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ORIGINAL RESEARCH

Proactive Coping in Early Pregnancy and Adverse Pregnancy Outcomes

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Objective: Outside of pregnancy, proactive coping has been associated with both mental and physical well-being and with improved quality of life in chronic disease, but its effects in pregnancy are understudied. Our objective was to evaluate whether early pregnancy proactive coping was associated with adverse perinatal outcomes.

Study Design: This was a planned secondary analysis of nulliparous pregnant people recruited from a tertiary care center. Participants completed a validated assessment of proactive coping (*Proactive Coping Scale*) at 8–20 weeks and were followed longitudinally through delivery. Detailed pregnancy and delivery data were collected by trained research personnel. The primary outcome was a composite of adverse perinatal outcomes including unplanned cesarean delivery, gestational diabetes, and hypertensive disorders of pregnancy. Secondary analyses included individual perinatal composite components and a neonatal morbidity composite measure. Multivariate regression compared adverse perinatal outcomes by Proactive Coping Scale quartile, controlling for a priori confounders.

Results: Of the 281 parturients, the median Proactive Coping Scale score was 45.0 (range 25–55), and 47% experienced an adverse perinatal outcome. After adjusting for confounders, those in the lowest Proactive Coping Scale quartile had 2.2 times higher odds of experiencing an adverse perinatal outcome compared to those in the highest Proactive Coping Scale quartile. There were no differences in odds of the individual composite components or the adverse neonatal outcome.

Conclusion: Lower early pregnancy proactive coping scores are associated with significant increase in adverse perinatal outcomes. Interventions that target improving proactive coping may be a novel mechanism for reducing perinatal morbidity.

Plain Language Summary: Proactive coping is the process of preparing for a stressor or goal, which has been studied in the context of chronic disease. We sought to understand how proactive coping relates to pregnancy outcomes. Our results indicated that higher proactive coping scores were associated with lower risk of adverse pregnancy outcomes. Therefore, interventions to increase proactive coping may have a role in reducing adverse pregnancy outcomes.

Keywords: proactive coping, adverse pregnancy outcomes, cesarean delivery, gestational diabetes, hypertensive disorders of pregnancy

Introduction

Proactive coping is defined as the ability to prepare for an upcoming stressor or goal, potentially averting a negative event. This concept has been studied as a predictor of mental and physical well-being across diverse settings and populations.[1] Proactive coping strategies, such as problem-based coping and environmental control, have been shown to be more efficacious in reducing anxiety and stress compared to emotion-based coping.[2] Proactive coping is distinct from

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preventive coping as it describes the process of internal goal management when facing an upcoming stressor, while preventive coping describes activities that prevent and minimize risk of adverse situations (ie, service utilization, preventive healthcare).[3] Proactive coping has been associated with better behavioral outcomes in rehabilitation, improved post-traumatic stress disorder symptoms in college students, and prevention of burnout in nurses,[4–6] as well as with personality subtypes, psychological states, and anxiety.[7,8]

Psychosocial stress has a strong and established relationship with adverse perinatal outcomes, including preterm birth and low birthweight; additionally, poor coping skills (ie, use of avoidant or emotional coping strategies) have been associated with antenatal and postnatal depression.[9–12] Given these associations between psychological well-being and perinatal outcomes, it is vital to pursue evidence-based mental health strategies for improving perinatal outcomes. No study to date has investigated the relationship between proactive coping and adverse pregnancy outcomes (APOs); better baseline proactive coping may be associated with better behavioral and physical outcomes in pregnancy. Potential mechanisms of such differences are not well understood, but extrapolation from other areas of medicine suggests that improved proactive coping skills can reduce physical reactivity to emotional stressors, therefore reducing elevations in blood pressure and other physiologic reactions to stress.[13,14] Proactive coping skills are also likely tied to differences in care management, risk tolerance, and decision-making, thus potentially impacting decisions made around labor and delivery. Though no recent studies have been published linking coping skills to perinatal health, the recent evidence from other areas of medicine highly suggests that such skills may impact pregnancy outcomes.

