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Actor and Partner Effects of Personality Traits on Depressive and Anxiety Symptoms During Early Pregnancy: A Dyadic Study of 1,536 Couples

Lljie Guo
Capital Medical University
Jiang Tian
Capital Medical University
Xiaoxin Wang
Beijing Obstetrics and Gynecology Hospital
Henry Xiang
The Ohio State University
Peixia Cheng
Capital Medical University
Huiping Zhu
zhuhuiping@ccmu.edu.cn

Capital Medical University

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Abstract

Background: Personality traits are considered important determinants of depressive and anxiety symptoms. However, current understanding has focused on the association at the individual level. The dyadic and couple-level roles of personality traits in depressive and anxiety symptoms remain unclear. This study aimed to examine the associations between personality traits and depressive and anxiety symptoms at the individual, dyadic, and couple levels among couples.

Methods:A cross-sectional study was conducted among 1,536 couples in China. Personality traits were assessed using the Eysenck Personality Questionnaire, and depressive and anxiety symptoms were measured using the Self-Rating Depression Scale (SDS) and Self-Rating Anxiety Scale (SAS). Actor-partner interdependence models were used to estimate actor and partner effects, and multinomial logistic regression was applied for couple-level outcomes.

Results: Neuroticism and psychoticism were the strongest risk-related traits, whereas extraversion showed protective associations. Actor effects were consistently observed. Notably, partner effects were selective and asymmetric: husbands' psychoticism was associated with higher depressive and anxiety symptoms in wives, with no reverse effects. At the couple level, neuroticism and psychoticism demonstrated associations with increased risks of both one-partner and dual-partner depression.

Conclusions: Personality traits influence perinatal depressive and anxiety symptoms through interconnected individual and dyadic mechanisms. The observed asymmetric partner effects and couple-level accumulation of maladaptive traits underscored the importance of relational contexts in perinatal mental health for couples. These findings support couple-based screening and intervention strategies, with individuals exhibiting high-risk personality traits prioritized for targeted monitoring and assessment.

1. Introduction

Common mental disorders, including depression and anxiety, are prevalent among parents during the perinatal period, and represent a substantial public health challenge globally[1]. In high-income countries, maternal depression affects approximately 11% of women during pregnancy, with anxiety rates reaching up to 13%[2], whereas in low- and middle-income countries, the prevalence of antenatal depression may be as high as 25.5% [3]. Emerging evidence suggests that paternal depression affects approximately 9%-10% of fathers during pregnancy and the first postnatal year[4]. Mental disorders in parents during this period have been linked to adverse pregnancy outcomes, impaired parent-infant bonding, and behavioral problems in offspring[5, 6, 7].

According to the stress-diathesis model, depression and anxiety arise from the interaction between underlying vulnerability and external stressors[8]. This framework suggests that personality traits play an important role during periods of heightened stress. Personality traits are enduring patterns of perception, interpersonal roles, and cognition regarding oneself and the environment, expressed across diverse contexts[9]. Previous research has largely focused on mothers and has consistently shown that neuroticism is associated with increased risk of depression and anxiety, whereas extraversion is associated with more favorable emotional outcomes[10, 11, 12]. In contrast, findings regarding psychoticism have been inconsistent, and its role in depression and anxiety remains unclear. Although these associations may theoretically extend to fathers, empirical evidence remains limited[13, 14]. To the best of our knowledge, no study has examined yet whether these associations extend to fathers and manifest consistently within couples.

Mental health within couples is interdependent[15]. Partners influence each other through emotional contagion, support process, and shared stress exposure[16, 17]. Previous evidence shows that depression in one partner increases the risk of depression and anxiety in the other[18–20]. A longitudinal study has reported that paternal depression leads to increased depression in mothers during pregnancy and in the first 6 postpartum months[18, 19], and the odds of paternal anxiety increase by more than 3-fold when mothers are depressed[20]. These findings suggest that depressive and anxiety symptoms during the perinatal period are not solely individual phenomena but are embedded within interpersonal dynamics. However, despite this interdependence, most previous studies have adopted an individual level analytical framework that merely treats partners as independent observations[10, 11, 12, 13, 14], while neglecting the inherent interdependence of dyadic data. Consequently, the bidirectional influence of both partners' personality traits on depressive and anxiety symptoms within couple dyads remains poorly understood.

To address these gaps, the current study examined the associations between personality traits and depressive and anxiety symptoms within couples during early pregnancy using a dyadic framework. We applied the actor-partner interdependence model (APIM) to simultaneously estimate actor effects and partner effects, allowing us to disentangle intrapersonal and interpersonal processes[21]. In addition, we extended previous research by examining couple-level depressive symptoms and exploring potential nonlinear associations across different traits levels. We hypothesized that: (1) neuroticism and psychoticism would be positively associated with mental disorders, whereas extraversion would be negatively associated (actor effects); (2) personality traits would also exert partner effects, such that one partner's neuroticism and psychoticism would be associated with depressive and anxiety symptoms in the partner; (partner effects); (3) these effects would differ between husbands and wives; and (4) the associations between personality traits and depressive symptoms would vary across trait levels of study subjects.

