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Delayed Healthcare and Follow-up Depressive Symptoms Among Middle-Aged and Older Chinese Adults: A National Cohort Analysis

Xiaowei Mai
The Affiliated Panyu Central Hospital of Guangzhou Medical University
Zhenyu Liang
The Affiliated Guangdong Second Provincial General Hospital of Jinan University
Lin Li
The Affiliated Guangdong Second Provincial General Hospital of Jinan University
Debo Xu
gdmuxdb@163.com

The Affiliated Guangdong Second Provincial General Hospital of Jinan University

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Abstract

Background

Delayed healthcare may be an important marker of access barriers and health vulnerability in later life, but evidence on depressive symptoms in China remains limited. We examined the association between delayed healthcare and depressive symptoms assessed at follow-up among middle-aged and older Chinese adults who were free of depressive symptoms at baseline.

Methods

We conducted a national cohort analysis using 2018 and 2020 China Health and Retirement Longitudinal Study data. Participants had a complete 2018 CES-D-10 assessment, no baseline depressive symptoms (score < 10), and a valid 2020 assessment. Delayed healthcare and depressive symptoms were both assessed in 2020. Modified Poisson regression with community-clustered robust variance estimated prevalence ratios (PRs). Fully adjusted models included baseline sociodemographic characteristics, depressive symptom score, health status, pain, functional limitation, alcohol use, and prior healthcare use. Attrition-weighted, baseline-survey-weighted, complete-case, and three-prior-wave depression-free analyses assessed robustness.

Results

Among 8,412 participants (mean age 59.8 years; 46.2% female), 772 (9.2%) reported delayed healthcare and 1,886 (22.4%) had depressive symptoms in 2020. The crude prevalence difference was 10.4 percentage points (31.9% vs 21.5%). Delayed healthcare was associated with a higher prevalence of depressive symptoms after full adjustment (PR 1.23, 95% CI 1.11–1.37; P < 0.001). The estimate was similar after attrition weighting (PR 1.23, 95% CI 1.11–1.37) and in complete-case analysis (PR 1.23, 95% CI 1.11–1.37); it remained elevated in participants free of depressive symptoms at all three earlier waves (PR 1.27, 95% CI 1.04–1.55).

Conclusions

Delayed healthcare was associated with a higher prevalence of depressive symptoms at follow-up in this national cohort. Timely access to care may be a clinically relevant component of mental-health risk recognition for middle-aged and older adults. Because delayed healthcare and depressive symptoms were measured in the same survey round, the findings are associative and do not establish temporal ordering or causality.

1. Introduction

Depressive symptoms in later life are closely intertwined with physical illness, functional limitation, and the ability to obtain needed care. Healthcare that is delayed or not received when needed can be understood both as an access problem and as a marker of social or clinical vulnerability. In China, unmet healthcare needs are concentrated among middle-aged and older adults with poor health, disability, multimorbidity, and poor psychological well-being [5]. National CHARLS analyses have linked unmet outpatient and inpatient needs to depressive symptoms [6] and to subsequent frailty [8].

The relation with depressive symptoms is clinically plausible but difficult to disentangle. Delay in care may prolong untreated symptoms, pain, uncertainty, and activity restriction; conversely, emerging depressive symptoms may make care-seeking, organisation, or communication more difficult. International studies link unmet healthcare needs with depressive symptoms in later life [7], and longitudinal evidence on perceived unmet needs suggests that such experiences can precede greater depressive symptom burden [9]. Much of the Chinese evidence is nevertheless cross-sectional, and directional interpretation remains difficult.

We therefore assembled a national 2018 cohort without depressive symptoms and examined the association of self-reported delayed healthcare with depressive symptoms assessed in the 2020 follow-up. Covariates and sensitivity analyses were selected a priori to address baseline health need and follow-up selection. Because delayed healthcare and depressive symptoms were ascertained in the same 2020 interview, the study estimates an adjusted association at follow-up rather than an exposure-outcome effect over time.

2. Methods

2.1 Study design and data source

This cohort analysis used data from the China Health and Retirement Longitudinal Study (CHARLS), a nationally representative survey of Chinese residents aged 45 years or older that uses multistage probability sampling and collects detailed health, social, and economic information [1]. The primary design linked the 2018 baseline assessment to the 2020 follow-up. The 2013 and 2015 waves were used only for an a priori strict sensitivity analysis of prior depressive symptom history. Reporting follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement [11].

