–13] were confirmed in this population; however, many of these preconception factors were not related to GDM and, therefore, suggest a limited role of adulthood health and lifestyle in explaining the relationship between ACEs and GDM risk. Results from the current study suggest that poorer adulthood mental health may be the most likely explanation for the link between ACEs and GDM risk, based on the findings that antenatal depression had the largest mediating effect among the preconception and antenatal intermediates that were examined, and that exposure to ACEs combined with exposure to preconception depressive symptoms was associated with a higher risk of developing GDM. This may be explained by the more extreme exposure to childhood adversity among women with preconception depressive symptoms who were 2.5 times more likely to have been physically abused than women without preconception depressive

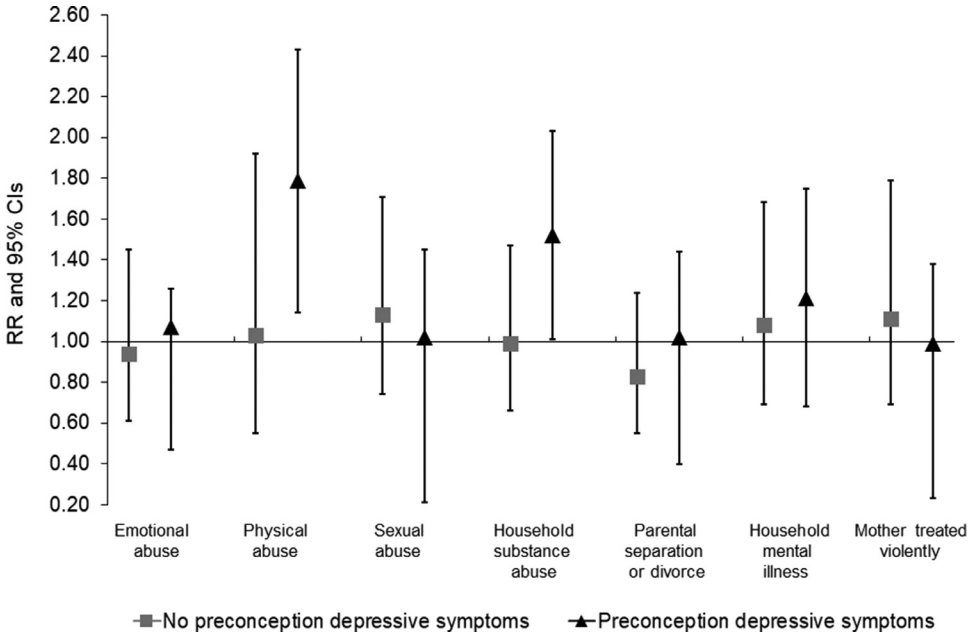

Figure 1. RRs and 95% CIs for associations of subcategories of adverse childhood experiences with development of gestational diabetes among women with and without preconception depressive symptoms (n=11,556; pregnancies from 6,317 women).
Note: Results were adjusted for family history of diabetes, age at menarche, polycystic ovary syndrome, preconception BMI, unhealthy diet, parity, maternal age, antenatal depression, and all other subcategories of adverse childhood experiences.

symptoms. Physical abuse was the adverse event that was most strongly related to GDM risk and that most often occurred in combination with at least three other adverse events. Moreover, the higher risk of GDM among women exposed to ACEs and preconception depressive symptoms suggests that exposure to stress during childhood and into adulthood may be important. Brain development begins in fetal life and continues into early adulthood,[47] and extensive research has linked early life adversity with negative effects on the structure and function of the brain.[47,48] These neurodevelopmental alterations may predispose to risk of depression[49,50] and promote neuroendocrine disruptions linked to glucose metabolism.[51–53]

Limitations

Childhood experiences were recalled retrospectively at age 37–42 years, which may have introduced bias as previous studies have shown mixed findings on the accuracy of adulthood memories of specific childhood experiences.[54,55] High agreement of 91% was found between GDM diagnosis reported in the survey and in administrative data records,[30] and the diagnosis of a small proportion of women may, therefore, have been misclassified. If under- or over-reporting of GDM is related to ACEs, this differential misclassification may have biased the results either toward or away from the null depending on the proportion of misclassified women. Moreover, even though extensive data have been collected on many population characteristics, no data were available on some potential early life risk factors (e.g., in utero exposures to poor nutrition or disease) and antenatal risk factors (e.g., delayed antenatal care, excessive gestational weight gain, and medication use); therefore, it cannot be excluded that unmeasured or imprecisely measured factors may alter the results.

CONCLUSIONS

Findings from this study indicate that exposure to moderate or severe childhood adversity is associated with a higher risk of GDM among women who developed depressive symptoms before pregnancy. In addition to primary prevention of ACEs, strategies to curb poor mental health trajectories into adulthood among women who grew up in stressful environments should be considered when developing programs for the prevention of GDM.

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DAJMS, LKC, and GDM conceptualized the idea and designed the study; DAJMS performed the statistical analysis, interpreted the results, and drafted the manuscript; LKC and GDM contributed to interpretation of the results and critical revision of the manuscript. All authors approved the version to be published.

Informed consent was obtained from all participants at each survey and the study was approved by the Human Research Ethics Committees at the Universities of Newcastle and Queensland, Australia.

Data are available from the Australian Longitudinal Study on Women's Health (contact ALSWH Data and Analytic Services at www.alswh.org.au) for researchers who meet the criteria for access to confidential data.

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SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2019.04.028.

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