

Postnatal Mental Health, Breastfeeding Beliefs, and Breastfeeding Practices in Rural China

Qi Jiang¹; Evelyn Zhang¹; Nourya Cohen¹; Mika Ohtori¹; Sabrina Zhu¹; Yian Guo¹; Hannah Faith Johnstone¹; Sarah-Eve Dill^{1*}; Huan Zhou²; Scott D Rozelle¹

¹ Rural Education Action, Program (REAP), Freeman Spogli Institute for International Studies, Stanford University, Stanford, California, USA

² West China School of Public Health and University, Chengdu, China

* Correspondence:

Sarah-Eve Dill

Freeman Spogli Institute for International Studies, Stanford University

sedill@stanford.edu

Abstract

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2 **Background:** The importance of breastfeeding in low- and middle- income countries is well
3 recognized, yet the importance of postnatal mental health on breastfeeding practices and beliefs
4 in these settings has been understudied. This study investigates the associations between
5 maternal mental health problems and breastfeeding beliefs as well as practices in rural China.

6 **Methods:** Cross-sectional data were collected from 742 mothers of infants under six months old
7 in rural Sichuan Province, China. Surveys collected data on maternal mental health problems
8 (depression, anxiety, and stress symptoms), breastfeeding beliefs (attitudes and self-efficacy),
9 and breastfeeding practices. Ordinary least squares regression, multiple logistic regression and
10 heterogeneous effect analyses were used to determine the associations between maternal mental
11 health and breastfeeding outcomes.

12 **Results:** Among all respondents, 13% showed symptoms of depression, 16% anxiety, and 9%
13 stress. The prevalence of full breastfeeding was 59.3%. Breastfeeding attitude was significantly
14 associated with symptoms of depression ($p=0.023$) and breastfeeding self-efficacy with
15 symptoms of depression ($p=0.001$) and symptoms of stress ($p=0.020$). However, there were no
16 significant associations between symptoms of mental health problems and full breastfeeding. The
17 heterogeneous effects analyses revealed that full breastfeeding was negatively associated with
18 stress symptoms when the infant was from a high-income family ($p=0.011$). In addition, full
19 breastfeeding was negatively associated with the father having a higher education level ($p=0.026$,
20 $p=0.048$, and $p=0.020$) and the infant being older than 2 months old ($p=0.000$, $p=0.000$, $p=0.00$),
21 regardless of maternal mental health problem symptoms.

22 **Conclusion:** Symptoms of maternal mental health problems are significantly associated with
23 breastfeeding attitude and self-efficacy, yet has less of an association with breastfeeding
24 practices. To improve breastfeeding practices, interventions need a multi-dimensional approach
25 that should not only focus on improving maternal mental well-being but also consider
26 demographic background characteristics.

27 **Keywords: breastfeeding, breastfeeding self-efficacy, breastfeeding attitude, mental health,**
28 **depression, anxiety, stress, rural China**

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Introduction

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It is well-established in the international literature that breastfeeding is crucial for the health and development of infants. Extensive research has shown that breastfeeding is associated with a number of positive infant health outcomes such as lower rates of respiratory infections and diarrhea (1–5), reduced risk of sudden infant death syndrome (6–8), and better immune system functioning (9). Breastfed infants have also been shown to have better health outcomes later in life, including improved cognitive performance and lower rates of chronic diseases such as diabetes and cardiovascular disease (8–10). Based on this evidence, the World Health Organization (WHO) recommends exclusive breastfeeding for the first 6 months and continued breastfeeding until the child is 2 years old (11).

Unfortunately, international literature has also shown that postnatal mental health problems among mothers can present a barrier to breastfeeding. Breastfeeding is a practice that involves heavy involvement from the mother, requiring her to be engaged in and willing to participate in the feeding process. For mothers facing mental health problems, these demands can feel burdensome and ultimately discourage her from breastfeeding. Studies have found that depressed mothers are less likely to exclusively breastfeed and more likely to terminate breastfeeding earlier (12–17). Similarly, studies have found that postpartum maternal anxiety is negatively associated with breastfeeding initiation, duration (18), and exclusivity (18,19), although these studies have only been conducted in high-income countries.

