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Partner Depression and Risk of Incident Depression Among Middle-Aged and Older Chinese Adults: A Repeated Person-Interval Analysis of CHARLS

Ran Xu
Jiangsu University
Huihui Hou
Second Affiliated Hospital of Naval Medical University
Lina Jiao
Second Affiliated Hospital of Naval Medical University
Junxia Niu
No. 905 Hospital of PLA Navy
Jiali He
Second Affiliated Hospital of Naval Medical University
Weiling Tian
Second Affiliated Hospital of Naval Medical University
Yanfei Zhang
Second Affiliated Hospital of Naval Medical University
Guorui Liu
psyliu@smmu.edu.cn

No. 905 Hospital of PLA Navy

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Abstract

Background

Spousal depressive symptoms are often correlated, but whether partner depression is associated with subsequent incident depression among initially non-depressed spouses remains unclear. We examined this association among middle-aged and older Chinese couples using a repeated incident-risk framework.

Methods

Data were obtained from five waves (2011–2020) of the China Health and Retirement Longitudinal Study. Across four consecutive intervals, individuals with CES-D-10 scores < 10 at interval baseline were considered at risk, and partner depression (CES-D-10 ≥ 10) was examined in relation to incident depression at the subsequent wave. Modified Poisson generalized estimating equations were used to estimate risk ratios (RRs) and 95% confidence intervals (CIs).

Results

The analysis included 23,886 person-interval observations from 11,612 recipients, with 4,969 incident depression events. Partner depression was associated with subsequent incident depression after full adjustment, including the recipient's interval-specific baseline CES-D score (RR = 1.134, 95% CI 1.072–1.200). Baseline CES-D was strongly associated with incident depression (RR per point = 1.168, 95% CI 1.157–1.179), but did not modify the association with partner depression (*P* for interaction = 0.696). Associations appeared stronger for wife-to-husband than husband-to-wife direction, although sex heterogeneity was not statistically significant (*P* for interaction = 0.053). Under stricter temporal ordering, the association was attenuated and no longer statistically significant (RR = 1.092, 95% CI 0.963–1.239).

Conclusions

Partner depression was prospectively associated with a modestly higher risk of incident depression. However, attenuation under stricter temporal ordering cautions against interpreting this association as direct spouse-to-spouse transmission.

1. Introduction

Depression is a major contributor to disability and impaired quality of life, particularly in middle-aged and older adults, who frequently experience age-related changes in physical health, social roles, family responsibilities, and social networks (1, 2). Although the development of depression is shaped by

individual biological, psychological, and social factors, mental health also occurs within an interpersonal context (3). For married adults, spouses share daily environments, socioeconomic circumstances, health behaviors, stressful life events, and sources of social support (4, 5). Consequently, the mental health of one spouse may be closely related to that of the other.

Accumulating evidence supports substantial concordance in depressive symptoms within couples (6). Several mechanisms may contribute to this association. Spouses are exposed to shared socioeconomic and environmental conditions and may become increasingly similar in health behaviors and psychosocial characteristics over the course of marriage (7). Depression in one spouse may also alter emotional communication, reduce perceived support, increase interpersonal strain, and place additional household or caregiving demands on the other spouse (8). These mechanisms have led to growing interest in depressive symptoms as a dyadic rather than exclusively individual phenomenon (9). However, observed concordance between spouses does not necessarily indicate direct transmission of depression from one partner to the other.

Longitudinal evidence has increasingly demonstrated associations between the health and depressive symptoms of one spouse and subsequent depressive symptoms in the other. Using data from the China Health and Retirement Longitudinal Study (CHARLS), He et al. found that several dimensions of spousal health, including depressive symptoms, were associated with the onset of depressive symptoms in the partner over a four-year follow-up (6). More recently, a longitudinal dyadic study using five waves of CHARLS, together with data from the United States and England, demonstrated substantial within-couple concordance in depressive symptoms (10). Importantly, however, recent evidence suggests that these prospective associations may partly reflect stable similarities between spouses. In a cross-cultural longitudinal study, associations observed in conventional actor–partner models were substantially attenuated after stable between-couple differences were separated from within-person changes; in the CHARLS sample, prospective cross-spouse associations were no longer statistically significant in random-intercept cross-lagged panel models (10). These findings suggest that spousal concordance in depressive symptoms may reflect a combination of shared or stable couple-level characteristics and dynamic longitudinal associations rather than a simple process of depression transmission.