2. Methods

2.1 Study Design and Participants

Participants in this cross-sectional study were 1,536 pregnant women and their partners recruited from Beijing Obstetrics and Gynecology Hospital, Beijing, China, between March 2024 and February 2025. The inclusion criteria were: (a) pregnant women with a gestational age ≤ 12 weeks; (b) both partners ≥ 18 years; and (c) willing to participate in the study. Exclusion criteria were the presence of cognitive or communication impairments that would preclude independent completion of the survey questionnaires.

2.2 Procedure

The study followed the principles of the Declaration of Helsinki and the human subject study policies. All study procedures were approved by the Institutional Review Board of Beijing Obstetrics and Gynecology Hospital (Approval No. 2023-KY-089-01) and the Ethics Committee of Capital Medical University (Approval No. Z2023SY045). Eligible participants were approached after a description of the study procedures. Written informed consent was obtained from both partners prior to participation. Couples were excluded if either partner declined to participate.

2.3 Measures

Data on demographic characteristics, health behaviors, and pregnancy-related variables were collected using a structured self-administered questionnaire. Depressive and anxiety symptoms were assessed using the Self-Rating Depression Scale and the Self-Rating Anxiety Scale, and personality traits were measured using the Eysenck Personality Questionnaire. All instruments were administered by trained researchers following standardized procedures.

Self-Rating Depression Scale (SDS). The SDS measured depressive symptoms[22]. It is a 20-item self-report questionnaire that measures the frequency of depressive symptoms over the past week, with each item rated on a 4-point scale (1 = less than one day; 2 = one to two days; 3 = three to four days; and 4 = five to seven days). Total raw scores range from 20 to 80, which are converted to standard scores by multiplying by 1.25. A standard score ≥ 53 indicates the presence of depressive symptoms, with higher scores reflecting greater severity. In the current sample, internal consistency was acceptable (Cronbach's α = 0.87).

Self-Rating Anxiety Scale (SAS). The SAS measured anxiety symptoms[23]. It is a 20-item self-report questionnaire that measures the frequency of anxiety over the past week using a 4-point scale(1 = less than one day; 2 = one to two days; 3 = three to four days; and 4 = five to seven days). Total raw scores range from 20 to 80, which are converted to standard scores by multiplying by 1.25. A standard score ≥ 50 indicates the presence anxiety, with higher scores reflecting greater severity. In the current sample, internal consistency was acceptable (Cronbach's α = 0.83).

Eysenck Personality Questionnaire (EPQ). Personality traits were assessed using the Chinese revised 88-item version of the EPQ[24]. The scale includes four subscales: extraversion, neuroticism, psychoticism, and lie desirability, each comprising 18 items. Raw scores for each subscale are converted into standardized T-scores based on normative data (T = 50 + 10 × [raw score - group mean] / group standard deviation). Higher scores indicate stronger tendencies toward the corresponding personality traits. According to the established criteria[24], extraversion was classified as introversion (T -scores < 43.3), intermediate (43.3 ≤ T ≤ 56.7), and extraversion (T > 56.7). Neuroticism and psychoticism were categorized as stable (T < 43.3), intermediate (43.3 ≤ T ≤ 56.7), and unstable (T > 56.7). Lie desirability was classified as low (T < 43.3), intermediate (43.3 ≤ T ≤ 56.7), and high (T > 56.7). Detailed definitions of each category are shown in supplementary material (Table S1, p1). In the current sample, internal consistency was acceptable (Cronbach's α = 0.75).

We included demographic characteristics of both partners as covariates, along with health behaviors and pregnancy-related variables based on previous studies[1, 3, 4, 16, 17, 25]. Demographic variables included age, nationality, occupation, education level, and household monthly income. Health-related variables included cigarette smoking, alcohol drinking, history of family depression, and previous mental disorders. Additional variables for pregnant women included number of embryos, miscarriage and pregnancy complications. Detailed definitions of the covariates are shown in supplementary material (Table S2, p2).

2.4 Statistical analysis

We first conducted descriptive analyses to summarize the characteristics of wives and husbands. Continuous variables are shown as mean (SD) or median (IQR), and categorical variables as n (%). The Shapiro-Wilk test and histograms were used to verify normal distribution. Univariate analyses, including the independent-sample *t*-test and one-way analysis of variance, were used to compare group differences. Pearson correlation coefficients were used to assess associations between partners within dyads. Correlation coefficients of ≤ 0.29 were interpreted as small, 0.30–0.49 as moderate, and ≥ 0.50 as large[26].

