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ORIGINAL RESEARCH

Changes in Dyadic Coping and Health Behaviors Across Pregnancy in Gestational Hypertension: A Three-Wave Dyadic Cross-Lagged Actor-Partner Interdependence Model Study

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Objective: Based on the Actor-Partner Interdependence Model, this study longitudinally explores the dynamic interactions between dyadic coping and health behaviors among patients with gestational hypertension and their spouses, providing a basis for promoting health behaviors in both partners.

Methods: Using the convenience sampling method, 260 cases of patients with gestational hypertension were selected. Dyadic Coping Inventory (DCI) and the Health Promoting Lifestyle Profile (HPLP) were used to conduct investigations at 20–21^{+6} weeks of gestation (T1), 28 weeks of gestation (T2), and 36 weeks of gestation (T3).

Results: The actor effects of dyadic coping between patients with gestational hypertension and their spouses on health behaviors were significant. That is, the dyadic coping of both patients (T1→T2: $\beta = 0.11$, T2→T3: $\beta = 0.10$, all $p < 0.01$) and spouses (T1→T2: $\beta = 0.09$, T2→T3: $\beta = 0.08$, all $p < 0.01$) could be positively and prospectively associated with their own health behaviors at the next time point. The actor effects of health behaviors of patients and spouses on dyadic coping were also significant. Specifically, the health behaviors of both patients (T1→T2: $\beta = 0.14$, T2→T3: $\beta = 0.11$, all $p < 0.001$) and spouses (T1→T2: $\beta = 0.12$, $P < 0.001$; T2→T3: $\beta = 0.10$, $p < 0.01$) could be positively and prospectively associated with their own dyadic coping at the next time point. Furthermore, significant partner effects of health behaviors were found: the health behaviors of both patients (T1→T2: $\beta = 0.13$, T2→T3: $\beta = 0.12$, all $p < 0.001$) and spouses (T1→T2: $\beta = 0.09$, T2→T3: $\beta = 0.07$, all $p < 0.01$) could be positively and prospectively associated with the other's health behaviors at the next time point.

Conclusion: Dyadic coping and health behaviors interact between patients with gestational hypertension and their spouses.

Keywords: hypertension, pregnancy-induced, patients, spouses, actor-partner interdependence model, dyadic coping, health behavior, longitudinal studies, cross-lagged analysis, clinical nursing research

Introduction

The global incidence of hypertensive disorders of pregnancy ranges from approximately 5% to 12%.[1] In China, it ranges from about 9.4% to 10.4%. The occurrence of this disease is the second leading cause of maternal deaths.[2] Gestational hypertension seriously endangers the health of mothers and children and can result in adverse outcomes such as preterm birth, low birth weight, and perinatal death. In recent years, as women postpone childbearing and the proportion of women of advanced maternal age increases, its prevalence is rising.[3,4]

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Health behavior management plays a critical role in the comprehensive prevention and control of hypertension during pregnancy. Existing studies indicate that a series of scientific self - management measures—such as regular blood pressure monitoring, a low - salt and low - fat diet, moderate physical activity, adequate rest, maintaining emotional stability, and adherence to prescribed medications—can significantly reduce the risk of developing gestational hypertension and its associated complications.[5,6] Nutritional interventions have also demonstrated significant protective effects. For instance, initiating daily supplementation of 0.4–0.8 mg folic acid at least three months before conception can reduce the risk of preeclampsia by 21%, while daily supplementation of 1000 mg of elemental calcium can lower the risk of gestational hypertension by 19%. These health behaviors are essential for preventing severe complications such as preeclampsia and placental abruption, effectively reducing the risks of preterm birth and perinatal mortality, thereby serving as a key factor in improving pregnancy outcomes.[7]

Dyadic coping refers to a collaborative process in which couples jointly address illness - related challenges through shared stress appraisal, resource coordination, and cooperative management. Grounded in theoretical frameworks such as the Systemic - Transactional Model (STM), it emphasizes the dynamic interdependence between partners in managing health stressors.[8] Empirical evidence indicates that effective dyadic coping enhances mutual support and monitoring, which, in turn, significantly improves patients' treatment adherence and self - management abilities, thereby contributing positively to health outcomes such as blood pressure control. Moreover, higher levels of dyadic coping are associated with more effective dyadic coping between spouses. Couples who engage in open discussions about disease - related challenges demonstrate greater persistence and consistency in adopting and maintaining health behaviors.[9] Although the importance of health behaviors and couple communication has gained preliminary recognition, significant theoretical and methodological gaps still exist in this field of research, limiting its depth and international relevance. Previous studies have mainly focused on factors at the individual level of the pregnant woman, treating the patient as an isolated unit of analysis and overlooking the role of marital relationships as a typical dyadic interaction system in shaping health behaviors.

The Actor - Partner Interdependence Model (APIM) is a classical framework for the dynamic interaction analysis of dyadic relationships. Its core lies in studying both the actor effect and the partner effect on both sides.[10] This model suggests that there is a strong interpersonal interaction in the intimate relationship between patients and their spouses. An individual's ideas and behaviors are not only influenced by themselves but also by each other.[11]

Therefore, the dyadic coping and health behavior of patients with gestational hypertension and their spouses may have a mutual influence. In the context of gestational hypertension, the Actor - Partner Interdependence Model (APIM) provides a robust theoretical tool for understanding how couples jointly influence health behaviors through their interactions.

A pregnant woman's health behaviors are influenced not only by her own illness perceptions and communication patterns (actor effects), but also by her spouse's attitudes toward the illness and supportive behaviors (partner effects). Conversely, the spouse's communication and supportive behaviors are also shaped by the pregnant woman's health status and patterns of interaction.

The APIM overcomes the limitation of traditional research that treats individuals as independent units of analysis, enabling researchers to capture dyad - level interaction mechanisms and thereby more comprehensively reveal the factors influencing health behaviors.

Based on the identified limitations of previous research, which has predominantly relied on cross - sectional designs focused on individuals and thus only captured static variable relationships, this study employs a cross - lagged analysis within the Actor - Partner Interdependence Model (APIM) framework. This approach allows for a dynamic investigation into the interplay between dyadic coping and health behaviors in couples facing gestational hypertension.