2.2 Participants

Participants were eligible if they had a complete CES-D-10 score in 2018, were free of depressive symptoms at baseline (score < 10), and had a valid 2020 CES-D-10 assessment. We then required a valid 2020 response concerning delayed healthcare. The primary analytical cohort comprised 8,412 individuals. For a stricter sensitivity analysis, we additionally required absence of depressive symptoms in 2013 and 2015; this cohort contained 3,724 participants before covariate restrictions (Fig. 1).

2.3 Delayed healthcare

The exposure was self-reported delayed medical service in the 2020 interview. Participants were classified as having delayed healthcare when they responded affirmatively; all other valid responses were classified as no delayed healthcare. The measure captures a participant-reported access disruption, without distinguishing its reason, duration, care setting, or clinical indication.

2.4 Depressive symptoms

Depressive symptoms were assessed using the 10-item Center for Epidemiologic Studies Depression Scale (CES-D-10). Item responses were scored from 0 to 3 after reversing the two positive-affect items and summed to a 0–30 total score. A score of 10 or higher defined depressive symptoms, consistent with the original short-scale literature and validation work among Chinese adults aged 45 years or older [2, 3]. The outcome was depressive symptoms in 2020 among participants below this threshold in 2018. This design establishes the absence of depressive symptoms at baseline but does not establish the timing of symptom onset relative to delayed healthcare within the 2020 survey round.

2.5 Covariates

Covariates were measured at the 2018 baseline whenever available and selected a priori as potential confounders or indicators of healthcare need. They included age, sex, educational attainment, marital/partner status, baseline CES-D-10 score, self-rated health, body pain, a six-item functional limitation indicator, alcohol use, and outpatient and inpatient healthcare use in 2018. Age was calculated from year of birth. Functional limitation was defined as difficulty in one or more assessed activities. Missing covariate categories were retained for categorical variables; the few missing age values were replaced with the cohort median for adjustment and accompanied by a missingness indicator in the follow-up model.

2.6 Statistical analysis

We described baseline characteristics by delayed-healthcare status using mean (standard deviation) or number (percentage). We estimated prevalence ratios (PRs) and 95% confidence intervals (CIs) using modified Poisson regression with a log link and community-clustered robust sandwich variance [4]. Model 0 was crude. Model 1 adjusted for age, sex, education, and partner status. Model 2 additionally adjusted for baseline CES-D-10 score, self-rated health, body pain, functional limitation, alcohol use, and 2018 outpatient and inpatient healthcare use. We also report the unadjusted absolute prevalence difference. Two-sided P values < 0.05 were considered statistically significant.

To address potential selection from loss to follow-up, we estimated a stabilized inverse-probability-of-follow-up weight from a logistic model containing the a priori baseline covariates and trimmed weights at the first and 99th percentiles (0.906 and 1.242), following standard inverse-probability-weighting principles for incomplete data [10]. The primary weighted sensitivity analysis applied this attrition weight to the fully adjusted model. Additional analyses combined the available 2018 baseline cross-sectional survey weights with attrition weights, restricted to complete covariates, and restricted to participants free of depressive symptoms in 2013, 2015, and 2018. Analyses were conducted in R. The main analysis

was unweighted because the estimand was an adjusted individual-level association; the baseline survey-weighted analysis was used to assess robustness to the sampling design and observed follow-up selection.

2.7 Ethics and data access

CHARLS obtained written informed consent from participants and received approval from the Biomedical Ethics Review Committee of Peking University (IRB00001052-11015). This study analysed de-identified data obtained under CHARLS data-use conditions and involved no contact with participants.

3. Results

3.1 Cohort and baseline characteristics

Of 15,961 participants with complete 2018 CES-D-10 data, 10,103 were free of depressive symptoms. A total of 8,412 (83.3%) had a valid 2020 depressive symptom assessment and delayed-healthcare response and comprised the primary cohort (Fig. 1). Their mean age was 59.8 years and 46.2% were female. In 2020, 772 participants (9.2%) reported delayed healthcare, and 1,886 (22.4%) met the CES-D-10 threshold for depressive symptoms.