To examine dyadic associations between personality traits and depressive and anxiety symptoms, we applied the APIM. This model accounts for the non-independence of dyadic data and allows simultaneous estimation of actor effects (associations between an individual's traits and their own outcomes) and partner effects (cross-partner associations)[21]. APIM has been widely used to examine intrapersonal and interpersonal

processes in dyads, including couples, parent-child dyads, and patient-caregiver relationships[27–29]. Given that wives and husbands represent distinguishable dyad members, we fitted the APIM using structural equation modeling (SEM) with maximum likelihood estimation[30]. Separate models were fitted to examine associations with depressive and anxiety symptoms, respectively. For each outcome, three models were estimated: an unadjusted model, a model adjusted for demographic characteristics (age, occupation, household monthly income, and education level), and fully adjusted model which additionally controlled for demographic characteristics and health-related covariates. Results from the fully adjusted model were used for interpretations and conclusions. Screening results of covariates are shown in supplementary material (Table S5-6, p4). Results from the unadjusted and partially adjusted models are shown in supplementary material (Table S7-8, p6). The indices employed to assess the model fit included χ^2/degrees of freedom (*df*) ratio ($\chi^2/df < 3$), root mean square error of approximation (RMSEA; <0.08), Tucker-Lewis index (TLI; >0.90), and comparative fit index (CFI; >0.90)[31].

Multinomial logistic regression was used to estimate odds ratios (ORs) and 95% CIs for the associations between personality traits and couple-level depressive symptoms. The outcome variable was categorized as neither partner depressed, one partner depressed, or both partners depressed, with "neither partner depressed" as the reference group. Distributions of personality trait categories and couple depressive symptom groups are shown in supplementary material (Tables S3-S4, p3). Three models were fitted: an unadjusted model, a model adjusted for demographic characteristics, and a fully adjusted model additionally controlling for health-related covariates. The fully adjusted model was considered the final model. Results from the unadjusted and partially adjusted models are shown in supplementary material (Table S9, p7). Dose-response relationships between personality traits (extraversion, neuroticism, psychoticism, and lie desirability) and couple-level depressive symptoms were assessed using restricted cubic spline models with three knots (10th, 50th, and 90th percentiles)[32], with nonlinearities tested by Wald statistics. Anxiety symptoms were excluded from these analyses due to the low prevalence of concordant cases.

Sensitivity analyses were conducted by excluding participants with previous mental disorders or a family history of depression to assess the robustness of the findings. The results based on the restricted sample are shown in the supplementary material, including APIM estimates for depressive and anxiety symptoms (Tables S10-S11, p8), a graphical representation of the APIM (Figure S2, p9), and multinomial logistic regression results for couple-level depressive symptoms (Table S12, p10).

All analyses were conducted using R software (version 4.2.2), with relevant packages including tidyverse (version 2.0.0), rms (version 6.5.0), glm2 (version 1.2.1), interactionR (version 0.1.6), forestplot (version 3.1.1), and ggplot2 (version 3.4.1). The APIM was estimated using R's lavaan package. All statistical tests were two-sided, with the $p < 0.05$ considered statistically significant.

3. Results

3.1. Preliminary analyses

The couples' sociodemographic characteristics are shown in Table 1. The mean age was 32.13 years (SD = 3.73) for wives and 33.27 years (SD = 4.37) for husbands ($p < 0.001$). No significant differences were observed in nationality or family history of depression ($p > 0.05$), whereas education and occupational distributions differed significantly between partners ($p < 0.001$). Compared with wives, husbands reported substantially higher rates of cigarettes smoking (45.9% vs. 6.5%, $p < 0.01$) and alcohol drinking (71.1% vs. 22.0%, $p < 0.01$). Husbands also reported a higher prevalence of depressive symptoms than wives (31.05% vs. 23.05%, $p < 0.001$), whereas anxiety symptoms prevalence was low and comparable between partners($p > 0.05$).

Husbands had higher levels of anxiety symptoms, depressive symptoms, and psychoticism, but lower lie desirability compared with wives (all $p < 0.01$; Table 2). No statistically significant differences were observed for extraversion or neuroticism (both $p > 0.05$). Correlations between study variables are shown in Table 3.

Table 1
Descriptive characteristics of the sample (N = 1536 couples)

Characteristics	Wives	Husbands	t/χ^2 test	*p*
Age (mean (SD))	32.13 (3.73)	33.27 (4.37)	-7.759	**<0.001**
Nationality (n,%)				
Han	1422 (92.6)	1420 (92.4)	30.053	**<0.001**
Other	114 (7.4)	116 (7.6)		
Education (n,%)				
High school and below	126 (8.2)	148 (9.6)	630.606	**<0.001**
Bachelor's degree	1009 (65.7)	982 (64.0)		
Master's degree or above	401 (26.1)	406 (26.4)		
Occupation (n,%)				
Government	138 (9.0)	163 (10.6)	212.847	**<0.001**
Professional	528 (34.4)	662 (43.1)		
Service and manual worker	358 (23.3)	395 (25.7)		
Others	512 (33.3)	316 (20.6)		
Household monthly income (RMB) (n,%)				
< 5000	81 (5.3)	-		
5000–9999	396 (25.8)	-		
10000–19999	691 (45.0)	-		
≥ 20000	368 (24.0)	-		
Cigarettes smoking (n,%)				
No	1436 (93.5)	831 (54.1)	40.257	**<0.001**
Yes	100 (6.5)	705 (45.9)		
Alcohol drinking (n,%)				
No	1198 (78.0)	443 (28.9)	6.879	**0.008**
Yes	338 (22.0)	1093 (71.1)		
History of family depression (n,%)				
No	1484 (96.6)	1510 (98.4)	0.530	0.467
Yes	52 (3.4)	26 (1.6)		
Previous mental disorders (n,%)				
No	1503 (97.9)	1507 (98.1)	0.091	0.763
Yes	33 (2.1)	29 (1.9)		
Embryo number (n,%)				
Single	1482 (96.5)	-		
Multiple	54 (3.5)	-		
Miscarriage (n,%)				
No	1126 (73.3)	-		
Yes	410 (26.7)	-		
Pregnancy complications (n,%)				
No	1251 (81.4)	-		