The following hypotheses are proposed:

H1: Dyadic coping and health behaviors in both patients with gestational hypertension and their spouses demonstrate significant dynamic changes over time.

H2: A bidirectional relationship prospectively associated with the relationship exists between the patient's dyadic coping and the spouse's across time.

H3: A bidirectional relationship prospectively associated with the relationship exists between the patient's health behaviors and the spouse's across time.

H4: Both actor effects (where an individual's own dyadic coping predicts their subsequent health behaviors) and partner effects (where one partner's dyadic coping predicts the other's subsequent health behaviors) are significant in the relationship between dyadic coping and health behaviors.

By examining the changing trends and the relationships prospectively associated with them between dyadic coping and health behaviors in these couples, this research aims to provide a new perspective and empirical evidence for developing interventions to enhance health behaviors in the context of gestational hypertension.

Objects and Methods

Study Objects

From October to December 2024, convenience sampling was employed to select 260 patients with gestational hypertension and their spouses who were admitted to the Department of Obstetrics and Gynecology of the Second Affiliated Hospital of Chongqing Medical University as the research subjects.

Inclusion criteria

- Patients meeting the diagnostic criteria for gestational hypertension,[12] with a gestational age of 20 to 21^{+6} weeks.
- The patients and their spouses were 18 years old or above.
- All patients signed the informed consent form.

Exclusion criteria

- Patients and/or spouses with cognitive impairment.
- The patient had a history of mental illness.
- During the follow-up, those who did not complete three longitudinal measurements due to miscarriage, premature birth, death, or other reasons.

This study was carried out after obtaining approval from the hospital ethics committee (certificate no.: 2023120016) for the clinical research work. All respondents voluntarily participated in this study and signed the informed consent form.

Research Methods

Sample Size Calculation

This study designed for longitudinal repeated measurement, the formula of sample size[13]

$$n = \frac{2}{\delta^2}[\sigma_\mu^2 + \frac{K + (K-1)\rho_c}{K}\sigma_e{}^2](U_{\alpha/2} + U_\beta)^2$$

In this study, the parameters are set as follows: $\alpha = 0.05$ and $1 - \beta = 0.90$, where $U_{\alpha/2}$ and U_β represent the upper α and β quantiles of the standard normal distribution, respectively. The sample size inflation factor is given by $K + (K-1)\rho_c$. Based on the preliminary trial, $K = 3$, the repeated measurement error $\sigma_e{}^2 = 172.907$, the conditional correlation coefficient $\rho_c = 0.751$, and the between-individual variance $\sigma_\mu^2 = 457.333$. Consequently, the calculated sample size is $n = 175$. To account for a 10% attrition rate in the longitudinal survey, the minimum required sample size is adjusted to $n = 175 \div (1–10\%) = 195$.

Survey Tools

General Information Questionnaire

Researchers used a general information questionnaire, which contains the following information: the patient's age, educational background, occupational status, place of residence, family income, living conditions, whether they are first-time mothers, whether they have a history of gestational hypertension, and the conception method. The specific information of the spouse includes age, education level, place of residence, and economic income.

Dyadic Coping Inventory (DCI)

Dyadic Coping Inventory was developed by Bodenmann et al[14] and translated into Chinese by Xu et al[15] It consists of 6 dimensions and a total of 37 items. By using a Likert 5 - point scale, the scores range from 37 to 175 points. A score below 111 points indicates an average level; a score of 111–145 is considered to be in the normal range. A score of >145 indicates above - average, with higher scores indicating more positive dyadic coping between couples. In this study, the Cronbach's α coefficients for the scale across the three measurement time points were 0.824, 0.830, and 0.902 for the patients, and 0.860, 0.885, and 0.846 for their spouses.

Health Promoting Lifestyle Profile (HPLP)

This study uses the Chinese version of the HPLP-II to investigate the health behaviors of patients and their spouses. The scale was developed by Walker et al[16] in 1987 and localized by Wenjun Cao et al[17] It consists of 40 items across six dimensions (interpersonal relationship, health responsibility, stress management, nutrition, sports, and mental growth). Each item is scored from 1 to 4 points, and the scale ranges from 40 to 160 points. A higher HPLP score indicates a higher level of health behaviors. In this study, the Cronbach's α coefficients for the scale across the three measurement time points were 0.842, 0.796, and 0.805 for the patients, and 0.910, 0.856, and 0.895 for their spouses.

The Cronbach's α coefficients of the scale in this study were 0.842, 0.796, and 0.805.

Data Collection Methods

Before conducting the survey, all the researchers participating in it were trained. The general - information questionnaire was obtained from the patients' medical records. The data of the dyadic coping scale and the health behavior assessment scale were collected at the time of diagnosis (20 to 21^{+6} weeks of pregnancy, T1), 28 weeks of pregnancy (T2), and 36 weeks of pregnancy (T3).

At the T1 time point, general patient information was collected and scales were administered via face - to - face interviews. For the T2 and T3 time points, scales were completed through either face - to - face interviews or telephone follow - ups. To ensure patient privacy, the survey was conducted in a confidential setting. Participants were assured that the questionnaire data would be used solely for this research. The study employed a confidential approach, utilizing coded identifiers for pseudonymization, with no disclosure of personal information or individual factors. Specifically, a unique coded identifier was generated for each patient and their spouse to enable longitudinal data linkage. The code key was stored in a password - protected file, accessible only to authorized researchers, to ensure data security.