Given that pregnancy outcomes, including risk for cesarean delivery and medical complications of pregnancy, are influenced by physiologic stress reactions, studying proactive coping in relation to pregnancy may offer a potential area of positive intervention to reduce adverse outcomes.[15] Therefore, we sought to evaluate whether proactive coping in pregnancy, particularly in early pregnancy, was associated with perinatal outcomes. We hypothesized that better early pregnancy proactive coping skills would be associated with lower rates of adverse perinatal outcomes.

Materials and Methods

Sample Population

This was a planned secondary analysis of the parent study, which sought to understand how early pregnancy dispositional optimism, a resilience factor associated with health benefits, related to adverse pregnancy outcomes.[16] Patients were enrolled when presenting for pregnancy care at a tertiary women's hospital in Providence, RI, from May 2019 through February 2022. Inclusion criteria for the parent study included: (1) nulliparous; (2) singleton pregnancy of gestational age (GA) 8–20 weeks at enrollment; (3) age ≥ 18 years; (4) English- or Spanish-speaking. Exclusion criteria included known major fetal or genetic anomalies or an intent to deliver at another hospital. The parent study was powered to detect a composite outcome rate of 60% among those with in the lowest dispositional optimism quartile with an alpha level of 0.05 and 80% power; this resulted in an estimated sample size of 284 participants. Participants completed written, informed consent at the time of enrollment. A total of 281 parturients were included in the final study dataset after inclusion, and exclusion criteria were applied; parturients who were lost to follow-up, underwent termination of pregnancy, or delivered at another institution were not included in final analyses.

Ethical Approval

The Women & Infants Hospital of Rhode Island Institutional Review Board gave approval to all study procedures prior to participant enrollment.

Data Collection

At enrollment, participants completed a series of validated scales, including the Proactive Coping Scale (PCS). The PCS (a sub-scale of the Proactive Coping Inventory) consists of 14 items addressing goal setting/attainment thoughts and behaviors.[2] Items are scored on a 5-point Likert scale ranging from not at all true to completely true and are totaled with scores ranging from 14 to 56. Higher scores indicate stronger proactive coping skills. Cronbach's alpha for the original scale is 0.85. Participants also completed a questionnaire, which included demographic information (self-reported race/

ethnicity [evaluated together to allow for assessment of minority status as a marker for underlying structural inequities in healthcare], years of education, marital status, employment status) and pre-pregnancy medical and psychiatric history (self-reported prior depression and/or anxiety).

Outcome Variables

Participants were followed to delivery, after which chart reviews were completed to abstract delivery and outcomes data for both participants and neonates by trained research staff. APOs included cesarean delivery, gestational diabetes (diagnosed using the Carpenter-Coustan criteria), and hypertensive disorders of pregnancy (including diagnosed gestational hypertension, preeclampsia [with or without severe features], or superimposed preeclampsia on chronic hypertension as defined by ACOG criteria).[17,18] We included cesarean delivery, which has an established link to postpartum mood disturbance, as it has also been associated with lower rates of realization of coping strategies.[19,20] Diabetes and hypertension were included in this composite as they represent conditions which, outside of pregnancy, have worse outcomes in patients with lower baseline proactive coping abilities.[14,21] The primary outcome was a composite of the APOs (defined as the presence of one or more individual APOs, listed above); secondary outcomes were individual perinatal composite components and a neonatal composite outcome (presence of one or more of the following: preterm birth, admission to the Neonatal Intensive Care unit [NICU], APGAR <7 at 5 minutes, umbilical artery pH <7.2, neonatal hypoglycemia, hyperbilirubinemia requiring treatment, and neonatal death). All outcome measures were binary (ie, presence or absence of the outcome).

Statistical Analysis

Statistical analyses were completed using RStudio software (version 2022.12.0+353, R version 4.2.2). Participants were categorized into four groups according to PCS quartile in order to identify meaningful groups with differing levels of proactive coping skills, as there are no established cutoffs for "low" versus "high" levels of coping. Baseline demographic characteristics were then compared among these groups using Kruskal–Wallis tests for continuous variables and Chi-Square or Fisher Exact tests for categorical variables. Prevalence of composite and individual APOs were compared across quartiles using a Mann–Kendall test of trend. Finally, univariate and multivariate regression was performed to assess odds ratios (OR, with 95% confidence intervals [CI]) of composite and individual APOs and neonatal composite according to PCS quartile (with the highest quartile as reference). Covariates for multivariable regression included variables known to be associated with proactive coping based on literature review, including race/ethnicity and pre-pregnancy medical (diabetes, hypertension) or psychiatric history. Adjusted OR was not calculated for outcomes with n <20 in order to avoid overfitting. Hochberg's Step-Up Procedure was used to determine significance when adjusting for multiple comparisons (initial alpha set to 0.05).