Characteristics	Wives	Husbands	t/χ^2 test	*p*
Yes	285 (18.6)	-		
Anemia (n,%)				
Normal	1419 (92.4)			
Abnormal	117 (7.6)			
Depressive symptom (n,%)				
No	1182 (76.95)	1059 (68.95)	24.500	**<0.001**
Yes	354 (23.05)	477 (31.05)		
Anxiety symptom (n,%)				
No	1487 (96.80)	1477(96.15)	0.950	0.330
Yes	49 (3.20)	59(3.58)		

Table 2
Comparison of anxiety, depression, and personality traits between husbands and wives.

Scale	Husbands (Mean (SD))	Wives (Mean (SD))	*t*	*p*
Anxiety symptom	37.45 ± 7.40	36.78 ± 6.94	2.61	**0.009**
Depressive symptom	46.75 ± 12.26	45.11 ± 10.95	3.90	**<0.001**
Extraversion	54.81 ± 11.14	55.22 ± 10.20	-1.08	0.282
Psychoticism	49.31 ± 9.77	45.84 ± 8.07	10.72	**<0.001**
Neuroticism	38.24 ± 10.91	37.77 ± 9.40	1.28	0.199
Lie desirability	45.25 ± 10.01	49.13 ± 8.38	-11.64	**<0.001**

Table 3
Bivariate correlations among depressive symptoms, anxiety symptoms, and personality traits for husbands and wives.

Variable	W-Anx	W-Dep	W-Ext	W-Psy	W-Neu	W-Lie	H-Anx	H-Dep	H-Ext	H-Psy	H-Neu	H-Lie
W-Anx	1											
W-Dep	**0.680****	1										
W-Ext	**-0.121****	**-0.254****	1									
W-Psy	**0.217****	**0.244****	**-0.057***	1								
W-Neu	**0.245****	**0.311****	**-0.136****	0.020	1							
W-Lie	**-0.066****	**-0.158****	0.016	**-0.234****	**-0.421****	1						
H-Anx	**0.137****	**0.137****	**-0.057****	0.049	**0.104****	-0.047	1					
H-Dep	**0.145****	**0.171****	**-0.072****	**0.084****	**0.089****	-0.023	**0.721****	1				
H-Ext	0.003	-0.018	**0.112****	0.018	-0.028	-0.004	**-0.107****	**-0.204****	1			
H-Psy	**0.101****	**0.134****	**-0.054***	**0.122****	**0.078****	-0.036	**0.279****	**0.323****	**-0.090***	1		
H-Neu	0.044	**0.076****	-0.004	0.015	**0.171****	**-0.146****	**0.311****	**0.304****	**-0.064****	**0.142****	1	
H-Lie	-0.123	-0.042	-0.036	0.004	**-0.118****	**0.154****	**-0.129****	**-0.150****	-0.020	**-0.344****	**-0.502****	1

Note: *p < 0.05,**p < 0.01,***p < 0.001. Abbreviations: W-Anx means Wives anxiety, W-Dep means Wives depression, W-Ext means Wives extraversion, W-Psy means Wives psychoticism, W-Neu means Wives neuroticism, W-Lie means Wives lie desirability, H-Anx means Husbands anxiety, H-Dep means Husbands depression, H-Ext means Husbands extraversion, H-Psy means Husbands psychoticism, H-Neu means Husbands neuroticism, H-Lie means Husbands lie desirability.

3.2. Primary analyses

3.2.1 APIM analyses. The APIM SEM framework was used to examine the associations between personality traits (neuroticism, psychoticism, extraversion, and lie desirability) and depressive and anxiety symptoms. Dyads were treated as distinguishable (wives vs. husbands). Separate APIMs were fitted for depressive symptoms and anxiety symptoms, with the results shown in Table 4. The graphical representation of the APIM (Figure S1, p5). Given the model fit indices are similar across the three models, we reported results from the Model 3 (depressive symptoms: χ^2/df = 1.550, TLI = 0.950, CFI = 0.967, RMSEA = 0.018; anxiety symptoms: χ^2/df = 1.542, TLI = 0.958, CFI = 0.972, RMSEA = 0.018).

Depressive symptoms: For actor effects, neuroticism and psychoticism were positively associated with individuals' depressive symptoms in both wives (β = 0.331 and 0.287, both $p < 0.001$) and husbands (β = 0.310 and 0.349, both $p < 0.001$), whereas extraversion and lie desirability were negatively associated with depressive symptoms. For partner effects, a significant association was observed only for husbands' psychoticism to wives' depressive symptoms (β = 0.097, $p < 0.001$), whereas the reverse association was not significant (β = 0.019, $p > 0.05$).