Statistical Methods

SPSS 26.0 software was employed for descriptive statistics and correlation analysis. Enumeration data were presented as the number of cases and percentage, while measurement data following a normal distribution were expressed as the mean ± standard deviation. Mplus 8.3 was utilized for the measurement equivalence test, and configural invariance, metric invariance, and scalar invariance models were established respectively. Additionally, cross - lagged models of intimacy, actor, and partner were constructed respectively to explore the interaction among patients' communication about their spouses' diseases, health behaviors, and the three time points, as well as the actor effect and the partner effect. Among these, the actor effect pertains to the effect between the predictor variable and the outcome variable of the same individual, and the partner effect refers to the effect between the predictor variable of one individual and the outcome variable of another individual. Latent variables were used to compute

each time point of the patients' and spouses' communication about diseases and health behaviors. x represents the sample mean, SD stands for standard deviation, χ^2 is the chi - square value, and df denotes degrees of freedom. In structural equation modeling, key fit indices include CFI (Comparative Fit Index), TLI (Tucker - Lewis Index), RMSEA (Root Mean Square Error of Approximation), and SRMR (Standardized Root Mean Square Residual). The model referenced is the APIM (Actor - Partner Interdependence Model). Generally, a model is considered to have good fit when CFI > 0.90, TLI > 0.90, RMSEA < 0.08, and SRMR < 0.08.

Results

General Information of the Respondents

Fifteen cases lost to follow - up were excluded, and the attrition flowchart is presented in Figure 1. A total of 245 valid questionnaires were collected in this study, and the baseline characteristics at T1 are summarized in Table 1. A comparison of baseline characteristics between participants who dropped out (n = 15) and those who completed the study (n = 245) revealed no statistically significant differences in age, education, parity, income, prior history of gestational hypertension, or any available clinical indicators (all p > 0.05).

Common Method Bias Test

The common method deviation was tested using the Harman single - factor method. Since this study adopted a longitudinal design, the common method deviation of the data retrieved from three measurements was tested. The results indicated that the variance interpretation rates of the first factor in the three measurements were 18.02%, 21.56%, and 24.90% respectively, all of which were lower than the critical value of 40%. This suggests that there was no serious common method bias in this study.[18]

Additionally, validity was assessed through a multitrait - multimethod matrix (MTMM) analysis, which revealed that the trait factor loadings were significant (λ = 0.78–0.85), while the method factor accounted for only 9% of the variance, indicating the absence of method bias.

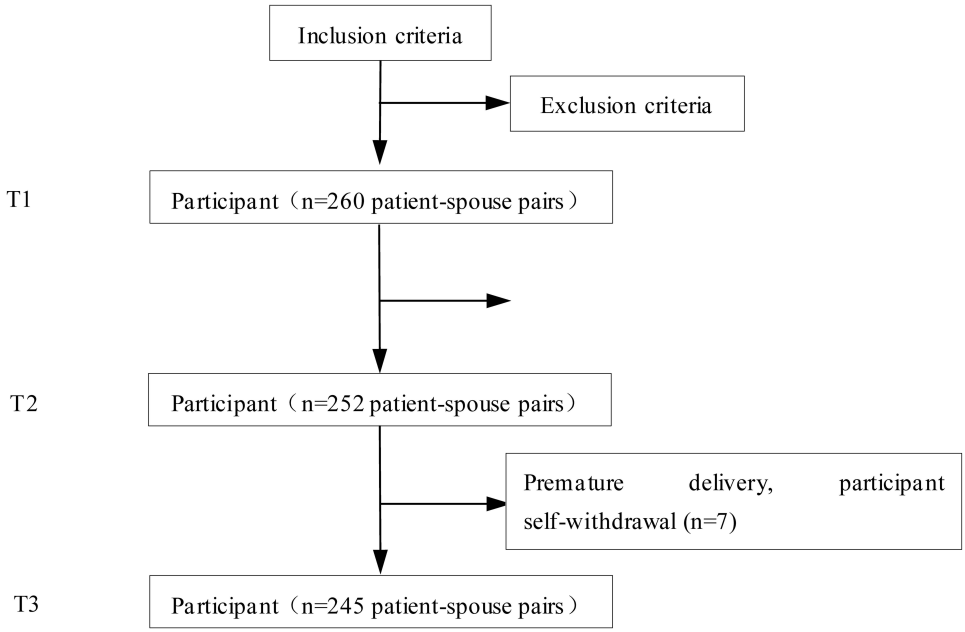

Figure 1 Participant flowchart.

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Table 1 Actors of General Information (n = 245)

Items		Patient Information n (%)	Spouse Information n (%)
Age (years)	20 to 29	164 (66.94)	162 (66.12)
	30 ~ 39	68 (27.76)	70 (28.57)
	≥40	13 (5.30)	13 (5.31)
Level of education	Junior high school and below	95 (38.78)	92 (37.55)
	High school	79 (32.24)	80 (32.65)
	Junior college and above	71 (28.98)	73 (29.80)
Monthly income (yuan)	< 3,000	20 (8.16)	13 (5.31)
	3,000~5,999	115 (46.94)	110 (44.90)
	6,000~7,999	68 (27.76)	75 (30.61)
	> 8,000	42 (17.14)	47 (19.18)
Place of residence	Town	104 (42.45)	104 (42.45)
	Rural	141 (57.55)	141 (57.55)
Career status	On-the-job	82 (33.47)	233 (95.10)
	Leaving a job	163 (66.53)	12 (4.90)
Primipara	Yes	177 (72.24)	-
	No	68 (27.76)	-
A history of pregnancy-induced hypertension	Yes	32 (13.06)	-
	No	213 (86.94)	-
Method of conception	Conceived naturally	197 (80.41)	-
	Manual assistance	48 (19.59)	-

Scores and Correlation Analysis of Dyadic Coping and Health Behavior of Patients with Gestational Hypertension and Their Spouses

A repeated measures ANOVA was conducted to analyze the time trends. The sphericity test indicated that the assumption of sphericity was violated (Mauchly's W = 0.72, p = 0.001). Therefore, the Greenhouse–Geisser correction was applied.

The scores of dyadic coping and health behavior of patients with gestational hypertension and their spouses are presented in Figures 2 and 3. As can be seen from the figures, there was a significant downward trend over time ($p < 0.001$), as shown in Table 2.

The scores of dyadic coping and health behavior were positively correlated during the T1 - T3 stage, and the correlation was significant ($p < 0.05$), as shown in Table 3 and Figure 4.