Despite these advances, several important gaps remain. First, previous studies of couples have primarily focused on concordance in depressive symptoms or longitudinal changes in continuous depressive symptom scores, but have not directly addressed a more clinically relevant question: whether depression in one spouse is associated with an increased risk of subsequent depression in the other spouse who is initially below the depression threshold. Second, the recipient's baseline depressive symptom burden has not been adequately considered when examining the prospective association between partner depression and subsequent incident depression. Third, whether this association differs between husbands and wives remains inconclusive.

To address these gaps, we used five waves of data from the China Health and Retirement Longitudinal Study (CHARLS) spanning 2011–2020 and constructed repeated person-interval observations across

four consecutive follow-up intervals. At the beginning of each interval, individuals who were below the predefined depression threshold were included in the population at risk, and their spouse's depression status was examined in relation to incident depression at the subsequent survey wave. Compared with relying on a single baseline assessment, this design allowed the recipient's depressive symptom burden to be updated and accounted for at the beginning of each interval. We aimed to determine whether partner depression was associated with subsequent incident depression after accounting for the recipient's pre-existing depressive symptom burden and other relevant factors, and to further examine whether the association differed between the husband-to-wife and wife-to-husband directions.

2. Methods

2.1 Study population

Data were obtained from the China Health and Retirement Longitudinal Study (CHARLS), a nationally representative longitudinal survey of middle-aged and older adults in China. CHARLS collects comprehensive information on demographic characteristics, socioeconomic status, health conditions, health-related behaviors, and psychological well-being. The present study used data from five survey waves conducted in 2011, 2013, 2015, 2018, and 2020.

Married couples were identified within households by linking individual identifiers, household identifiers, and spouse information. Couple-level longitudinal records were then constructed across four consecutive survey intervals: 2011–2013, 2013–2015, 2015–2018, and 2018–2020. A total of 27,067 couple-interval observations were identified across the four intervals.

Because the present study examined the directional association between depression in one spouse and subsequent incident depression in the other spouse, each couple-interval could potentially contribute two directional observations, with either the husband or the wife serving as the recipient. For each direction, the recipient was required to be free of depression at the beginning of the interval, have depression status available at the subsequent survey, and have information on the partner's depression status at the beginning of the interval. After applying these criteria, 25,870 eligible person-interval observations were included in the longitudinal database, comprising 11,611 wife-recipient observations and 14,259 husband-recipient observations from 12,964 unique recipients and 7,676 households.

For the primary analysis, observations with missing data on covariates included in the fully adjusted model were excluded. The final complete-case analytic sample consisted of 23,886 person-interval observations from 11,612 unique recipients and 7,108 households. The study sample selection process is shown in Figure 1.

2.2 Ethics

The CHARLS study was first approved by the Ethics Committee of Peking University in 2008 (IRB00001052-11,015). All study procedures were conducted in accordance with the Declaration of

Helsinki and relevant ethical standards. All procedures in this study adhered to the applicable CHARLS guidelines and regulations. All participants provided informed consent before voluntarily enrolling in CHARLS.

2.3 Longitudinal person-interval design

A longitudinal person-interval design was used to examine whether depression in one spouse was associated with the development of depression in the other spouse at the subsequent survey wave. Each person-interval observation represented one recipient spouse followed from the beginning to the end of a specific survey interval. Partner depression was assessed at the beginning of each interval, whereas incident depression in the recipient was assessed at the subsequent survey wave. Thus, for the 2011–2013 interval, partner depression status in 2011 was used to predict incident depression in the recipient in 2013. The same approach was applied to the 2013–2015, 2015–2018, and 2018–2020 intervals.

To specifically investigate incident depression, only recipients who were free of depression at the beginning of a given interval were considered at risk and included for that interval. Individuals could contribute observations to multiple intervals if they remained eligible. Therefore, the resulting dataset contained repeated person-interval observations nested within individuals and households.

2.4 Assessment of depression

Depressive symptoms were assessed using the 10-item Center for Epidemiologic Studies Depression Scale (CES-D-10) (11). The scale assesses the frequency of depressive symptoms during the preceding week, with each item scored from 0 to 3 and total scores ranging from 0 to 30, with higher scores indicating greater depressive symptom severity.

A CES-D-10 score of ≥10 was used to define depression. The primary exposure, **partner depression**, was defined as a CES-D-10 score ≥10 in the spouse at the beginning of the corresponding survey interval.

The primary outcome was **incident depression in the recipient spouse**. For each survey interval, recipients with a CES-D-10 score <10 at the beginning of the interval were considered free of depression and therefore at risk for incident depression. Incident depression was defined as a CES-D-10 score ≥10 at the subsequent survey wave.