Compared with participants without delayed healthcare, those reporting delay were more often female (57.9% vs 45.0%), had poorer self-rated health (22.3% vs 12.9%), severe body pain (17.7% vs 8.3%), functional limitation (62.6% vs 45.0%), and use of outpatient (23.7% vs 12.6%) or inpatient care (19.6% vs 11.6%) at baseline. Their mean baseline CES-D-10 score was also higher (4.9 vs 4.2; Table 1).

Table 1

Baseline characteristics of the primary cohort by delayed healthcare reported in 2020.

Characteristic	Level	No delay (n = 7,640)	Delayed (n = 772)
Age, years	Mean (SD)	59.9 (9.2)	59.3 (8.4)
Sex	Female	3,439 (45.0%)	447 (57.9%)
	Male	4,201 (55.0%)	325 (42.1%)
Education	High school or above	1,243 (16.3%)	167 (21.6%)
	Middle	2,101 (27.5%)	230 (29.8%)
	Primary	1,839 (24.1%)	173 (22.4%)
	No formal/less than primary	2,457 (32.2%)	202 (26.2%)
Partner status	Partnered	6,940 (90.8%)	695 (90.0%)
	Not partnered	700 (9.2%)	77 (10.0%)
Self-rated health	Good/very good	2,690 (35.2%)	162 (21.0%)
	Fair	3,962 (51.9%)	438 (56.7%)
	Poor/very poor	984 (12.9%)	172 (22.3%)
Body pain	None	3,885 (50.9%)	235 (30.4%)
	Mild/moderate	3,120 (40.8%)	399 (51.7%)
	Severe	632 (8.3%)	137 (17.7%)
Functional limitation	Any limitation	3,438 (45.0%)	483 (62.6%)
	No limitation	4,014 (52.5%)	282 (36.5%)
Alcohol use	Any drinking	3,093 (40.5%)	284 (36.8%)
	No drinking	4,543 (59.5%)	487 (63.1%)
Outpatient care in 2018	Yes	959 (12.6%)	183 (23.7%)
Inpatient care in 2018	Yes	883 (11.6%)	151 (19.6%)
Baseline CES-D-10 score	Mean (SD)	4.2 (2.8)	4.9 (2.8)

Note. *Values are n (%) unless otherwise stated. Percentages may not sum to 100 because of small amounts of missing data, which were retained as analytic categories where applicable.*

3.2 Association between delayed healthcare and depressive symptoms

Depressive symptoms in 2020 were present in 246 of 772 participants with delayed healthcare (31.9%) and 1,640 of 7,640 participants without delayed healthcare (21.5%), an unadjusted absolute difference of 10.4 percentage points. The crude PR was 1.48 (95% CI 1.33–1.66). The estimate increased slightly after demographic adjustment (PR 1.51, 95% CI 1.35–1.68) and attenuated after additional adjustment for baseline depressive symptom burden, health status, pain, functional limitation, alcohol use, and prior healthcare use (PR 1.23, 95% CI 1.11–1.37; P < 0.001; Table 2).

Table 2
Association of delayed healthcare with depressive symptoms in 2020: primary models.

Model	Adjustment	PR (95% CI)	P value	n
Model 0	Crude	1.48 (1.33–1.66)	< 0.001	8,412
Model 1	Demographic-adjusted	1.51 (1.35–1.68)	< 0.001	8,412
Model 2	Fully adjusted	1.23 (1.11–1.37)	< 0.001	8,409
Model 3	Fully adjusted + attrition weights	1.23 (1.11–1.37)	< 0.001	8,409

Note. *Modified Poisson regression with community-clustered robust variance. Demographic-adjusted model includes age, sex, education, and partner status. Fully adjusted model additionally includes baseline CES-D-10 score, self-rated health, body pain, functional limitation, alcohol use, and 2018 outpatient and inpatient healthcare use. PR, prevalence ratio; CI, confidence interval.*

3.3 Sensitivity analyses

The fully adjusted estimate was essentially unchanged after inverse-probability-of-follow-up weighting (PR 1.23, 95% CI 1.11–1.37). When 2018 cross-sectional survey weights were combined with attrition weights, the association remained elevated (PR 1.33, 95% CI 1.10–1.61). Complete-case analysis yielded a similar PR (1.23, 95% CI 1.11–1.37). In the strict cohort without depressive symptoms in 2013, 2015, and 2018, delayed healthcare remained associated with 2020 depressive symptoms (PR 1.27, 95% CI 1.04–1.55; Table 3 and Fig. 2).