Postnatal mental health problems can also worsen breastfeeding beliefs, which have been found to be critical for breastfeeding practices. Existing global literature suggests that maternal depression affects breastfeeding beliefs, such as self-efficacy, which is defined as a mother’s confidence in her ability to breastfeed her newborn, and attitude, which is defined as a mother’s

68 viewpoint and stance on breastfeeding. Maternal depression and anxiety have been found to be
69 associated with lower breastfeeding self-efficacy (20–22). Maternal depression and stress have
70 also been shown to be associated with less favorable attitudes towards breastfeeding (23,24),
71 such as being more skeptical or unsupportive of the practice (25). Having a positive attitude
72 about breastfeeding is important since breastfeeding beliefs have been shown to not only be
73 associated with higher rates of exclusive breastfeeding (25–28), but also other measures of
74 breastfeeding outcomes, such as the duration the infant is breastfed (27–29), and the mother’s
75 satisfaction with breastfeeding (30).

76 Increasing evidence shows that the prevalence of postnatal mental health problems in
77 low- and middle-income countries (LMICs), including China, is particularly high (27). Given the
78 association between mental health and breastfeeding, there is a concern that breastfeeding
79 outcomes in these countries are being severely impacted. Like other LMICs, rural China has
80 been shown to have a high prevalence of maternal mental health issues, as well as poor infant
81 feeding practices. Postnatal depression rates have empirically been shown to range from 20% to
82 25% (28,29), which are high compared to the global rate of 13% (30). This high prevalence of
83 maternal mental health is accompanied by low rates of exclusive breastfeeding, ranging from
84 4.2% to 28.7% (31–33). These rates are low compared to the global rate of exclusive
85 breastfeeding among infants younger than 6 months, which is 37% (34). Yet, there have been no
86 studies on the relationship between postnatal mental health and breastfeeding beliefs and
87 practices in rural China. Considering the high prevalence of maternal mental health issues and
88 poor infant feeding practices, the relationship between maternal mental health and breastfeeding
89 outcomes in rural China needs to be better understood.

90 The goal of this study is to investigate the association between symptoms of postnatal
91 mental health problems, breastfeeding beliefs (self-efficacy and attitudes), and breastfeeding
92 practices in rural China. Specifically, we aim to pursue three objectives. First, we describe the
93 prevalence of symptoms of mental health problems among new mothers in rural China and
94 identify their breastfeeding practices and beliefs. Second, we examine the correlation between
95 symptoms of postnatal mental health problems and breastfeeding beliefs. Finally, we determine
96 the correlation between symptoms of postnatal mental health problems and breastfeeding
97 practices.

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Methods

100 A cross-sectional study was conducted in the rural areas of one prefecture in Sichuan
101 Province. According to the National Bureau of Statistics of China, 48% of Sichuan’s population
102 are rural residents. The average per capita disposable income in the rural areas of Sichuan is
103 13,331 RMB (1906 US dollars), far lower than the national average of 28,228 RMB (4033 US
104 dollars) (35). For these reasons, the study area can be considered relatively representative of rural
105 southwestern China.

Sampling

107 The research team implemented a 3-step sampling protocol to select households for the
108 study. First, from the nine counties within the sample prefecture, the four nationally-designated
109 “poverty counties” (*pinkun xian*) were included, which are counties that have more than 2% of
110 their population living under the national poverty line of 3,000 RMB (458 US dollars) (36).
111 These counties were selected in order to sample the mental health and breastfeeding outcomes of
112 low-income, rural mothers. Second, sample townships were chosen within each sample county.

113 The sampling frame included two exclusion criteria: non-rural townships and rural townships
114 with populations less than 10,000. Of the remaining townships, 20 townships per county were
115 randomly selected, resulting in a total of 80 rural townships.

116 The third step of the protocol selected mothers and households from the sample
117 townships. After obtaining a list of all households with pregnant women beyond their second
118 trimester or with infants under 6 months old from the local county-level Maternal and Child
119 Hospital in each sample county, the research team randomly selected 25 families in each
120 township. If there were not enough eligible households in a township, the team then included
121 eligible households living in villages surrounding the township. In total, 1,296 households were
122 identified as potential candidates for the study. For the purposes of this study, two groups of
123 women were excluded: pregnant women and non-breastfeeding new mothers, since the focus of
124 the study is specifically on the impact of mental health on breastfeeding mothers. This resulted in
125 a final sample of 742 breastfeeding mothers.