The recipient's CES-D-10 score at the beginning of each interval was additionally retained as a continuous variable. This allowed adjustment for subthreshold differences in baseline depressive symptom severity among recipients who did not meet the depression criterion at interval entry.

2.5 Covariates

Covariates included age, sex, educational attainment, birthplace, current smoking, current drinking, social participation, baseline CES-D-10 score, and survey interval. Age was treated as a continuous variable, and sex was categorized as female or male. Educational attainment was categorized as primary school or below, middle school, and high school or above. Birthplace was categorized as rural or urban. Current smoking and current drinking were coded as binary variables, and social participation was categorized according to whether the participant participated in social activities. For time-varying covariates, including age, smoking, drinking, social participation, and baseline CES-D-10 score, values measured at the beginning of each corresponding survey interval were used. Survey interval was included as a categorical variable, with 2011–2013 as the reference category.

2.6 Statistical analysis

Descriptive statistics were first used to characterize the analytic sample. Continuous variables are presented as means and standard deviations, whereas categorical variables are presented as frequencies and percentages.

The association between partner depression at the beginning of each interval and subsequent incident depression in the recipient was examined using generalized estimating equations (GEEs). Because the analytic dataset contained repeated person-interval observations and observations from both members of the same couple, household-level clustering was used to account for within-household dependence. A Poisson distribution with a log link and robust standard errors was specified to directly estimate risk ratios (RRs) and 95% confidence intervals (CIs). The primary analyses used an independence working correlation structure.

A series of sequential models was fitted to examine the association between partner depression and incident depression and to assess changes in the estimated association after adjustment for different groups of covariates. **Model 1** adjusted for survey interval. **Model 2** additionally adjusted for age, sex, educational attainment, and birthplace. **Model 2a** further added the recipient's CES-D-10 score at the beginning of the interval to Model 2. **Model 2b** added current smoking, current drinking, and social participation to Model 2 without adjustment for baseline CES-D-10 score. **Model 3**, the fully adjusted model, simultaneously included survey interval, age, sex, educational attainment, birthplace, baseline CES-D-10 score, current smoking, current drinking, and social participation.

The Model 2a and Model 2b specifications were included to distinguish the contribution of the recipient's pre-existing depressive symptom burden from that of lifestyle and social factors to changes in the association between partner depression and subsequent incident depression.

Potential differences in the association according to recipient sex were examined by adding an interaction term between partner depression and recipient sex to the fully adjusted GEE model. Sex-specific estimates were subsequently derived for **husband depression predicting incident depression in wives** and **wife depression predicting incident depression in husbands**. The ratio of the two RRs and the

corresponding interaction *P* value were used to evaluate whether the magnitude of the association differed according to recipient sex.

We additionally examined whether baseline depressive symptom severity modified the association between partner depression and incident depression by including an interaction term between partner depression and the recipient's baseline CES-D-10 score in the fully adjusted model.

Several sensitivity analyses were conducted. First, because birthplace accounted for most of the missing covariate data, the fully adjusted model was repeated without adjustment for birthplace, thereby retaining a larger analytic sample. Second, alternative GEE working correlation and clustering specifications were examined to evaluate the robustness of the findings to assumptions regarding within-cluster correlation. Third, a stricter temporal analysis was conducted in which **incident depression in the partner during the preceding survey interval** was used as the exposure to predict **incident depression in the recipient during the subsequent interval**. In this analysis, covariates were assessed before the exposure whenever available, providing greater temporal separation between partner depression and the recipient's subsequent outcome.

All statistical tests were two-sided, and $P < 0.05$ was considered statistically significant. Analyses were performed using Python.

3. Results

3.1 Characteristics of the study sample

The primary analysis included 23,886 person-interval observations from 11,612 unique recipients in 7,108 households. The mean age of the recipients was 58.08 years (SD = 8.57), and 56.5% were male. More than half of the observations (56.1%) were from participants with primary school education or below, and 89.4% were from participants born in rural areas. The mean baseline CES-D score was 4.30 (SD = 2.78). Current smoking and drinking were reported in 32.5% and 40.5% of observations, respectively, and 58.4% involved recipients who participated in social activities (Table 1).

Partner depression was present in 5,867 (24.6%) person-interval observations. During the subsequent survey wave, 4,969 (20.8%) observations met the criteria for incident depression in the recipient. The four follow-up intervals contributed relatively similar proportions of observations, ranging from 22.6% for 2018–2020 to 27.0% for 2013–2015 (Table 1).