Anxiety symptoms: For actor effects, a similar pattern was observed for anxiety symptoms. Neuroticism and psychoticism were positively associated with individuals' own anxiety symptoms in both wives (β = 0.344 and 0.228, both $p < 0.001$) and husbands (β = 0.178 and 0.104, both $p < 0.001$), whereas extraversion and lie desirability were negatively associated with anxiety symptoms. For partner effects, husbands' psychoticism remained positively associated with wives' anxiety symptoms (β = 0.075, $p < 0.001$), whereas the reverse association was not significant (β = 0.036, $p > 0.05$). In contrast, wives' lie desirability was negatively associated with husbands' anxiety symptoms (β = −0.059, $p < 0.05$).

Overall, significant actor effects were consistently observed across all personality traits, whereas partner effects were more limited. The results of the sensitivity analyses were largely consistent with the main findings.

Table 4
Results of the actor-partner interdependence model for depressive and anxiety symptoms

Independent Variable	Effect	Depression		Anxiety	
		β (*B*)	*p*	*β* (*B*)	*p*
Neuroticism					
Wives neuroticism	Actor	0.331 (0.386)	**< 0.001**	0.344 (0.254)	**< 0.001**
Husbands neuroticism	Actor	0.310 (0.346)	**< 0.001**	0.178 (0.134)	**< 0.001**
Husbands neuroticism	Partner	0.026 (0.027)	0.296	0.025 (0.016)	0.315
Wives neuroticism	Partner	0.028 (0.036)	0.239	0.039 (0.034)	0.202
Psychoticism					
Wives psychoticism	Actor	0.287 (0.386)	**< 0.001**	0.228 (0.195)	**< 0.001**
Husbands psychoticism	Actor	0.349 (0.434)	**< 0.001**	0.104 (0.087)	**0.001**
Husbands psychoticism	Partner	0.097 (0.108)	**< 0.001**	0.075 (0.052)	**0.002**
Wives psychoticism	Partner	0.019 (0.029)	0.408	0.036 (0.036)	0.266
Extraversion					
Wives extraversion	Actor	-0.253 (-0.272)	**< 0.001**	-0.135 (-0.092)	**< 0.001**
Husbands extraversion	Actor	-0.216 (-0.239)	**< 0.001**	-0.092 (-0.068)	**0.001**
Husbands extraversion	Partner	-0.005 (-0.005)	0.831	0.009 (0.005)	0.732
Wives extraversion	Partner	-0.042 (-0.051)	0.093	0.024 (0.019)	0.360
Lie desirability					
Wives lie desirability	Actor	-0.156 (-0.204)	**< 0.001**	-0.120 (-0.100)	**< 0.001**
Husbands lie desirability	Actor	-0.132 (-0.162)	**< 0.001**	-0.172 (-0.142)	**< 0.001**
Husbands lie desirability	Partner	-0.016 (-0.018)	0.510	-0.022 (-0.016)	0.363
Wives lie desirability	Partner	-0.004 (-0.005)	0.883	-0.059 (-0.058)	**0.034**

Note: Model 3 was adjusted for age, education level, occupation, household income, cigarettes smoking, alcohol drinking, family history of depression, and previous mental disorders. Actor effects represent associations between an individual's personality traits and their own emotional symptoms, whereas partner effects represent associations between one partner's traits and the other partner's symptoms within the dyad. Values in bold indicate statistically significant effects. Abbreviations: *B*, unstandardized coefficients; *β*, standardized coefficients.

3.2.2 Multinomial logistic regression analyses of couple-level depressive symptoms

Multinomial logistic regression analyses examined associations between personality traits and couple-level depressive symptoms (Table 6). After adjusting for demographic and health-related covariates, neuroticism and psychoticism emerged as the strongest predictors for couple-level depressive symptoms.

For neuroticism, increasing levels were associated with progressively higher risks of depressive symptoms. Compared with the stable group, intermediate and unstable neuroticism were associated with higher odds of one-partner depressive symptoms in wives (OR = 2.04, 95% CI: 1.50–2.78; OR = 6.04, 95% CI: 3.05–11.95) and husbands (OR = 1.68, 95% CI: 1.22–2.31; OR = 5.16, 95% CI: 3.02–8.84). For both-partner depressive symptoms, associations were stronger, particularly for unstable neuroticism (wives: OR = 16.72, 95% CI: 7.08–39.45; husbands: OR = 5.82, 95% CI: 2.64–12.86). For psychoticism, higher levels were also associated with increased risks of depressive symptoms. Unstable psychoticism was significantly associated with higher odds of one-partner depressive symptoms in both wives and husbands (OR = 1.90 [1.16–3.09] and 3.27 [2.21–4.82], respectively), and with substantially higher odds of both-partner depressive symptoms (wives: OR = 7.61 [3.78–15.33]; husbands: OR = 6.82 [3.48–13.37]). Intermediate psychoticism showed a weaker and less consistent pattern.