Table 3

Sensitivity analyses for the association of delayed healthcare with depressive symptoms in 2020.

Analysis	Specification	PR (95% CI)	P value	n
Attrition-weighted	Fully adjusted + stabilized follow-up weight	1.23 (1.11–1.37)	< 0.001	8,409
Survey and attrition weighted	Fully adjusted + 2018 survey and follow-up weights	1.33 (1.10–1.61)	0.004	7,681
Complete-case	Fully adjusted among participants with complete covariates	1.23 (1.11–1.37)	< 0.001	8,139
Prior-wave depression-free	Fully adjusted; no depressive symptoms in 2013, 2015, and 2018	1.27 (1.04–1.55)	0.017	3,722

Note. *All models use modified Poisson regression with community-clustered robust variance. Follow-up weights were stabilized and trimmed at the first and 99th percentiles. PR, prevalence ratio; CI, confidence interval.*

4. Discussion

4.1 Principal findings

In this national cohort of Chinese adults who were free of depressive symptoms in 2018, delayed healthcare reported at the 2020 follow-up was associated with a 23% higher prevalence of depressive symptoms after extensive adjustment. The association was stable after weighting for follow-up, complete-case restriction, and a stricter requirement of no depressive symptoms in three prior survey waves. Participants reporting delayed healthcare also had a higher baseline burden of poor self-rated health, pain, functional limitation, and prior healthcare use, emphasising the importance of accounting for clinical need when examining this relation.

4.2 Comparison with previous research

Our results extend evidence from China showing that unmet healthcare needs cluster among people with poor health and depressive symptoms [5] and that unmet outpatient or inpatient needs are associated with depression in cross-sectional data [6]. They are also consistent with international work linking unmet healthcare needs with depressive symptoms after accounting for important health and social factors [7] and with prospective evidence that unmet-need perceptions can precede greater depressive symptom burden [9]. The present analysis differs by identifying a baseline depression-free population and by using historic CHARLS waves in a stringent sensitivity analysis. These features reduce, but cannot eliminate, concern that the association reflects longstanding depressive symptom burden or contemporaneous reverse pathways.

4.3 Potential mechanisms

Several pathways may be involved. Delayed care may leave pain, physical symptoms, or functional problems unmanaged and may prolong uncertainty about a health concern. It may also signal financial, logistical, informational, or social barriers that are themselves related to mental well-being. The pronounced attenuation from the crude to the fully adjusted estimate is compatible with a substantial role for baseline health need and vulnerability. At the same time, the remaining association could reflect unmeasured clinical severity, social support, income, local access, or reverse pathways in which emerging depressive symptoms make obtaining care more difficult. The data do not permit separation of these mechanisms.

4.4 Strengths and limitations

Strengths include a large national sample, a baseline depression-free cohort, a validated CES-D-10 threshold for the Chinese middle-aged and older population, adjustment for multiple baseline health-need indicators, community-clustered robust inference, and complementary attrition-weighted and prior-wave sensitivity analyses. The study also has important limitations. First, delayed healthcare and the follow-up CES-D-10 were reported in the same 2020 interview; therefore, their order within that year is unknown and the analysis cannot estimate incident depression or support a causal interpretation. Second, delayed healthcare was a single self-reported measure, without information on reason, duration, urgency, care setting, clinical indication, or whether the service was ultimately received. Third, depressive symptoms indicate screening-level symptom burden rather than a clinical diagnosis. Fourth, key factors such as income, insurance benefits, chronic disease severity, social support, and local service availability were not included in the primary adjustment set; residual confounding is therefore plausible. Finally, attrition weights address observed predictors of follow-up under model assumptions but cannot remove bias from unobserved selection.

4.5 Clinical and policy implications

For clinicians, a report of delayed care in a middle-aged or older patient may be a useful prompt to assess ongoing symptoms, pain, functional difficulty, and psychological distress, and to identify practical barriers to obtaining care. For health systems, preserving timely routes to primary and chronic-disease care may have value beyond physical disease management. Future studies should measure care disruption before repeated assessment of depressive symptoms, incorporate socioeconomic and health-system determinants, and identify specific barriers amenable to intervention.