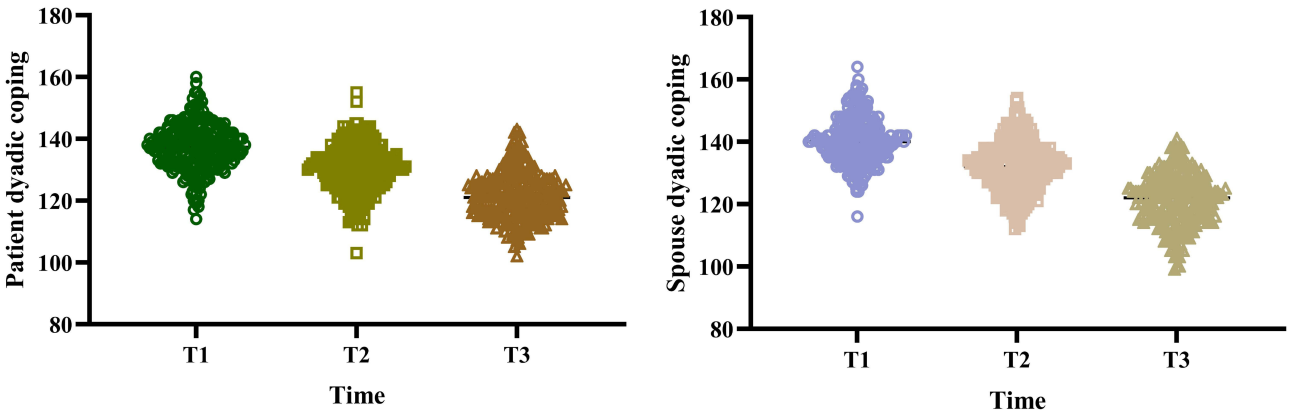

Figure 2 Distribution of dyadic coping scores in patients with gestational hypertension and their spouses.

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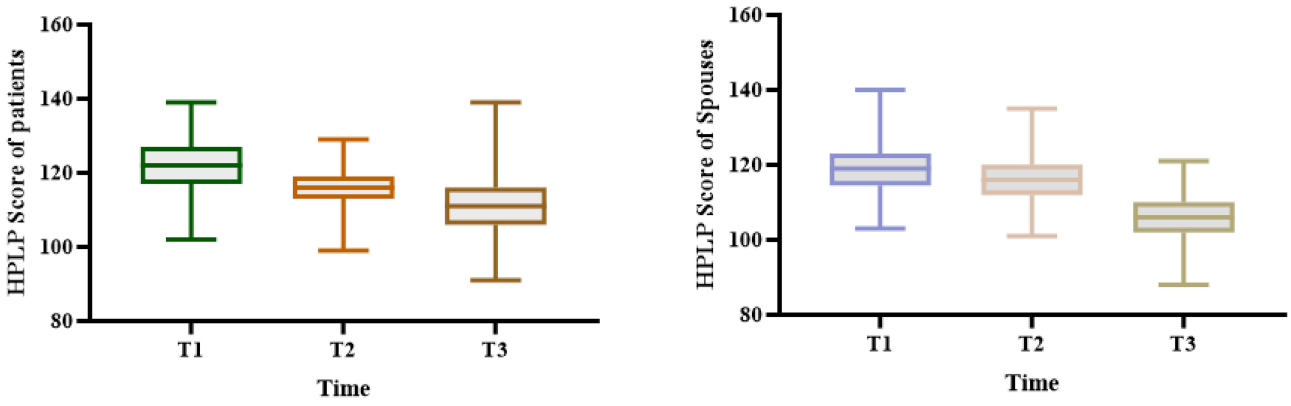

Figure 3 Distribution of Health Behavior Scores in patients with gestational hypertension and their spouses.

Equivalence Test Measurement

The study employed the Weighted Least Squares Mean and Variance Adjusted (WLSMV) estimator for parameter estimation. Scalar invariance was assessed by examining the equality of intercepts. Measurement invariance was tested across the time dimension.

The models of configural invariance, metric invariance, and scalar invariance of dyadic coping and health behavior between patients and their spouses were constructed respectively. The goodness - of - fit of the resulting models is presented in Table 4. The results indicated that the dyadic coping and health behavior of patients and their spouses met the configural invariance, metric invariance, and scalar invariance ($\Delta CFI \leq 0.01$) over time, which met the prerequisite for cross - lag analysis.

Cross - Lag Analysis of the Actor - Partner Interdependence Model of Dyadic Coping and Health Behavior Between Patients with Gestational Hypertension and Their Spouses

A cross - lag actor - partner interdependence model of dyadic coping and health behavior between patients and their spouses (model M1) was constructed. In this model, the same observed variables at three measurement points were allowed to be correlated with the latent variable error at the same time point.

Then, the model was restricted (model M2). That is, the autoregressive effect/actor effect and partner effect of patients and their spouses on the same variable were restricted to be equal, and the actor effect and the partner effect were equal across different variables.

The results of model fitting are presented in Table 5. Compared to M1, although the $\Delta\chi^2$ (Δdf) was statistically significant, we prioritized $\Delta CFI \leq 0.01$ as the criterion for model equivalence. This is because $\Delta\chi^2$ is highly sensitive to sample size and tends to reject the null hypothesis in large samples, whereas ΔCFI provides a more robust model

Table 2 Scores of Dyadic Coping and Health Behaviors of Patients with Gestational Hypertension and Their Spouses (n=245, Score, $\bar{x} \pm s$)

Items	PIC	SIC	PHB	SHB
Pregnancy at 20 to 21^{+6} weeks	136.80±7.23	140.26±7.37	121.96±6.74	118.74±6.56
28 weeks gestation	129.65±8.32	132.09±7.95	115.59±5.13	116.12±6.50
36 weeks gestation	121.99±7.34	121.41±7.19	110.81±7.10	106.02±6.13
F	249.334	317.125	192.890	248.110
p	< 0.001	< 0.001	< 0.001	< 0.001

Abbreviations: PIC, Patient dyadic coping; SIC, Spouse dyadic coping; PHB, Patient health behaviors; SHB, Spousal health behaviors.