In contrast, extraversion showed protective associations. Compared with introversion, higher extraversion was associated with lower odds of one-partner depressive symptoms (wives: OR = 0.68 [0.48–0.97]; husbands: OR = 0.59 [0.43–0.82]) and markedly lower odds of both-partner depressive symptoms (wives: OR = 0.31 [0.17–0.56]; husbands: OR = 0.32 [0.18–0.57]). Associations for lie desirability were inconsistent. Higher levels were

associated with increased odds of both-partner depressive symptoms in both wives (intermediate: OR = 2.18 [1.16–4.10]; high: OR = 2.66 [1.20–5.89]) and husbands (high: OR = 2.23 [1.04–4.78]), whereas associations with one-partner depressive symptoms were generally not significant. The results of the sensitivity analyses were largely consistent with the main findings. Results are shown in supplementary materials (Table S12, p10).

The dose-response associations between personality traits and couple-level depressive symptoms risk are shown in Fig. 1. Significant nonlinear relationships were observed for wives' neuroticism, husbands' neuroticism, psychoticism, and wives' extraversion (all *p*-value for nonlinearity < 0.05).

Table 6 Multinomial logistic regression associations between personality traits and couple-level depressive symptoms.

Personality trait	One partner depressed		Both partners depressed	
	OR (95% CI)		OR (95% CI)	
	Wives	Husbands	Wives	Husbands
Extroversion				
Introversion	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Intermediate	0.73 (0.52-1.05)	0.79 (0.57-1.10)	0.49 (0.29-0.85)**	0.59 (0.34-1.01)
extroversion	0.68 (0.48-0.97)*	0.59 (0.43-0.82)**	0.31 (0.17-0.56)***	0.32 (0.18-0.57)***
Neuroticism				
Stable	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Intermediate	2.04 (1.50-2.78)***	1.68 (1.22-2.31)***	1.62 (0.90-2.92)	2.14 (1.23-3.72)**
Unstable	6.04 (3.05-11.95)***	5.16 (3.02-8.84)***	16.72 (7.08-39.45)***	5.82 (2.64-12.86)***
Psychoticism				
Stable	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Intermediate	1.38 (1.07-1.77)*	1.32 (0.99-1.75)	2.73 (1.63-4.57)***	1.39 (0.76-2.54)
Unstable	1.90 (1.16-3.09)*	3.27 (2.21-4.82)***	7.61 (3.78-15.33)***	6.82 (3.48-13.37)***
Lie Desirability				
Low	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)	1.00 (Reference)
Intermediate	1.24 (0.90-1.72)	1.48 (1.12-1.96)**	2.18 (1.16-4.10)*	1.67 (0.99-2.82)
High	1.33 (0.89-2.00)	1.16 (0.76-1.77)	2.66 (1.20-5.89)*	2.23 (1.04-4.78)*

Note: The reference category for both outcome levels ("one partner depressed" and "both partners depressed") was "neither partner depressed". Personality traits were categorized into three levels based on standardized T-scores. Detailed definitions of each category are provided in the supplementary material (Table S3, p3). Models 3 were adjusted for age, occupation, household income, education level, family history of depression, cigarettes smoking, alcohol drinking, and pregnancy comorbidities. Abbreviations: OR= odd ratio, CI=confidence interval. *$p < 0.05$,**$p < 0.01$,*** $p < 0.001$.

4. Discussion

This current study added data to perinatal mental health research by demonstrating that personality traits operated within a hierarchical dyadic system, encompassing individual vulnerability, partner influence, and couple-level risk accumulation. Across analyses, neuroticism and psychoticism emerged as the most robust risk-related traits, whereas extraversion and lie desirability generally functioned as protective factors. Importantly, these associations were not confined to individuals but extended to interpersonal and couple-level dynamics, underscoring the relational embedding of perinatal emotional disorders.

At the individual level, the strong and consistent actor effects of all personality traits provided a clear support for the stress–diathesis model, reinforcing personality as a stable vulnerability factor that becomes particularly salient under the psychological and relational demands of early pregnancy. Our results are consistent with previous evidence[10, 11, 12, 13, 14, 33]. Previous research has identified neuroticism as a core individual vulnerability factor for perinatal mental health[33]. In contrast, extraversion and lie desirability were consistently protective. This study was broadly consistent with previous work linking extraversion to positive affect and psychological well-being, but also suggested a potential interpersonal pathway[34]. One possible explanation is that extraverted individuals may engage more actively in social interaction and emotional expression,

thereby facilitating positive communication within the relationship[35]. This in turn may contribute to a more supportive interpersonal environment and therefore reduce the transmission of negative affect[36].