Table 1. Characteristics of the study sample included in the primary analysis

Characteristics	Overall (N = 23,886)
Age, years	58.08 ± 8.57
Sex, n (%)	
Female	10,397 (43.5)
Male	13,489 (56.5)
Educational attainment, n (%)	
Primary school or below	13,401 (56.1)
Middle school	6,634 (27.8)
High school or above	3,851 (16.1)
Birthplace, n (%)	
Rural	21,344 (89.4)
Urban	2,542 (10.6)
Baseline CES-D score	4.30 ± 2.78
Current smoking, n (%)	
No	16,127 (67.5)
Yes	7,759 (32.5)
Current drinking, n (%)	
No	14,203 (59.5)
Yes	9,683 (40.5)
Social participation, n (%)	
No	9,932 (41.6)
Yes	13,954 (58.4)
Partner depression, n (%)	
No	18,019 (75.4)
Yes	5,867 (24.6)
Incident depression, n (%)	
No	18,917 (79.2)
Yes	4,969 (20.8%)

Follow-up interval, n (%)	
2011 – 2013	5,638 (23.6)
2013 – 2015	6,457 (27.0)
2015 – 2018	6,382 (26.7)
2018 – 2020	5,409 (22.6)

Note: Values are presented as mean ± standard deviation (SD) for continuous variables and n (%) for categorical variables. The primary analysis included 23,886 person-interval observations from 11,612 recipients in 7,108 households. Baseline CES-D refers to the recipient's CES-D score measured at the beginning of each survey interval. Educational attainment was categorized as primary school or below, middle school, and high school or above. Birthplace was categorized as rural or urban. Partner depression represents the depression status of the recipient's spouse at the beginning of each survey interval, and incident depression represents newly identified depression in the recipient at the subsequent survey wave. Because participants could contribute observations to more than one survey interval, the number of observations does not represent the number of unique individuals.

3.2 Association between partner depression and incident depression

Partner depression was significantly associated with an increased risk of subsequent incident depression in the recipient (Table 2). In Model 1, adjusted for survey interval, recipients whose partners had depression had a 24.9% higher risk of developing depression at the subsequent wave than those whose partners did not have depression (RR = 1.249, 95% CI: 1.177–1.325; $P < 0.001$). After additional adjustment for age, sex, educational attainment, and birthplace, the association was slightly stronger (Model 2: RR = 1.318, 95% CI: 1.242–1.398; $P < 0.001$).

The magnitude of the association was attenuated after further adjustment for the recipient's baseline CES-D score but remained statistically significant (Model 2a: RR = 1.138, 95% CI: 1.075–1.204; $P < 0.001$). In contrast, additional adjustment for smoking, drinking, and social participation resulted in little change from Model 2 (Model 2b: RR = 1.311, 95% CI: 1.236–1.390; $P < 0.001$).

In the fully adjusted model, which simultaneously accounted for demographic characteristics, baseline CES-D score, lifestyle factors, and social participation, partner depression remained associated with a 13.4% higher risk of subsequent incident depression in the recipient (RR = 1.134, 95% CI: 1.072–1.200; $P < 0.001$). The complete results of the fully adjusted model (Model 3), including estimates for all covariates, are presented in Supplementary Table S1.

Table 2. Association between partner depression and incident depression in the recipient

Model	RR (95% CI)	*P* value
Model 1	1.249 (1.177 – 1.325)	< 0.001
Model 2	1.318 (1.242 – 1.398)	< 0.001
Model 2a: + baseline CES-D	1.138 (1.075 – 1.204)	< 0.001
Model 2b: + lifestyle/social factors	1.311 (1.236 – 1.390)	< 0.001
Model 3: fully adjusted	1.134 (1.072 – 1.200)	< 0.001

Note: RR, risk ratio; CI, confidence interval; CES-D, Center for Epidemiologic Studies Depression Scale.
Model 1 adjusted for survey interval.
Model 2 additionally adjusted for age, sex, education, and birthplace.
Model 2a additionally adjusted for baseline CES-D score based on Model 2.
Model 2b additionally adjusted for smoking, drinking, and social participation based on Model 2.
Model 3 simultaneously adjusted for survey interval, age, sex, education, birthplace, baseline CES-D score, smoking, drinking, and social participation.
All models were estimated using generalized estimating equations with a log link and independent working correlation structure, with clustering at the household level.