126 **Data collection**

127 Data were collected from November to December 2019 by trained survey enumerators.
128 During the training, enumerators were taught how to implement the survey instruments for each
129 of the study's main components. Once the training was completed, enumerators conducted one-
130 on-one survey interviews at each sample household. The survey data collected included:
131 postnatal mental health (symptoms of depression, anxiety, and stress), breastfeeding beliefs
132 (attitudes and self-efficacy), breastfeeding practices, and demographic characteristics.

133 ***Postnatal mental health***

134 To measure the mental health of sample mothers, the research team used the Depression,
135 Anxiety, and Stress Scale-21 (DASS-21). This is a 21-item short-form version of the DASS-42
136 that was originally created by Lovibond and Lovibond (37). The DASS-21 scale has been

137 validated in China (38,39). To complete the DASS-21 scale, enumerators asked mothers to rank
138 each statement (7 for each subsection) from 0 to 3, depending on how much the statement
139 applied to them in the past week. Each individual's DASS-21 score was then calculated by
140 adding up the ranking for every sub-question in a specific section and multiplying the sum by 2.
141 Hence, for each section, the total sum score could range from 0 to 42. Mothers who scored
142 greater than or equal to 9 for depression, 7 for anxiety, and 14 for stress were considered to have
143 symptoms of each respective mental health problem. It is important to note that the resulting
144 score of the DASS-21 scale is not a clinical diagnosis but only a reasonable measurement of the
145 severity of depression, anxiety, and stress symptoms.

146 *Breastfeeding beliefs*

147 Two measures for breastfeeding beliefs were collected: breastfeeding attitudes and
148 breastfeeding self-efficacy. First, to measure maternal attitudes about breastfeeding, enumerators
149 administered the Iowa Infant Feeding Attitude Scale (40), which has been used in Turkey (23),
150 Ethiopia (41), the United Kingdom (42), Russia (42), and the United States (43). It has also been
151 validated in China (44). Breastfeeding mothers were read 18 statements, such as “breastfeeding
152 is more convenient than formula feeding” and asked to use a 5-point Likert scale to express if
153 they agreed or disagreed with the statement (1 being strongly disagree and 5 being strongly
154 agree). Total scores range from 18 to 90. Statements that were representative of worse attitudes
155 were reverse coded so that a higher score correlates to a more positive attitude about
156 breastfeeding.

157 Second, to determine the mother’s self-efficacy surrounding breastfeeding, enumerators
158 administered the short form of the Breastfeeding Self-Efficacy Scale (45). It has previously been
159 used in Kenya (46), Turkey (47), and Malaysia (48), and was validated in Chinese by Ip et al
160 (49). Breastfeeding mothers were asked to rate how confident they were about 16 breastfeeding-

161 related items based on a 5-point Likert scale (1 being not at all confident to 5 being always
162 confident). An example of an item is “I manage to keep up with my infant’s breastfeeding
163 demands”. Total scores range from 16 to 80, where a higher score corresponds to higher levels of
164 self-efficacy.

165 ***Breastfeeding practices***

166 The mother’s breastfeeding practices were determined through a 24-hour dietary recall, in
167 which enumerators asked mothers to list all the foods and liquids they fed their infant in the last
168 24 hours. Based on this data, mothers were then divided into two feeding categories: full
169 breastfeeding and mixed breastfeeding. Full breastfeeding included both exclusive and
170 predominant breastfeeding. As defined by the WHO, exclusive breastfeeding is breastfeeding
171 while giving no other foods or liquids, while predominantly breastfeeding is feeding breastmilk
172 along with other water or water-based liquids (broth or juice) (50). Mixed breastfeeding included
173 infants who were fed breastmilk along with other milk substitutes (formula or animal milk),
174 other liquids, or solids.

175 ***Demographic characteristics***

176 Data on demographic characteristics of each sample family and infant were also collected
177 by enumerators. Family characteristics included mother’s age, mother’s and father’s education
178 levels, and family yearly income. Demographic characteristics of the infant were collected from
179 the birth certificate, and included information such as the infant’s gender, age in months, whether
180 the infant’s birth weight was low, and whether the infant was born prematurely.