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Table 3 Dyadic Coping and Health Behavior Scores of Patients with Gestational Hypertension and Their Spouses and Correlation Analysis (*r* Value, n=245)

Items	PIC_T1	PIC_T1	PIC_T1	PIC_T1	PIC_T1	PIC_T1	PIC_T1	PIC_T1	PIC_T1	PIC_T1	PIC_T1	PIC_T1
PIC_T1	1											
PIC_T2	0.401**	1										
PIC_T3	0.422**	0.417**	1									
SIC_T1	0.238**	0.252**	0.215*	1								
SIC_T2	0.241**	0.227**	0.268**	0.427**	1							
SIC_T3	0.201**	0.202**	0.230**	0.396**	0.320**	1						
PHB_T1	0.352**	0.321**	0.273*	0.346*	0.313*	0.218*	1					
PHB_T2	0.337**	0.382**	0.337**	0.310**	0.284**	0.293**	0.462**	1				
PHB_T3	0.260**	0.321**	0.359**	0.250**	0.261**	0.350**	0.417**	0.420**	1			
SHB_T1	0.276**	0.216**	0.211*	0.314*	0.301**	0.215*	0.492**	0.392**	0.291*	1		
SHB_T2	0.228**	0.243**	0.212**	0.297**	0.322**	0.287*	0.363**	0.375**	0.384*	0.455**	1	
SHB_T3	0.237**	0.204**	0.247**	0.223**	0.236**	0.306**	0.325**	0.298**	0.453**	0.499**	0.498**	1

Note: *P < 0.05; **P < 0.01.

Abbreviations: PIC, Patient dyadic coping; SIC, Spouse dyadic coping; PHB, Patient health behaviors; SHB, Spousal health behaviors.

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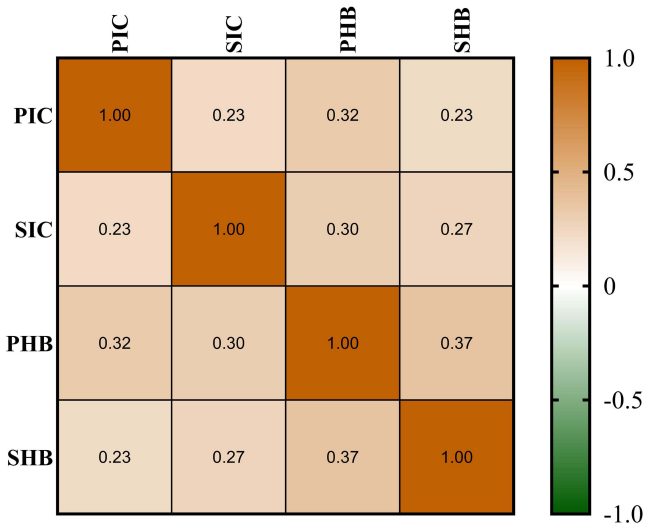

Figure 4 Correlation analysis of health behavior scores between patients with gestational hypertension and their spouses.
Abbreviations: PIC, Patient dyadic coping; SIC, Spouse dyadic coping; PHB, Patient health behaviors; SHB, Spousal health behaviors.

comparison index, offering a better balance between model fit and parsimony. Thus, despite a significant $\Delta\chi^2$, the observation that $\Delta CFI \leq 0.01$ indicates that the difference between models is not practically meaningful. Following the principle of parsimony, selecting M2 as the final model is justified.

Table 4 Equivalence Model Fitting Results of Three Measurements of Dyadic Coping Between Patients and Their Spouses

		χ^2	*df*	*p*	CFI	ΔCFI	TLI	RMSEA	SRMR
PIC	Configural invariance	216.327	72	< 0.001	0.989	–	0.983	0.038	0.023
	Metric invariance	228.533	80	< 0.001	0.988	0.000	0.985	0.036	0.025
	Scalar invariance	296.341	88	< 0.001	0.982	0.004	0.976	0.041	0.026
SIC	Configural invariance	222.315	72	< 0.001	0.988	–	0.982	0.038	0.031
	Metric invariance	236.620	80	< 0.001	0.988	0.000	0.984	0.037	0.032
	Scalar invariance	312.774	88	< 0.001	0.982	0.003	0.981	0.038	0.034
PHB	Configural invariance	436.584	106	< 0.001	0.974	–	0.963	0.049	0.036
	Metric invariance	444.830	114	< 0.001	0.974	0.000	0.966	0.047	0.039
	Scalar invariance	495.471	122	< 0.001	0.970	0.003	0.965	0.048	0.039
SHB	Configural invariance	526.535	106	< 0.001	0.972	–	0.956	0.055	0.054
	Metric invariance	537.187	114	< 0.001	0.970	0.002	0.960	0.053	0.055
	Scalar invariance	598.016	122	< 0.001	0.966	0.004	0.958	0.054	0.055

Abbreviations: χ^2, chi square; df, degrees of freedom; CFI, comparative fit index; ΔCFI, variation comparative fit index; TLI, non-benchmarking fit index; PIC, Patient dyadic coping; SIC, Spouse dyadic coping; PHB, Patient health behaviors; SHB, Spousal health behaviors; RMSEA, root mean square of progressive residual; SRMR, standardized root mean square residual.

Table 5 The Fitting Results of the Actor-Partner Interdependence Model of Dyadic Coping and Health Behavior for Patients with Gestational Hypertension and Their Spouses

Model	χ^2	*df*	*p*	CFI	ΔCFI	TLI	RMSEA	SRMR
M1: Saturation model of dyadic coping and health behaviors in women with gestational hypertension and their spouses	2482.333	780	< 0.001	0.944	–	0.938	0.041	0.075
M2: Bounded model	2594.156	806	< 0.001	0.941	0.001	0.940	0.039	0.076

Abbreviations: χ^2, chi square; CFI, comparative fit index; df, degrees of freedom; ΔCFI, variation comparative fit index; TLI, non-benchmarking fit index; RMSEA, root mean square of progressive residual; SRMR, standardized root mean square residual.