Results

Patient Characteristics

All of the 281 participants from the parent study were included in this analysis, and there was no missing data among participants. Mean ± standard deviation (SD) GA was 13.0 ± 4.6 weeks at enrollment and 39.1 ± 4.0 weeks at delivery. Mean maternal age was 27.7 ± 8.8 years at delivery. The racial/ethnic makeup of participants included: 157 (56%) non-Hispanic White, 38 (14%) non-Hispanic Black, 49 (17%) Hispanic, and 37 (13%) other. One hundred and ten (40%) participants completed college, 213 (76%) were married, and 203 (72%) were employed at enrollment. Only 12 (4%) individuals had pre-pregnancy diabetes, and 9 (3%) had pre-pregnancy hypertension. Psychiatric history was reported in 102 (36%), with 74 (27%) reporting pre-pregnancy depression and 84 (31%) reporting pre-pregnancy anxiety.

Proactive Coping Scale

Median PCS score was 45, with interquartile range 41–49. PCS quartiles by demographic characteristics are shown in Table 1; distribution of self-reported race/ethnicity was significantly different across quartiles (p = 0.008), with a higher percentage of individuals of Hispanic ethnicity in the lowest PCS quartiles. There were no other baseline differences across groups.

Table 1 Demographic, Pregnancy and Delivery Characteristics of Parturients by Proactive Coping Quartile in Early Pregnancy

	Proactive Coping Quartile				
	Lowest Q1 (n = 61)	**Q2 (n = 65)**	**Q3 (n = 73)**	**Highest Q4 (n = 82)**	***p*-value**
PCS score range	25–40	41–44	45–48	49–55	
Age at enrollment, mean (SD)	26.7 ± 5.9	27.9 ± 15.1	27.1 ± 5.5	27.1 ± 6.2	0.8
Gestational age at enrollment, mean (SD)	13.1 ± 3.6	13.1 ± 3.6	13.9 ± 6.9	12.4 ± 3.6	0.2
Self-reported race/ethnicity					
Non-Hispanic White	37 (60.7)	39 (60.0)	43 (58.9)	38 (46.3)	**0.008**
Non-Hispanic Black	1 (1.6)	5 (7.7)	14 (19.2)	18 (22.0)	
Hispanic	15 (24.6)	14 (21.5)	6 (8.2)	14 (17.1)	
Other*	8 (13.1)	7 (10.8)	10 (13.7)	12 (14.6)	
Education					
High school or less	35 (57.4)	45 (69.2)	53 (72.6)	63 (76.8)	0.09
Any college	24 (39.3)	18 (27.7)	20 (27.4)	19 (23.2)	
Do not know/refused	2 (3.3)	2 (3.1)	0 (0.0)	0 (0.0)	
Marital status					
Married/partnered	50 (82.0)	48 (73.8)	55 (75.3)	60 (73.2)	0.6
Single	8 (13.1)	14 (21.5)	12 (16.4)	19 (23.2)	
Do not know/refused	3 (4.9)	3 (4.6)	6 (8.2)	3 (3.7)	
Employment status					
Employed	39 (63.9)	47 (72.3)	57 (78.1)	60 (73.2)	0.7
Unemployed	19 (31.1)	15 (23.1)	14 (19.2)	20 (24.4)	
Do not know/Refused	3 (4.9)	3 (4.6)	2 (2.7)	2 (2.4)	
Pre-pregnancy medical history					
Diabetes	4 (6.6)	1 (1.5)	3 (4.1)	1 (1.2)	0.3
Hypertension	2 (3.3)	5 (7.7)	4 (5.5)	1 (1.2)	0.2
Depressive disorder[∫]	19 (32.8)	19 (30.6)	19 (26.0)	17 (21.2)	0.4
Anxiety disorder[∫]	20 (35.7)	22 (34.9)	22 (30.1)	20 (25.0)	0.5
Gestational age at delivery, mean (SD)	39.4 ± 1.4	38.4 ± 3.7	39.6 ± 6.6	39.0 ± 2.0	0.6
Birthweight (g), mean (SD)	3178 ± 875	3026 ± 1071	3233 ± 600	3025 ± 961	0.6
Induction of labor	35 (57.4)	28 (43.1)	38 (52.1)	46 (56.1)	0.3