3.3 Sex-specific associations

Sex-specific analyses suggested that the association between partner depression and subsequent incident depression differed in magnitude according to the sex of the recipient (Table 3). Among wives, depression in the husband was associated with an estimated 7.3% higher risk of subsequent incident depression, although the association did not reach statistical significance (RR = 1.073, 95% CI: 0.993 – 1.159; *P* = 0.077). Among husbands, depression in the wife was associated with an 18.4% higher risk of subsequent incident depression (RR = 1.184, 95% CI: 1.100 – 1.274; *P* < 0.001).

The ratio of the two RRs was 1.104 (95% CI: 0.999 – 1.220), with a P value for interaction of 0.053. Thus, although the association appeared stronger in the wife-to-husband direction than in the husband-to-wife direction, statistical evidence for a sex difference was borderline and did not meet the conventional threshold for statistical significance.

Table 3. Sex-specific associations of partner depression with subsequent incident depression

Direction of association	RR (95% CI)	*P* value
Husband depression → wife incident depression	1.073 (0.993 – 1.159)	0.077
Wife depression → husband incident depression	1.184 (1.100 – 1.274)	< 0.001
Ratio of RRs (male/female)	1.104 (0.999 – 1.220)	0.053

Note: Estimates were obtained from the fully adjusted GEE model including an interaction term between partner depression and recipient sex. The ratio of RRs represents the relative magnitude of the association in male versus female recipients. *P* for interaction = 0.053.

3.4 Sensitivity analyses

The main findings were generally supported by sensitivity analyses (Supplementary Tables S2 and S3). When birthplace was excluded from the covariate set, allowing a larger sample of 25,790 person-interval observations to be retained, the association between partner depression and subsequent incident depression remained significant and was similar in magnitude to the primary estimate (RR = 1.143, 95% CI: 1.082–1.207; $P < 0.001$).

In the stricter temporal analysis, incident depression in the partner during the preceding interval was used to predict incident depression in the recipient during the subsequent interval. The analytic sample included 8,609 observations. The estimated associations were positive but less precise than those in the primary analysis. Adjustment for demographic characteristics yielded a significant association (RR = 1.142, 95% CI: 1.006–1.297; $P = 0.041$); however, the association was attenuated after adjustment for the recipient's pre-exposure CES-D score (RR = 1.092, 95% CI: 0.963–1.239; $P = 0.172$) and remained nonsignificant in the fully adjusted model (RR = 1.092, 95% CI: 0.963–1.239; $P = 0.170$).

Results also varied according to the GEE working correlation and clustering specifications (Supplementary Table S3). Under the independence working correlation structure, estimates were similar when clustering was specified at the household or recipient level. With an exchangeable structure, the household-clustered estimate was attenuated toward the null (RR = 1.021, 95% CI: 0.965–1.080; $P = 0.475$), whereas the recipient-clustered estimate remained significant (RR = 1.127, 95% CI: 1.070–1.187; $P < 0.001$). The estimated within-cluster working correlations under the exchangeable models were low (approximately 0.07).

3.5 Modification by baseline depressive symptom severity

Finally, we examined whether the association between partner depression and subsequent incident depression varied according to the recipient's baseline depressive symptom severity (Supplementary Table S4). Baseline CES-D score was strongly associated with subsequent incident depression (RR per one-point increase = 1.169, 95% CI: 1.157–1.182; $P < 0.001$). However, there was no evidence of an interaction between partner depression and baseline CES-D score (RR for interaction = 0.996, 95% CI: 0.975–1.017; $P = 0.696$), suggesting that the association between partner depression and subsequent incident depression did not materially differ across baseline CES-D levels.

Discussion

In this longitudinal study of middle-aged and older Chinese couples, we examined whether depression in one spouse was associated with subsequent incident depression in the other spouse using repeated person-interval observations across four consecutive follow-up periods. Several findings are noteworthy. First, partner depression was associated with a higher risk of subsequent incident depression in recipients who were below the depression threshold at the beginning of each interval. This association remained statistically significant after adjustment for demographic, behavioral, and social factors, as

well as the recipient's interval-specific baseline depressive symptom score. Second, adjustment for baseline CES-D substantially attenuated the association, suggesting that the recipient's pre-existing depressive symptom burden accounted for an important proportion of the observed spousal association. Third, the association appeared stronger in the wife-to-husband direction than in the husband-to-wife direction, although the formal sex interaction was borderline. Finally, when a stricter temporal sequence was imposed, in which incident depression in the spouse during a preceding interval was used to predict incident depression in the recipient during the subsequent interval, the fully adjusted association was attenuated and no longer statistically significant.