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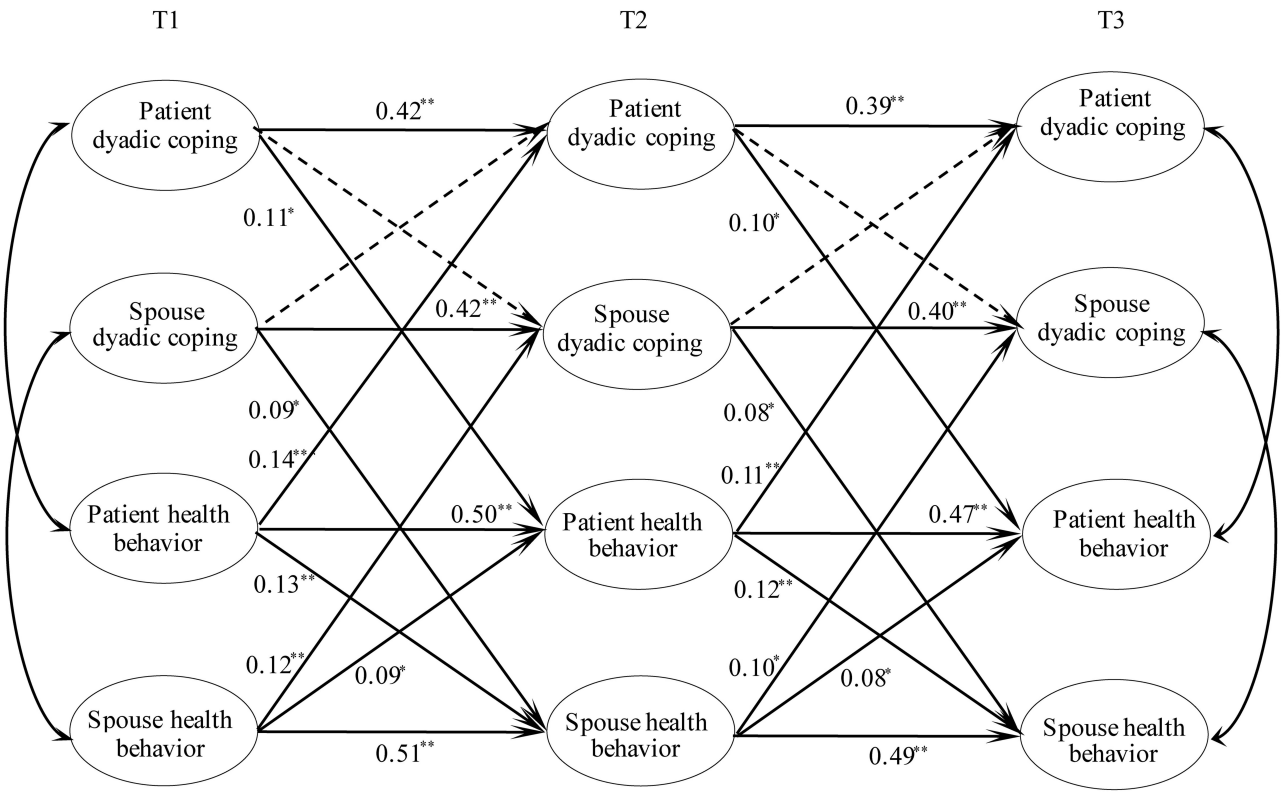

Figure 5 Actor-partner interdependence model diagram of cross-lagged dyadic coping and health behaviors of patients with gestational hypertension and their spouses. *P<0.01, **P<0.001; Solid lines indicate statistically significant paths, whereas dashed lines represent non-significant paths.

Path Analysis of Cross - Lagged Actor - Partner Interdependence Model (CL - APIM) for Dyadic Coping and Health Behavior of Patients with Gestational Hypertension and Their Spouses

The standardized coefficients of the bounded model M2 are presented in Figure 5. As depicted in Figure 5, the three longitudinal measurements of dyadic coping and health behavior among patients with gestational hypertension and their spouses exhibited strong stability. The autoregressive coefficients (β) ranged from 0.39 to 0.51, and all p <- values were less than 0.001.

The actor effect of dyadic coping between patients with gestational hypertension and their spouses on health behavior is significant. Specifically, the patient's dyadic coping can be positively and prospectively associated with the patient's health behavior in the subsequent stage (T1→T2: β = 0.11, T2→T3: β = 0.10, both p < 0.01). Similarly, the spouses' dyadic coping can be positively and prospectively associated with the spouses' health behavior in the next stage (T1→T2: β = 0.09, T2→T3: β = 0.08, both p < 0.01).

The actor effect of patient and spouse health behavior on dyadic coping was significant. That is, the patient's health behavior could be positively and prospectively associated with the patient's dyadic coping in the next stage (T1→T2: β = 0.14, T2→T3: β = 0.11, all p < 0.001), and the spouse's health behavior could be positively and prospectively associated with the spouse's dyadic coping in the next stage (T1→T2: β = 0.09, T2→T3: β = 0.08, all p < 0.01).

The partner effect of health behavior was also significant. Specifically, the patient's health behavior could be positively and prospectively associated with the spouse's health behavior in the next stage (T1→T2: β = 0.13, T2→T3: β = 0.12, all p < 0.001), and the spouse's health behavior could also be positively and prospectively associated with the patient's health behavior in the next stage (T1→T2: β = 0.10, p < 0.001; T2→T3: β = 0.09, β = 0.07, all p < 0.01). (Table 6)

Table 6 Path Analysis of the Cross-Lagged Actor-Partner Interdependence Model for Dyadic Coping and Health Behaviors in Pregnant Women with Hypertensive Disorders and Their Spouses