Notes: Columns are n (%) unless otherwise indicated, significance set to p<0.05 (bold). *Includes Asian American/Pacific Islander, American Indian, Cape Verdean. ∫Participant self-report of prior or current diagnosis of depression and/or anxiety.

Adverse Perinatal Outcomes

One hundred and thirty-four (134, 47%) participants experienced one or more maternal APOs. There were no differences in trends of APO prevalence across quartiles (Table 2). Odds of composite APOs were 2.2 times higher in those with the lowest PCS scores (Quartile 1) compared to those with the highest PCS scores (Quartile 4) when adjusting for a priori cofounders. Individual component outcomes, and composite neonatal morbidity were not significantly associated with PCS scores in univariable or multivariable models.

Table 2 Adverse Perinatal Outcomes (APOs) by Proactive Coping Quartile and According to Univariate and Multivariate Regression

Outcome	Proactive Coping Quartile				
	Lowest Q1 (n = 61)	Q2 (n = 65)	Q3 (n = 73)	Highest Q4 (n = 82)	*p*-value*
Composite adverse perinatal outcome[†]	37 (60.7)	31 (47.7)	33 (45.2)	33 (40.7)	0.1
Odds ratio (OR)[a]	**2.12 (1.08–4.24)**	1.32 (0.68–2.58)	1.20 (0.63–2.28)	Referent (1)	
Adjusted Odds Ratio (aOR)[b]	**2.24 (1.13–4.54)**	1.22 (0.62–2.43)	1.21 (0.63–2.33)	Referent (1)	
Gestational diabetes	7 (11.5)	1 (1.5)	4 (5.5)	6 (7.3)	0.9
Odds ratio (OR)[a]	1.68 (0.53–5.50)	0.20 (0.01–1.22)	0.72 (0.18–2.64)	Referent (1)	
Adjusted Odds Ratio (aOR)[b]	–	–	–	–	
Hypertensive disorders of pregnancy	18 (29.5)	13 (20.0)	13 (17.8)	21 (25.6)	0.8
Odds ratio (OR)[a]	1.16 (0.54–2.45)	0.67 (0.29–1.48)	0.62 (0.28–1.34)	Referent (1)	
Adjusted Odds Ratio (aOR)[b]	–	–	–	–	
Cesarean delivery	23 (37.7)	22 (33.8)	22 (30.1)	21 (25.9)	0.4
Odds ratio (OR)[a]	1.70 (0.82–3.53)	1.43 (0.69–2.95)	1.23 (0.61–2.51)	Referent (1)	
Adjusted Odds Ratio (aOR)[b]	1.94 (0.92–4.12)	1.45 (0.69–3.06)	1.31 (0.64–2.72)	Referent (1)	
Composite neonatal morbidity[§]	21 (34.4)	18 (27.7)	17 (23.3)	30 (36.6)	0.5
Odds ratio (OR)[a]	0.92 (0.45–1.86)	0.72 (0.35–1.45)	0.54 (0.26–1.10)	Referent (1)	
Adjusted Odds Ratio (aOR)[b]	0.89 (0.43–1.82)	–	–	Referent (1)	

Notes: All values given as number (%) or as odds ratio (95% confidence interval). *Mann–Kendall test of trend; p-values < 0.05 indicate significant trend from Q1 (lowest) to Q4 (highest). [a]Odds of outcome (with 95% confidence interval [CI]) based on score on Proactive Coping Scale. Bolded values indicate significance with p<0.05. [b]Odds of outcome (with 95% confidence interval [CI]) based on score on Proactive Coping Scale, adjusted for self-reported minority race, and pre-pregnancy psychiatric or medical history. Not performed for n<20 to avoid overfitting. Bolded values indicate significance with p<0.05. [†]Composite outcome includes gestational diabetes, hypertensive disorders of pregnancy, and cesarean delivery. [§]Neonatal morbidity composite: preterm birth, admission to the Neonatal Intensive Care unit (NICU), APGAR <7 at 5 minutes, umbilical artery pH <7.2, neonatal hypoglycemia, hyperbilirubinemia requiring treatment and neonatal death.