More importantly, this study provided a more differentiated understanding of interpersonal processes by revealing that partner effects were selective and asymmetric. The most stable dyadic effect was observed for husbands' psychoticism, which was consistently associated with increased depressive and anxiety symptoms in wives, whereas the reverse pathway was not statistically significant. To the best of our knowledge, this pattern has not been reported in previous studies. One possible explanation was that individuals high in psychoticism may contribute to greater interpersonal conflict and lower relationship satisfaction, which may in turn increase emotional distress in their partners[37]. During early pregnancy, women may be more reliant on partner support, and partners high in psychoticism may be less able to provide stable emotional support, thereby more sensitive to partners' emotional stress[38, 39]. The absence of a reverse partner effect may reflect differences in emotional expression or coping patterns, with men potentially less likely to report or be influenced by their partner's emotional states. In contrast, the protective effect of wives' lie desirability on husbands' anxiety further suggests that adaptive interpersonal traits may function as emotional stabilizers within the dyad. Individuals with higher lie desirability are typically characterized by a tendency to avoid conflict, maintain interpersonal harmony, and present socially desirable behaviors. In this context, wives with higher lie desirability may be more likely to suppress the expression of negative emotions and avoid confrontation in daily interactions[40]. As a result, they may contribute to a more emotionally predictable and low-conflict family environment, which in turn could reduce the transmission of anxiety-related emotional states within the dyad[41].

At the couple level, multinomial analyses provided additional evidence for a cumulative and synergistic process. The graded associations observed for neuroticism and psychoticism indicated a clear dose-response pattern, where increasing maladaptive traits in either partner, and especially in both, substantially elevated the risk of concordant depressive symptoms. This pattern supports the concept of an emergent dyadic vulnerability state, in which maladaptive personality configurations impair mutual emotion regulation, stress communication, and co-regulation capacity within the couple system[42, 43]. Moreover, a longitudinal study suggests that neuroticism may not only predispose individuals to depressive and anxiety symptoms but may also be shaped by them[44]. Conversely, extraversion demonstrated a protective role at the dyadic level in our study, particularly in reducing the likelihood of shared depressive symptoms. This study further extended previous evidence by suggesting that maternal extraversion may not only shape an individual's own emotional well-being but also influence depressive outcomes in their partner. Within traditional gender role expectations, women often assume greater responsibility for emotional caregiving and relationship maintenance within marriage[45]. In this context, wives with higher levels of extraversion may be more likely to facilitate the sharing of positive experiences, maintain a relaxed and supportive interactional atmosphere, and express encouragement and appreciation. These interpersonal behaviors may, in turn, enhance marital quality and buffer stress, thereby reducing the risk of co-occurring depressive symptoms within the couple.

Importantly, our findings also added new data for clarifying inconsistencies in previous literature regarding psychoticism[46, 47]. While previous studies have often reported null or inconsistent associations, our dyadic and couple-level results suggested that psychoticism may not primarily act as an individual-level predictor but rather as an interpersonal risk factor that becomes visible only when examined within relational contexts. This may explain why previous individual-focused studies failed to detect stable associations. Therefore, our study provided evidence that the role of psychoticism should be reconsidered within a relational framework rather than treated as a weak or inconsistent individual trait predictor.

Our findings should be interpreted with a number of study limitations. The cross-sectional design precluded causal inference and did not capture temporal dynamics in dyadic processes[21]. Self-reported measures might introduce reporting bias. In addition, relatively small proportion in extreme personality categories might have contributed to less stable estimates for certain comparisons. Third, our study sample was limited to heterosexual couples in early pregnancy, which may restrict generalizability. Finally, although gender differences were observed, the study was not designed to formally test gender-specific mechanisms.

Despite these limitations, this study advanced current knowledge by demonstrating that personality traits in the perinatal period should be conceptualized within a dyadic vulnerability framework, in which individual susceptibility, partner influence, and couple-level synergy jointly shape emotional outcomes. This perspective moves beyond parallel individual associations and emphasizes that perinatal depression and anxiety are embedded within relational systems[48, 49]. These findings underscore the need for couple-centered screening and interventions that account for individual personality risk and interpersonal dynamics[50–52]. Husbands and wives with high-risk personality traits should be prioritized for depression and anxiety screening and monitoring during early period of pregnancy.

Declarations

Ethics approval and consent to participate

This study procedures were approved by the Institutional Review Board of Beijing Obstetrics and Gynecology Hospital (Approval No. 2023-KY-089-01) and the Ethics Committee of Capital Medical University (Approval No. Z2023SY045). Written informed consent was obtained from all participants. All procedures were performed in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Authors' information

Authors and Affiliations

Department of Epidemiology and Health Statistics, School of Public Health, Capital Medical University, Beijing, China

Lijie Guo & Jiang Tian

Department of Obstetrics, Beijing Obstetrics and Gynecology Hospital, Capital Medical University, Beijing Maternal and Child Health Care Hospital, Beijing, China

Xiaoxin Wang

The Research Institute at Nationwide Children's Hospital, Department of Pediatrics, The Ohio State University, Columbus, Ohio, USA

Henry Xiang

Department of Maternal and Child Health, School of Public Health, Capital Medical University, Beijing, China

Peixia Cheng & Huiping Zhu

Beijing Key Laboratory of Environment and Aging, Capital Medical University, Beijing, China

Huiping Zhu

Laboratory for Gene-Environment and Reproductive Health, Laboratory for Clinical Medicine, Capital Medical University, Beijing, China

Huiping Zhu

Corresponding author

Peixia Cheng and Huiping Zhu are co-corresponding authors.