181 **Statistical Analysis**

182 The statistical analysis for the study is composed of four parts. First, the research team
183 calculated the overall prevalence of maternal depression, anxiety, and stress symptoms, as well
184 as the overall prevalence of breastfeeding outcomes, which include breastfeeding practice and

185 beliefs. Second, an adjusted ordinary least squares (OLS) regression was used to identify the
186 correlations between mental health and breastfeeding beliefs, while controlling for other
187 potential confounders. The specification of the adjusted model is:

$$188 \quad Belief_i = \beta_0 + \beta_1 Mental_health_i + Control_i + \epsilon_i \quad (1)$$

189 where $Belief_i$ refers to breastfeeding beliefs (breastfeeding attitude or breastfeeding self-
190 efficacy). $Mental_health_i$ is the dummy variable for mental health (depression, anxiety, or
191 stress symptoms), which takes the value of 1 when mother_{*i*} showed symptoms of mental health
192 problems and takes the value of 0 when mother_{*i*} did not. $Control_i$ is a set of control variables,
193 including infant gender and age, whether the infant was born prematurely, whether the infant has
194 low birth weight, maternal age and education level, paternal education level, and family income.

195 Third, a multivariate logistic regression was run to examine the associations between
196 mental health problems and breastfeeding practices. The specification of the regression model is:

$$197 \quad Practice_i = \beta_0 + \beta_1 Mental_health_i + Control_i + \epsilon_i \quad (2)$$

198 where $Practice_i$ takes the value of 1 when mother_{*i*} was fully breastfeeding and takes the value
199 of 0 when mother_{*i*} was mixed breastfeeding. In equation (2), the definitions of the variables,
200 $Mental_health_i$ and $Control_i$ are the same as those in equation (1).

201 Finally, a heterogeneous analysis was conducted to measure the effects of symptoms of
202 maternal mental health problems on breastfeeding practice by five demographic characteristics,
203 including three socio-economic status (SES) characteristics (education levels of each parent and
204 family income), maternal age, and infant age. The specification of the adjusted model is:

$$205 \quad Practice_i = \beta_0 + \beta_1 Mp_low_i + \beta_2 Mp_high_i + \beta_3 Mh_low_i + Control_i + \epsilon_i \quad (3)$$

206 where Mp_low_i , Mp_high_i , and Mh_low_i are three binary variables. Mp_low_i takes the value of
207 1 when mother_{*i*} shows symptoms of mental health problems and is of low SES/low maternal

208 age/low infant age, and 0 otherwise. Mp_high_i takes the value of 1 when $mother_i$ shows
 209 symptoms of mental health problems and is of high SES/high maternal age/high infant age, and 0
 210 otherwise. Mh_low_i takes the value of 1 when $mother_i$ does not have symptoms of mental health
 211 problems and is of low SES/low maternal age/low infant age, and 0 otherwise. $Practice_i$ and
 212 $Control_i$ are the same as those in equation (1).

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Results

215 Table 1 shows the demographic characteristics of the study sample. Of the infants
 216 sampled, 416 (56.1%) were male and the average age was a little over two and a half months (2.7
 217 months). Only 22 sample infants (3.0%) were born prematurely, and 22 (3.0%) had low birth
 218 weight. The average age of the 742 mothers sampled was approximately 27.9 years old.
 219 Additionally, mothers were slightly less educated than fathers, with 297 (40.0% of mothers)
 220 having graduated from high school compared to 341 (46.0% of the fathers) having graduated
 221 from high school.

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Table 1. Descriptive statistics of demographic characteristics (n=742).