Discussion

In this study, we evaluated the relationship between proactive coping and adverse pregnancy outcomes (APOs). Our results indicated an association between proactive coping and APOs: those in the lowest PCS quartile had 2.2 times higher odds of an APO when adjusted for confounding variables, including pre-pregnancy psychiatric and medical history. This is consistent with findings from other studies in healthcare settings.

Results in the Context of What is Known

Our results suggest that proactive coping may be an effective target for interventions to reduce APOs. Randomized control trials of interventions to increase proactive coping have been shown to affect disease outcomes. In diabetes management, for example, proactive coping interventions were able to significantly increase adherence to behavioral changes promoting weight loss; furthermore, proactive coping was able to predict long-term weight-loss self-management.[21] Similar interventions have been implemented in preparing for aging in both middle and late adulthood.[22] These successes suggest that similar, low-cost interventions may be effective in pregnancy as well.

Clinical Implications

The study was not powered for individual adverse pregnancy outcomes, but the association between PCS score and APO risk does appear to be largely driven by cesarean delivery risk, which represented 65.7% of those with an APO and 31.3% of all parturients (comparable to national nulliparous cesarean delivery rates).[23] In prior studies including by this group, cesarean delivery was associated with lower scores on the Labor Agentry Scale, which is a direct measure of control and expectancies during childbirth.[24,25] As Labor Agentry may be affected by proactive coping abilities, it is reasonable that the risk and sequelae of cesarean delivery could be impacted by lower proactive coping scores.[20] Interventions to prepare parturients to

cope with alterations in their labor plan, including the possibility of a cesarean delivery, may indeed reduce the psychological distress associated with this outcome.

Strengths and Limitations

Our study has multiple strengths; our study population is racially and ethnically diverse, which allows us to make conclusions regarding the effect of proactive coping on parturients of many different cultural and economic backgrounds. Furthermore, there were few baseline differences in medical or pregnancy history across quartiles, thus making the groups relatively comparable. We also may surmise from the differences observed in proactive coping across racial/ethnic groups that aspects of systemic racism and healthcare inequality may contribute to observed differences in early-pregnancy coping. Prior literature suggests that, in addition to coping with medical outcomes, individuals who identify as a minority race and/or ethnicity often utilize proactive coping skills to deal with racial discrimination.[26] The additional burden of coping with medical outcomes and racism suggests that individuals identifying with minority racial and/or ethnic groups require better baseline coping abilities, unfortunately compounding the inequalities present in medical outcomes among minority groups at baseline.

Our study should also be interpreted in the context of several limitations. Our study population included participants from a single hospital, which may limit the generalizability of our findings, particularly because the rate of induction of labor (52.3% across all parturients) is higher than the national median (39.8%).[27] We were also underpowered to assess individual adverse outcomes, therefore reducing our capacity to make conclusions regarding the significance of individual measures. This is an area of future study, as we hope to assess how improved proactive coping modulates risk of individual pregnancy outcomes, therefore helping target interventions. Furthermore, individual outcomes were not able to be assessed independently given the inherently elevated risk of cesarean delivery in gestational diabetes or pregnancy-induced hypertension. Cesarean deliveries, which appear to have driven the increased odds of APOs in association with lower proactive coping abilities, were not delineated or specified according to indication, number, or complication. We did not assess pre-pregnancy or early pregnancy body mass index or tobacco smoking as confounders. Lastly, we were unable to collect information on those who declined participation, which introduces potential selection bias based on willingness to participate.

Conclusions

Lower levels of proactive coping in early pregnancy were associated with an increased odds of APOs. Because proactive coping is modifiable, interventions that improving coping have the potential to reduce maternal morbidity associated with lower baseline proactive coping and should be assessed in future studies.

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