Actor-Partner Interdependence	Path	*β* (T1→T2)	*p*	95% *CI*	*β* (T2→T3)	95% *CI*	*p*
Actor Interdependence	PIC → PHB	0.11	0.003	[0.08,0.14]	0.10	[0.06,0.15]	0.003
	SIC → SHB	0.09	0.007	[0.05,0.12]	0.08	[0.05,0.17]	0.005
	PHB → PIC	0.14	<0.001	[0.12,0.33]	0.11	[0.05,0.26]	<0.001
	SHB → SIC	0.12	<0.001	[0.07,0.22]	0.10	[0.06,0.30]	0.004
Partner Interdependence	PHB→ SHB	0.13	<0.001	[0.06,0.23]	0.12	[0.05,0.21]	<0.001
	SHB → PHB	0.09	0.008	[0.04,0.27]	0.08	[0.04,0.19]	0.008
	PIC → SIC	0.03	0.094	[−0.04,0.10]	0.03	[−0.02,0.08]	0.110
	SIC → PIC	0.04	0.078	[−0.03,0.11]	0.03	[−0.04,0.13]	0.085

Note: A→B translates to from A to B.
Abbreviations: PIC, Patient dyadic coping; SIC, Spouse dyadic coping; PHB, Patient health behaviors; SHB, Spousal health behaviors.

Discussion

The present study found that both patients with gestational hypertension and their spouses exhibited a declining trend in dyadic coping and health behavior scores throughout the course of pregnancy. This phenomenon can be interpreted from multiple dimensions, including physiological, psychological, social, and systemic support factors. Firstly, on the physiological level, as gestational age advances, pregnant women often experience progressively intensifying physical discomforts, such as hypertension-related symptoms, peripheral edema, increased fetal movement, and reduced sleep quality. These manifestations can substantially deplete the body's energy reserves, impairing the ability to engage in consistent health behavior management—such as regular blood pressure monitoring and adherence to a low-salt diet—while also diminishing the frequency and quality of active participation in disease-related communication.[19]

Secondly, at the psychological level, common experiences in late pregnancy, including anxiety, fear of childbirth, and persistent concerns about fetal well-being, can occupy the limited cognitive resources of both patients and their spouses. This may lead to emotional exhaustion when managing the disease, making them more inclined to reduce open discussions and shared decision-making regarding illness management, thereby compromising the effectiveness and sustainability of dyadic coping.[20]

Thirdly, from a cognitive-behavioral perspective, some patients and their spouses possess insufficient awareness of the long-term risks associated with gestational hypertension. When symptoms temporarily alleviate, they may develop a false sense of security, assuming the condition is under control. This cognitive bias can result in decreased adherence to essential interventions, such as continuous monitoring, standardized medication use, and lifestyle modifications, and is particularly pronounced in the later stages of pregnancy.

In addition, social and systemic support factors play a critical role. Without access to systematic disease education or professional guidance from healthcare providers, couples may struggle to adapt flexibly to the evolving health demands of pregnancy, leading to rigid coping strategies and diminished supportive behaviors. Moreover, spouses' own health behaviors may be adversely affected by work and family pressures, causing a shift of attention away from disease management toward routine domestic responsibilities, which further contributes to the overall decline in scores.

The interplay of these multifaceted factors collectively accounts for the progressive deterioration of dyadic coping and health behaviors in late pregnancy. These findings highlight the necessity of designing and implementing targeted reinforcement of support and intervention measures during this critical period to safeguard maternal-fetal safety and optimize pregnancy outcomes.

The results of this study reveal a bidirectional relationship between dyadic coping and the health behaviors of patients with gestational hypertension and their spouses. The dyadic coping between patients with gestational hypertension and their spouses can be significantly and positively prospectively associated with their own health behaviors in the next stage. This is mainly because communication enhances disease cognition and self - efficacy.

From the perspectives of Social Cognitive Theory and Self - Efficacy Theory, the positive association between the effect of dyadic coping on health behaviors can be explained through the mechanisms of knowledge sharing and efficacy

enhancement.[21] When couples engage in sufficient discussion regarding symptom management, medication adherence, and related issues, it not only deepens their shared understanding of the illness but also fosters a mutual monitoring dynamic, thereby translating health beliefs into concrete actions.[22]

However, time - lagged effects indicate a declining trend in this influence. Beyond the micro - system interactions between couples, meso - system factors (eg., family support networks), exo - system factors (eg., accessibility of healthcare resources), and macro - system factors (eg., cultural values, health policies) collectively constitute a multi - layered environment that influences health behaviors. Over time, the intervention of these external factors may dilute the direct effect of communication.[23]

When patients and their spouses fully communicate about the symptom management, medication compliance, and lifestyle adjustment of gestational hypertension, they can not only enhance their shared understanding of disease knowledge but also develop a tacit understanding of mutual supervision.[24] This communication helps the couple clarify the treatment goals, such as discussing how to follow a low - salt diet and arrange work and rest properly, thus making the specific implementation path of healthy behaviors clearer.

In addition, positive dyadic coping, especially when the spouse shows caring and supportive behavior, can significantly enhance patients' self - efficacy, that is, their belief in their ability to control the disease through their actions.[25] Health beliefs directly translate into internal motivation to adhere to health behaviors such as measuring blood pressure, taking medicine as prescribed, and maintaining emotional stability.

Furthermore, the health behaviors of pregnant women with hypertension and their spouses are significantly and positively prospectively associated with their own dyadic coping in the subsequent stage, aligning with the behavior - cognition cycle theory. Successful health behaviors, such as effective blood pressure control, provide positive feedback material for communication. Meanwhile, the positive emotional states resulting from these health behaviors also create a favorable psychological environment for constructive communication. This is primarily because behavioral practice generates positive feedback and enhances communication confidence.[26,27]

When patients or their spouses experience the actual effect of disease improvement through healthy behavior management, such as successfully controlling blood pressure or improving diet, they are more willing to share this positive experience. Successful experiences not only enhance the confidence of patients and spouses in managing the disease but also become positive topics of communication between spouses, thereby stimulating more open and in - depth dyadic coping.

Adhering to healthy behaviors, such as regular exercise and emotion management, also helps improve the psychological state and reduce anxiety and depression. This creates a good psychological foundation for constructive disease - related communication.[28] When both parties are in a more positive emotional state, they are more capable of communicating with respect and understanding and sharing their feelings and concerns. This can further consolidate and enhance the enthusiasm and effectiveness of communication.