5. Conclusions

Among Chinese adults free of depressive symptoms at baseline, self-reported delayed healthcare was associated with a higher prevalence of depressive symptoms at the 2020 follow-up. The finding was consistent across several sensitivity analyses, including a stricter history-based cohort. It supports timely healthcare access as a potentially important component of later-life mental-health risk recognition, while the concurrent 2020 exposure and outcome assessment requires cautious, non-causal interpretation.

Declarations

Ethics approval and consent to participate

The original CHARLS study was approved by the Biomedical Ethics Review Committee of Peking University (IRB00001052-11015), and CHARLS obtained written informed consent from all participants. This secondary analysis used de-identified data.All procedures were conducted in accordance with the Declaration of Helsinki and its later amendments.

Consent to participate

Written informed consent was obtained from all participants in the original CHARLS study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

Debo Xu: Conceptualization and funding acquisition. Xiaowei Mai: Formal analysis and writing—original draft. Zhenyu Liang, Qiong Meng, and Lin Li: Data curation, writing—review and editing, and supervision. All authors read and approved the final manuscript.

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Data Availability

The datasets analysed during the current study are available from the China Health and Retirement Longitudinal Study (CHARLS) repository (https://charls.pku.edu.cn/), subject to registration and the

repository's data-access requirements.

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Figures

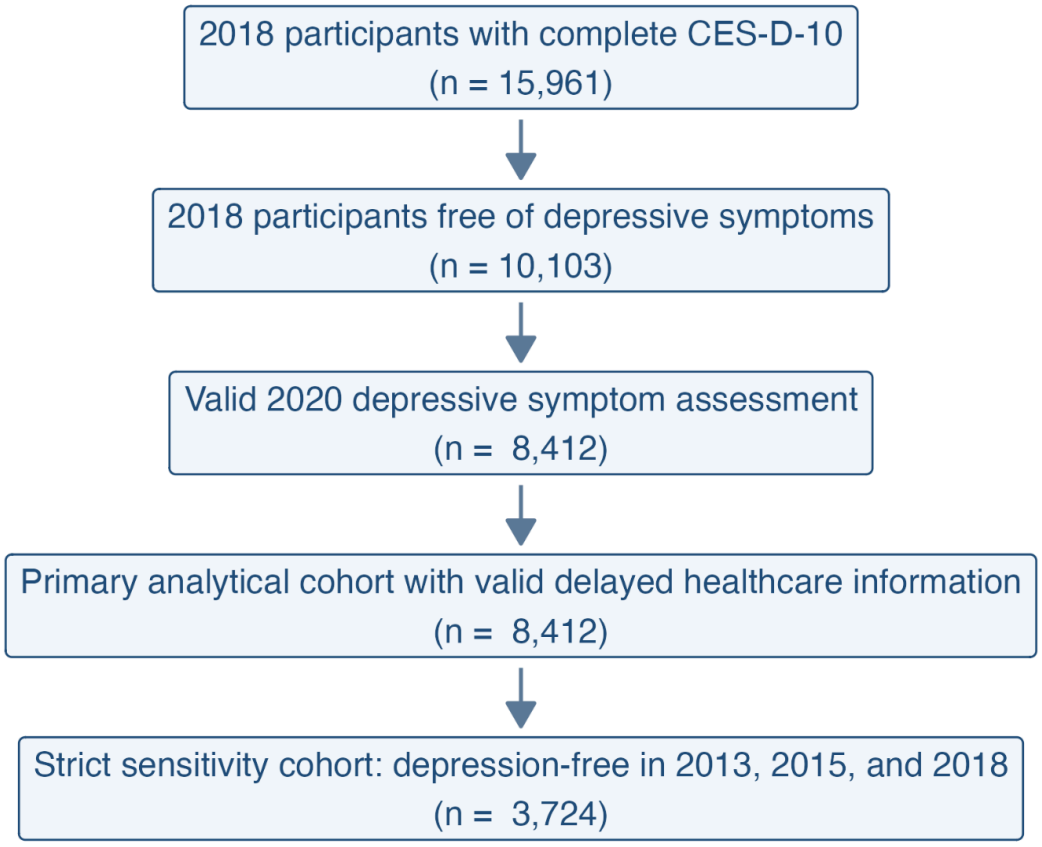


Figure 1

Construction of the primary analytical cohort and strict sensitivity cohort. CES-D-10, 10-item Center for Epidemiologic Studies Depression Scale.