	N (%) or Mean (SD)
Infant gender (% male), N (%)	416 (56.1%)
Infant age (months), mean (SD)	2.7 (2.0)
Premature, N (%)	22 (3.0%)
Low birth weight, N (%)	22 (3.0%)
Maternal age (years), mean (SD)	27.9 (4.9)
Mother graduated high school, N (%)	297 (40.0%)
Father graduated high school, N (%)	341 (46.0%)
Family yearly income (ten thousand yuan), mean (SD)	7.4 (6.2)

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224 The prevalence of the symptoms of mental health issues and descriptive data on
 225 breastfeeding practices and beliefs among sample mothers is shown in Table 2. According to the
 226 data, 96 mothers (13.0%) exhibited symptoms of depression, 119 (16.0%) exhibited symptoms of
 227 anxiety, and 67 (9.0%) exhibited symptoms of stress. Just over half of the sample mothers (440)
 228 fully breastfed their infants, which accounts for 59.3% of the sample. For breastfeeding attitude,
 229 mothers scored an average of 61.3, within a range of 18-90. For breastfeeding self-efficacy,
 230 mothers scored an average of 56.1, within a range of 16-80.

Table 2. Descriptive statistics of breastfeeding practices, knowledge, and beliefs (n=742).

	N (%) or Mean (SD)
<i>Panel A. Postnatal mental health</i>	
Symptoms of depression, N (%)	96 (13.0%)
Symptoms of anxiety, N (%)	119 (16.0%)
Symptoms of stress, N (%)	67 (9.0%)
<i>Panel B. Breastfeeding practice</i>	
Exclusive or predominantly breastfeeding, N (%)	440 (59.3%)
Any breastfeeding, N (%)	302 (40.7%)
<i>Panel C. Breastfeeding beliefs</i>	
Breastfeeding attitude score (range: 18-90), mean (SD)	61.3 (4.5)
Breastfeeding self-efficacy score (range: 16-80), mean (SD)	56.1 (8.8)

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232 The OLS regression analysis for the correlations between mental health problems and
 233 breastfeeding beliefs are shown in Table 3. Mothers with symptoms of depression had
 234 significantly lower breastfeeding attitude scores ($p=0.023$). Additionally, mothers with
 235 symptoms of depression and symptoms of stress also had significantly lower breastfeeding self-
 236 efficacy scores ($p=0.001$ and 0.020 , respectively). Symptoms of anxiety were not significantly
 237 correlated with breastfeeding beliefs.

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Table 3. Associations between postnatal mental health problems and breastfeeding beliefs (n=742).

	Breastfeeding attitude		Breastfeeding self-efficacy	
	β (SE)	p-value	β (SE)	p-value
Symptoms of depression	-1.11 (0.49)	0.023	-2.93 (0.89)	0.001
Symptoms of anxiety	-0.47 (0.46)	0.305	-1.58 (0.83)	0.057
Symptoms of stress	-0.71 (0.59)	0.228	-2.49 (1.07)	0.020

Notes: Controlled for demographic characteristics and breastfeeding practices (infant gender, infant age, premature birth status, whether the infant was born with a low birth weight, maternal age, maternal education level, paternal education level, family income, and breastfeeding practice).

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240 Table 4 reports the logit regression analysis of the associations between mental health
 241 problems and breastfeeding practices. None of the mental health problems measured were
 242 significantly associated with the mother’s breastfeeding practices. In order to determine if the
 243 associations between mental health and breastfeeding practices differed among various
 244 subgroups of the sample, a heterogeneous effects analysis was performed. The results are
 245 presented in Table 5, where each panel shows adjusted odds ratio of a mother who practiced full
 246 breastfeeding given a specific demographic variable and whether or not she had symptoms of
 247 depression, anxiety, or stress.

Table 4. Associations between postnatal mental health problems and breastfeeding practices (n=742).

	Adjusted OR (95% CI)	p-value
Symptoms of depression	0.75 (0.47-1.74)	0.206
Symptoms of anxiety	1.23 (0.80-1.90)	0.346
Symptoms of stress	0.60 (0.35-1.03)	0.062

Notes: Mixed breastfeeding used as reference group. Controlled for demographic characteristics (infant gender, infant age, premature birth status, whether the infant was born with a low birth weight, maternal age, maternal education level, paternal education level, and family income).

248 Panel A shows the heterogeneous effects of family income on the association of postnatal
249 mental health and breastfeeding practices. Compared to those without symptoms of stress and
250 with high family income, mothers with stress symptoms and high family income (OR: 0.20, 95%
251 CI: 0.07-0.55) and mothers without stress symptoms and low family income (OR: 0.70, 95% CI:
252 0.50-0.98) were significantly less likely to practice full breastfeeding. In terms of the differences
253 between subgroups, among mothers experiencing symptoms of stress, those with high family
254 income were significantly different than those with low family income ($p=0.011$).