Our findings are broadly consistent with previous evidence showing concordance in depressive symptoms and other dimensions of mental health within couples (12). Spouses share many aspects of their social and physical environments and may influence each other's health through emotional interactions, health behaviors, caregiving demands, and household responsibilities (13). Previous CHARLS-based research has also shown that poorer health status in one spouse, including depressive symptoms, is associated with the subsequent onset of depressive symptoms in the other partner (6). However, the present study extends this literature by adopting a repeated incident-risk framework. Rather than examining only concurrent symptom concordance or changes in continuous depressive symptom scores, individuals meeting the depression threshold at the beginning of each interval were excluded from the corresponding risk set, and partner depression was related prospectively to whether the initially non-depressed recipient crossed the depression threshold at the subsequent wave. This distinction is clinically relevant because it focuses on the emergence of depression among individuals who have not yet reached the predefined symptom threshold.

An important finding was the substantial attenuation of the association after accounting for the recipient's baseline depressive symptom burden. In the demographic-adjusted model, partner depression was associated with a 31.8% higher risk of subsequent incident depression (RR = 1.318), whereas additional adjustment for baseline CES-D reduced the excess risk to 13.8% (RR = 1.138). The fully adjusted estimate remained similar (RR = 1.134). At the same time, baseline CES-D itself was strongly associated with subsequent depression, with each one-point increase corresponding to an approximately 16.8% higher risk in the fully adjusted model. These findings indicate that being below a conventional depression threshold does not imply equivalent underlying risk. Individuals with greater subthreshold depressive symptom burden were substantially more likely to meet the depression criterion at follow-up. The attenuation of the association after adjustment for baseline CES-D therefore suggests that the recipient's pre-existing symptom burden accounted for an important part of the observed association between partner depression and subsequent incident depression.

We further examined whether baseline depressive symptom burden modified the association between partner depression and subsequent incident depression. Despite its strong association with subsequent depression, baseline CES-D did not significantly modify the association with partner depression (*P* for interaction = 0.696). Thus, higher subthreshold depressive symptoms identified individuals at greater overall risk of subsequent depression, but there was no evidence that these individuals were more

susceptible to the association with partner depression. This distinction is important because the recipient's own depressive symptom burden appears to be an important predictor of subsequent depression, rather than a marker of heightened sensitivity to a spouse's depression.

Several mechanisms may underlie the observed prospective association between partner depression and subsequent incident depression. Spouses share socioeconomic resources, living environments, social contexts, and stressful life experiences over extended periods, which may contribute to concordance in their mental health, as proposed by the shared resource hypothesis (14). At the same time, depression in one spouse may influence the psychological well-being of the other through interpersonal processes, including emotional contagion, reduced emotional support, increased caregiving burden, and changes in marital interactions (15–18). Stable couple-level characteristics, including assortative partnering and mutually shaped lifestyles, may further contribute to spousal concordance (19). These mechanisms are not mutually exclusive, and their relative contributions cannot be disentangled in the present observational study.

Recent dyadic evidence provides important context for this interpretation. A cross-cultural longitudinal study using repeated CHARLS data reported substantial concordance in depressive symptoms between husbands and wives in conventional actor–partner analyses. However, when stable between-couple differences were separated from within-person fluctuations using random-intercept cross-lagged panel models, prospective cross-spouse associations in the Chinese sample were markedly attenuated and were no longer statistically significant (6). These findings suggest that at least part of the observed longitudinal concordance between spouses may reflect stable couple-level similarities rather than short-term spouse-to-spouse transmission (20). Taken together, the available evidence supports a cautious interpretation of our findings: partner depression may identify a broader dyadic context associated with elevated depression risk, while the extent to which this association reflects shared exposures, stable couple characteristics, or dynamic interpersonal influence remains uncertain.

The results of the strict temporal analysis further reinforce the need for caution in interpreting the observed association as a direct temporal effect. In the primary analysis, depression status in the spouse at the beginning of an interval was associated with incident depression in the recipient at the subsequent wave. However, depression status assessed at a survey wave does not identify precisely when symptoms emerged, and the psychological states of both spouses may already have been developing concurrently before measurement. We therefore conducted a more stringent analysis in which incident depression in the spouse during one interval preceded the period in which incident depression was assessed in the recipient. Under this design, the fully adjusted association was weaker and not statistically significant (RR = 1.092, 95% CI 0.963–1.239). This result does not negate the association observed in the primary analysis, because the strict temporal analysis involved a substantially smaller sample and a longer temporal separation between exposure and outcome. Nevertheless, it suggests that the primary association should not be interpreted as demonstrating that depression arising in one spouse directly causes subsequent depression in the other. Nevertheless, the attenuation provides little support for a simple short-term pathway in which newly occurring depression

in one spouse directly leads to subsequent depression in the other. The observed association may instead arise from a combination of shared exposures, stable couple-level characteristics, and interpersonal processes operating over longer periods (8, 19, 21).