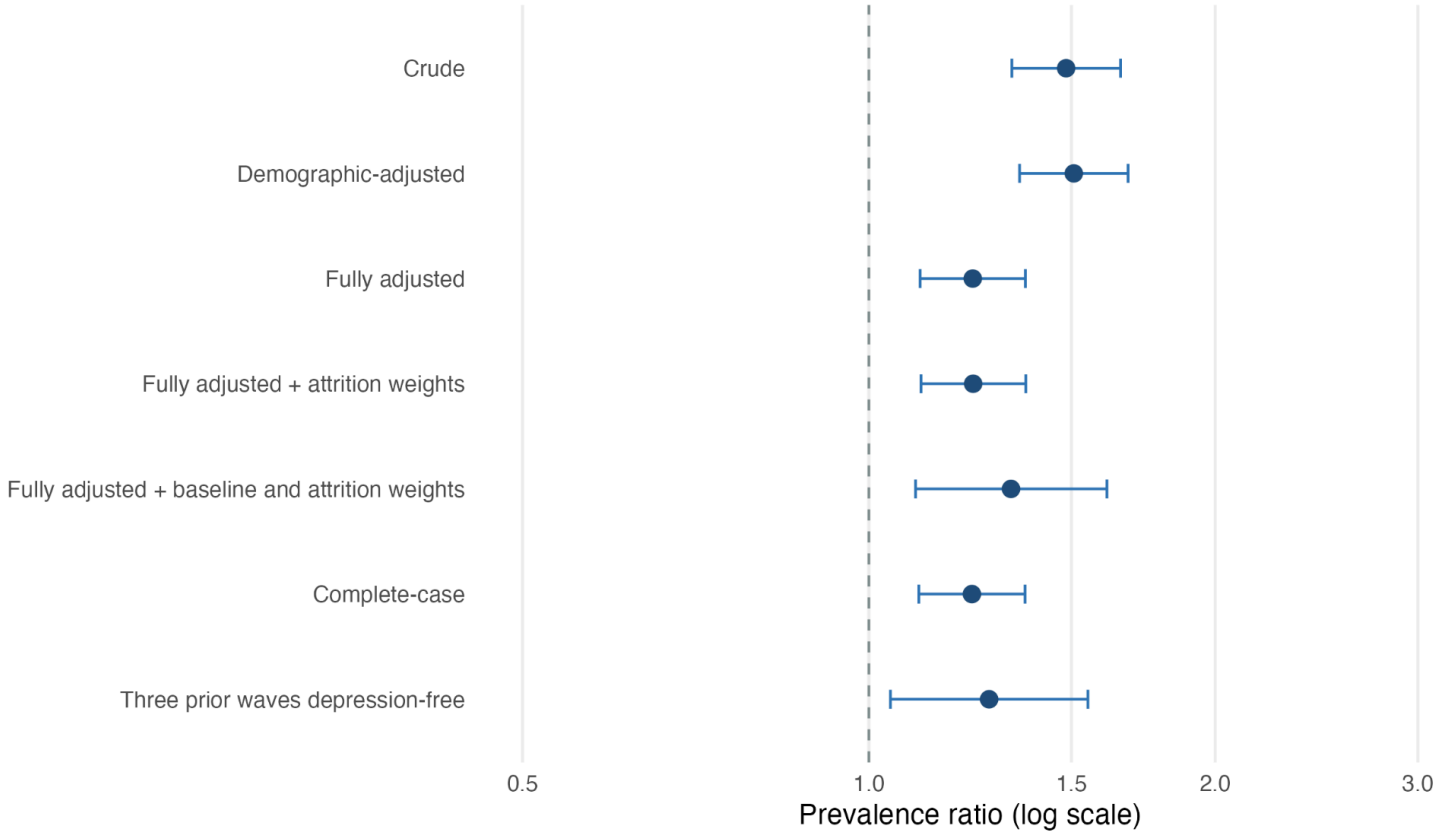


Figure 2

Estimated prevalence ratios for depressive symptoms associated with delayed healthcare across primary and sensitivity analyses. Points are prevalence ratios and horizontal lines are 95% confidence intervals; the vertical dashed line denotes the null value.