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Author Contribution

Lijie Guo: data collection, data analysis, writing—original draft, visualisation.Jiang Tian: data collection, methodology.Xiaoxin Wang: data collection, project administration, validation. Henry Xiang: writing—review and editing, conceptualisation. Peixia Cheng: conceptualisation, methodology, supervision, validation, writing—review and editing. Huiping Zhu: conceptualisation, funding acquisition, investigation, methodology, supervision, validation, project administration, resources, software, writing—review and editing.

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Data Availability

Data supporting the conclusions of this article will be made available upon reasonable request. Huiping Zhu, the corresponding author, can be contacted.

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Figures

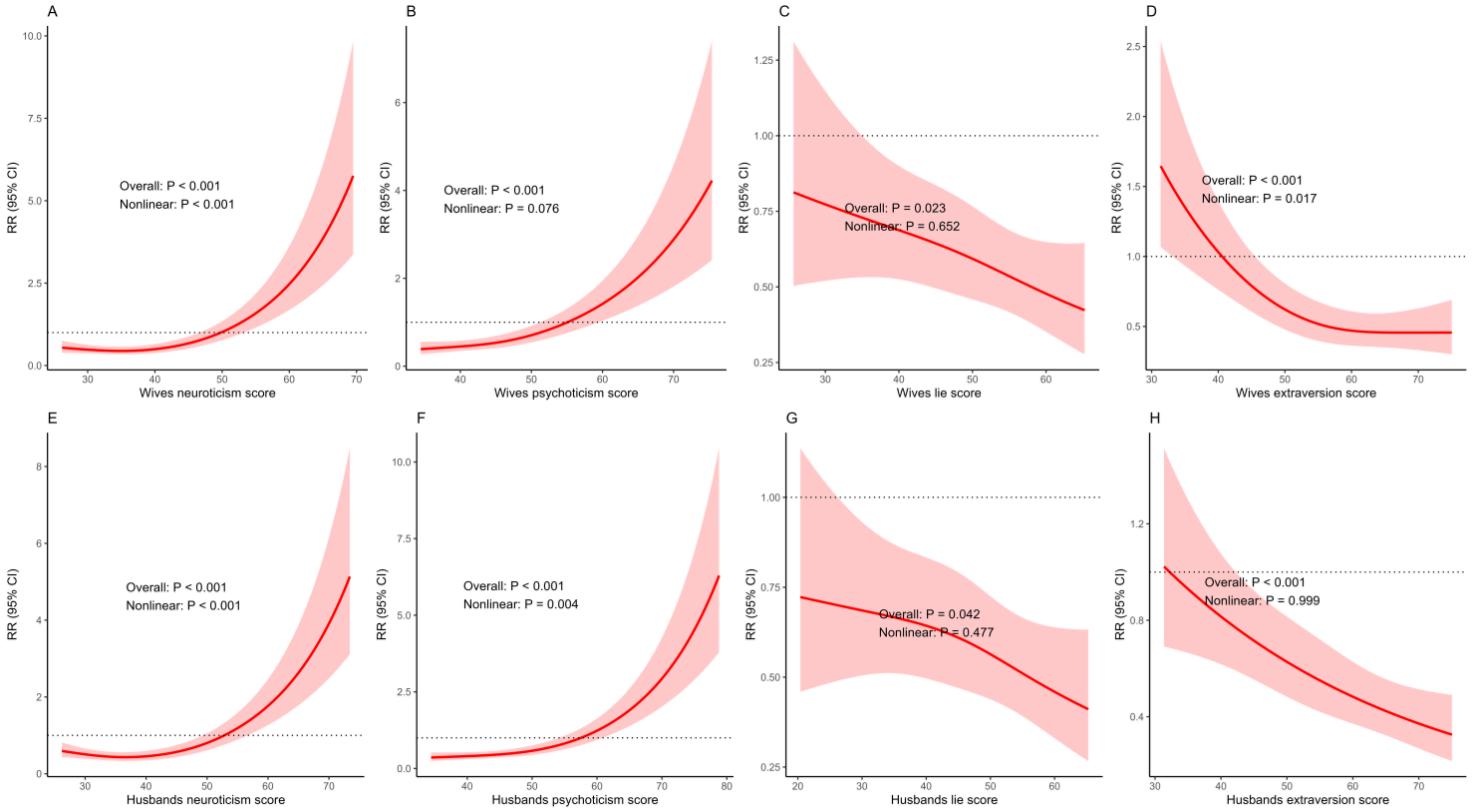

Figure 1

Associations between Eysenck personality traits and depressive symptoms in early pregnancy.

Note: Restricted cubic spline analyses were used to examine dose-response associations between personality trait scores and depressive symptoms among couples. Panels A-D present associations for wives' neuroticism, psychoticism, lie, and extraversion scores, respectively; panels E-H present corresponding associations for husbands. The red curves indicate estimated risk ratios (RRs), and the shaded areas indicate 95% confidence intervals. The horizontal dotted line represents RR = 1. Overall and nonlinear P values are displayed in each panel.

Supplementary Files

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