We found limited evidence of sex differences in the association between partner depression and subsequent incident depression. In sex-specific estimates, wife depression was associated with subsequent incident depression in husbands (RR = 1.184, 95% CI 1.100–1.274), whereas the estimate for husband depression in relation to subsequent incident depression in wives was smaller and its confidence interval included the null (RR = 1.073, 95% CI 0.993–1.159). However, the formal test for interaction did not reach statistical significance (P for interaction = 0.053), indicating insufficient evidence that the magnitude of the association differed between husbands and wives. The observed directional pattern may nevertheless warrant further investigation. Previous research has suggested that men in later life may rely more heavily on their spouses for emotional support and everyday social interaction, whereas women may have broader sources of social and emotional support outside marriage (22, 23). Differences in caregiving roles, emotional communication, and coping strategies may also contribute to directional patterns in spousal mental health associations. However, given the lack of a statistically significant interaction, these explanations remain speculative, and the present findings should not be interpreted as establishing a sex-specific difference.

From a clinical and public health perspective, our findings suggest that depression assessment in middle-aged and older adults may benefit from considering the couple context. Having a spouse with depression may help identify individuals at increased risk of developing depression even when they do not currently meet the depression threshold. Importantly, however, our results also indicate that the recipient's own subthreshold depressive symptoms are a particularly strong indicator of future risk. Therefore, the practical implication is not simply that spouses of depressed individuals will subsequently become depressed, but rather that the presence of depression within a couple may provide an opportunity to assess the psychological well-being of both partners. Screening the non-depressed spouse for emerging or subthreshold symptoms and relevant household or social stressors may facilitate earlier recognition of individuals at elevated risk.

Several limitations should also be considered. First, depression was defined using CES-D symptoms rather than a clinical diagnostic interview; therefore, incident depression in this study represents newly reaching the predefined depressive symptom threshold rather than a confirmed diagnosis of major depressive disorder. Second, the observational design precludes causal inference. Unmeasured or incompletely measured couple-level characteristics—including relationship quality, shared stressful life events, household financial strain, caregiving burden, personality characteristics, and other common environmental exposures—may contribute to the observed association. Third, although the primary analysis established temporal ordering between partner depression measured at the beginning of an interval and recipient depression assessed at follow-up, the exact onset of depressive symptoms between survey waves was unknown. The attenuation observed in the stricter temporal analysis further emphasizes this limitation. Fourth, complete-case analysis resulted in the exclusion of observations with

missing covariate data, particularly birthplace information. Nevertheless, sensitivity analysis excluding birthplace as a covariate increased the available sample and produced a similar association (RR = 1.143, 95% CI 1.082 − 1.207), suggesting that this source of missingness was unlikely to explain the primary finding. Finally, estimates varied across alternative GEE specifications, particularly when an exchangeable household-level working correlation structure was used. Although the estimated within-cluster correlation was small, this variability indicates that the magnitude of the association is sensitive to assumptions regarding the correlation structure and should therefore be interpreted with appropriate caution.

Conclusion

In this longitudinal study of Chinese middle-aged and older couples, depression in one spouse was associated with an increased risk of subsequent incident depression in an initially non-depressed partner. However, the magnitude of this association was substantially reduced after accounting for the recipient's pre-existing depressive symptom burden, and a stricter temporal analysis did not provide clear evidence of a persistent prospective association. These findings suggest that depression tends to cluster within couples, but such clustering likely reflects a combination of individual vulnerability, shared couple-level characteristics, and potentially dynamic interpersonal processes rather than simple spouse-to-spouse transmission. Assessment of depression risk in middle-aged and older adults may therefore benefit from considering both individual subthreshold symptoms and the broader psychological context of the couple.

Declarations

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Authors' contributions

RX: Writing – original draft, Writing – review & editing. HH: Writing – original draft, Writing – review & editing. LJ: Writing – original draft, Writing – review & editing. JN: Writing – original draft, Writing – review & editing. JH: Writing – original draft. WT: Writing – original draft. YZ: Investigation, Writing – original draft, Writing – review & editing. GL: Investigation, Writing – original draft, Writing – review & editing.

Data Availability Statement

The study uses secondary data which is available on reasonable request through http://charls.pku.edu.cn/.