The results of this study indicate that the partner effect of health behavior is significant. That is, the health behaviors of patients and their spouses are prospectively associated with each other's health behaviors in the next stage. According to the family system theory, family members can dynamically influence each other, which may lead to a lag in the partner effect due to behavioral demonstration, social support, and environmental shaping in the shared life of patients and their spouses.[29] The healthy behavior of one partner can serve as a model for the other partner to imitate through observational learning. Meanwhile, social support such as encouragement and reminders can enhance the self - efficacy of the other partner and assist them in overcoming the obstacles of behavior change.[30] In addition, the shared living environment of couples, such as diet structure and activity arrangements, will continuously affect the behavioral choices of both partners. The improvement of one partner's health behavior can directly optimize this shared environment. Since behavioral change needs to go through multiple stages, from cognition to preparation, action, and maintenance, there is a natural time lag in the effect of this mutual influence.

This study employed a three-wave longitudinal design and utilized the Actor-Partner Interdependence Model (APIM) to systematically test the four proposed hypotheses, confirming significant dynamic interactions between dyadic coping and health behaviors among both women with gestational hypertension and their spouses. Hypothesis H1 was supported, as evidenced by a significant downward trend in scores for both dyadic coping and health behaviors over the course of

pregnancy, indicating that the increasing physiological discomfort and psychological burden in late gestation exert a negative impact on spousal collaborative management and health-promoting practices. Hypotheses H2 and H3 were also confirmed; cross-lagged analyses revealed bidirectional predictive relationships between dyadic coping and health behaviors, supporting their co-dependent, mutually reinforcing nature—active disease-related communication promotes the adoption and maintenance of health behaviors, while effective self-management practices, in turn, enhance dyadic coping capacity. Hypothesis H4, concerning actor and partner effects, was likewise substantiated: actor effects were reflected in the significant positive prediction of an individual's own subsequent outcomes based on their current psychological state or behavior, whereas partner effects demonstrated a notable "ripple effect," whereby one partner's health behaviors significantly predicted the other partner's subsequent health behaviors, affirming the mutual influence mechanism inherent in the marital dyad as an affective and behavioral unit. However, it is noteworthy that the partner effect of dyadic coping on health behaviors did not reach statistical significance, suggesting that in the specific context of gestational hypertension, the direct influence of disease-related communication on a partner's behaviors may be limited, with its effects potentially mediated more through actor pathways or indirect emotional support mechanisms. In conclusion, this study transcends the traditional paradigm of treating pregnant women as isolated analytical units and, for the first time, constructs a longitudinal evidence chain illustrating how interactive dynamics within the marital dyad influence health behaviors, thereby providing a robust theoretical foundation for developing dyadic interventions aimed at optimizing pregnancy outcomes.

Limitations

This study has several limitations. The single-center convenience sampling may overrepresent patients with more severe conditions, better healthcare access, or higher adherence, limiting the generalizability of findings to primary care, rural, or lower health-literacy populations, and excluding those in less stable relationships. This restricted diversity could bias estimates of actor and partner effects, such as overestimating communication benefits or interaction intensity.

Relying solely on patient-reported outcomes introduces risks of social desirability and common method biases, potentially affecting the accuracy of variable relationship estimates. The use of traditional Pearson correlations and repeated measures comparisons, without adjusting for the non-independent dyadic and longitudinal data structure, may inflate statistical accuracy and lead to p-value misinterpretation.

The statistical models did not adjust for key confounders like mental health, social support, or economic stress, whose omission may confound the estimated individual and partner effects. Attrition during follow-up could introduce selection bias, affecting longitudinal interpretability. Furthermore, the traditional Cross-Lagged Panel Model (CLPM) does not separate between-person from within-person effects, so reported cross-lagged associations should be viewed as exploratory of dynamic interplay rather than strict causal inferences.

These limitations necessitate caution in generalizing findings to broader hypertensive pregnancy populations. Future research should adopt multi-center random sampling, include objective measures and key covariates, and use advanced methods like the RI-CLPM to better distinguish within-person fluctuations from between-person stability.

Conclusions

There is a positive prospective association between dyadic coping and health behavior in patients with gestational hypertension and their spouses. The actor effect is significant. The dyadic coping of patients and their spouses is prospectively associated with the health behavior in the next stage, and the health behavior of patients and their spouses can be positively and prospectively associated with the dyadic coping in the next stage.

The partner effect has partial significance, and the health behaviors of patients and their spouses are prospectively associated with each other's health behaviors in the next stage.

This finding suggests that clinical healthcare providers should integrate couple - based participation into routine care protocols. During prenatal visits, it is essential to concurrently assess the communication patterns and health behaviors of both partners. Utilizing platforms such as WeChat groups to regularly disseminate disease management knowledge and organizing scenario - based health education sessions can enhance the couple's shared illness perception.

Furthermore, structured communication techniques should be promoted. This includes guiding couples to conduct a 2 - minute morning planning discussion, a 20 - minute evening stress - sharing session, and a weekly 1 - hour family meeting. Adopting a framework of "expressing appreciation — discussing disagreements — making joint decisions" can help resolve communication barriers.

Simultaneously, encouraging spouses to provide specific positive feedback when the patient adheres to a low - salt diet or monitors blood pressure can reinforce the patient's self - efficacy.

Additionally, a dual - track interactive nursing model can be introduced. In this model, nurses collaborate with the couple during the initial familiarization phase to develop a personalized management plan. During the progression phase, telephone follow - ups are used to monitor implementation, and spouses are guided to undertake collaborative tasks such as medication reminders and accompanying the patient during exercise. This approach leverages the partner effect to foster mutual positive influences on health behaviors.

Ethics and Consent Statements

This study was finally approved by the Ethics Committee of the Second Affiliated Hospital of Chongqing Medical University. Informed consent was obtained from all patients in this study.

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Disclosure

The authors have no conflicts of interest to disclose for this work.

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