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Ethics approval and consent to participate

The CHARLS study was first approved by the Ethics Committee of Peking University in 2008 (IRB00001052-11,015). All study procedures were conducted in accordance with the Declaration of Helsinki and relevant ethical standards. All procedures in this study adhered to the applicable CHARLS guidelines and regulations. All participants provided informed consent before voluntarily enrolling in CHARLS.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Figures

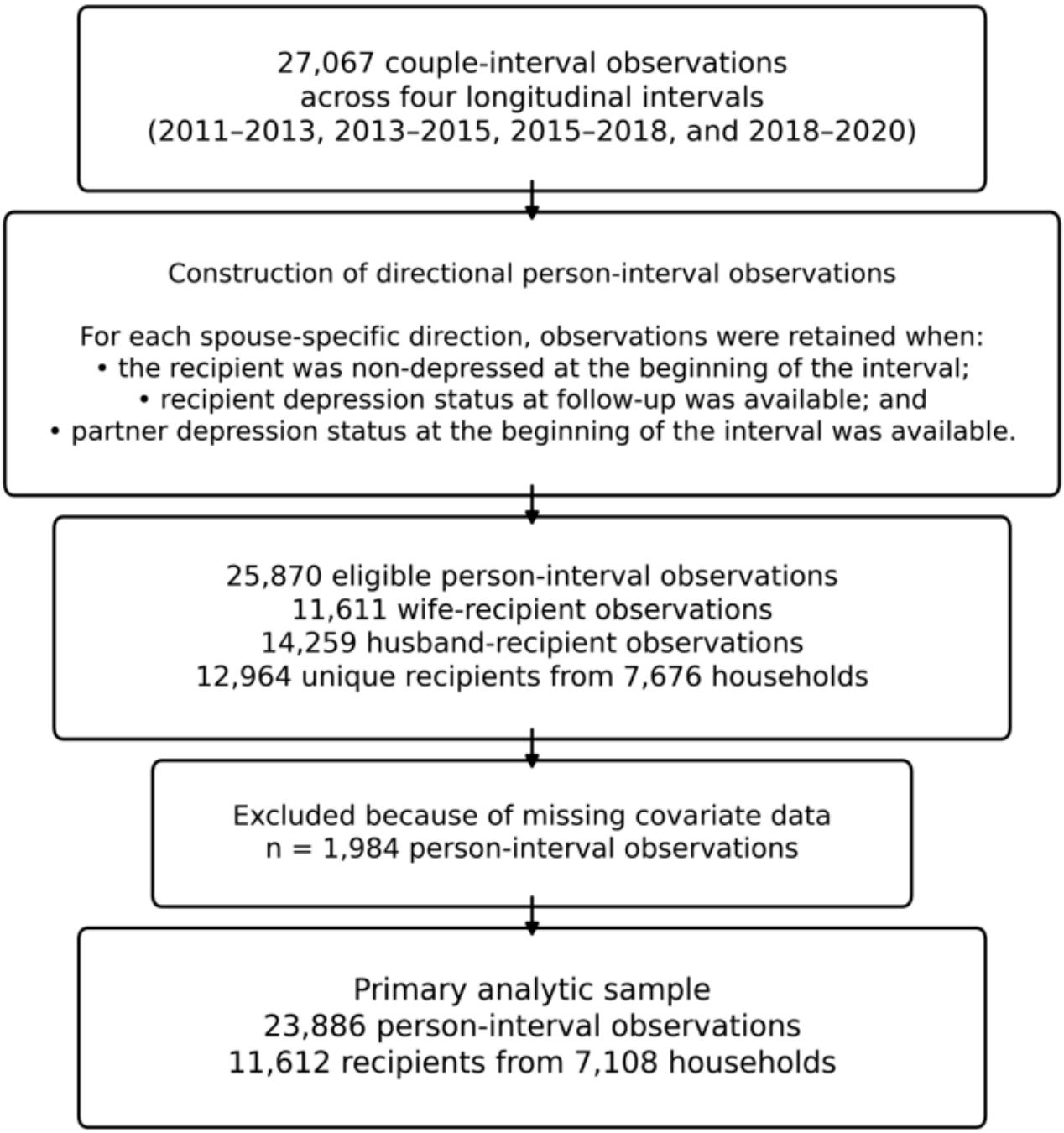


Figure 1

Flowchart of study sample selection and construction of person-interval observations

Note: Each couple-interval could contribute up to two directional person-interval observations, corresponding to husband-to-wife and wife-to-husband associations.

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