255 Panel B shows the heterogeneous effects of maternal education level, which yielded no
256 significant results in any of the subgroups. Panel C shows the heterogeneous effects of maternal
257 age. Younger mothers with symptoms of anxiety were significantly more likely to fully
258 breastfeed (OR: 1.94, 95% CI: 1.14-3.31) compared to older mothers without symptoms of
259 anxiety. Younger mothers without symptoms of depression (OR: 1.45, 95% CI: 1.03-2.03) or
260 stress (OR: 1.41, 95% CI: 1.01-1.96) were also more likely to fully breastfeed their infants
261 compared to their older counterparts. Panel D shows the heterogeneous effects of paternal
262 education level. Compared to infants who had fathers with higher education levels, infants whose
263 fathers had lower education levels and mothers without symptoms of depression (OR: 1.48, 95%
264 CI: 1.05-2.08), anxiety (OR: 1.42, 95% CI: 1.00-2.00), or stress (OR: 1.49, 95% CI: 1.06-2.09)
265 were significantly more likely to be fully breastfed.

266 Panel E shows the heterogeneous effects of infant age. Mothers with younger infants and
267 symptoms of anxiety were significantly more likely to practice full breastfeeding (OR: 2.68, 95%
268 CI: 1.40-5.13) compared to mothers without anxiety symptoms who had older infants. Mothers
269 with younger infants without symptoms of depression (OR: 1.87, 95% CI: 1.35-2.59), anxiety
270 (OR: 1.60, 95% CI: 1.15-2.22), and stress (OR: 1.81, 95% CI: 1.32-2.49) were also more likely

271 to practice full breastfeeding compared to mothers with older infants. Among mothers with
272 symptoms of anxiety, there is a significant difference between those with younger infants and
273 those with older infants ($p=0.034$).

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Discussion

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The goal of this study was to examine the association between maternal mental health and breastfeeding beliefs and practices. From the sample of 742 mothers, this study found significant correlations between maternal mental health and breastfeeding beliefs. Symptoms of depression were negatively associated with breastfeeding attitude and self-efficacy, and symptoms of stress were negatively associated with self-efficacy. These results align with the international literature that has found that postnatal mental health can have a negative impact on breastfeeding beliefs (20–24).

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However, the overall correlation between maternal mental health and breastfeeding practices was surprisingly not significant, contradicting previous findings in the international literature (12–17). The results did show nuanced correlations between mental health and SES, with stress associated with a lower likelihood of fully breastfeeding among high income mothers. In addition, various demographic characteristics (mother age, infant age, and paternal education) were significantly correlated with breastfeeding practices. While there are mixed results on the relationship between various demographic characteristics and breastfeeding practices in the global literature, these findings are supported by other studies in LMICs showing that mothers are more likely to breastfeed if they are younger (51), have younger infants (52,53), or have higher income status (52–54).

293 Interestingly, while maternal education was not significantly correlated with fully
294 breastfeeding, there was a significant association with lower paternal education level. These
295 results seem to contradict previous findings that higher paternal education levels are positively
296 associated with breastfeeding (55,56). One possible explanation specific to the context of rural
297 China is that more educated fathers are more likely to out-migrate for work than less educated
298 fathers, leaving the mother and infant behind. Previous studies have shown that paternal support
299 promotes exclusive breastfeeding (57,58), so it is possible that less educated fathers are more
300 likely to be at home and provide the support the mother needs to fully breastfeed.

301 This study has limitations. First, the study only looks at cross sectional data and is
302 therefore unable to draw conclusions on the directionality or causality of the relationship
303 between mental health and breastfeeding outcomes. In addition, our assessment of mental health
304 problems was based on a self-report assessment of symptoms rather than a professional
305 diagnosis. Due to stigma against reporting symptoms of mental illness in LMICs, it is possible
306 that the prevalence of depression, anxiety and stress symptoms are underestimated among
307 women in the sample.

308 This study also has many strengths. This research fills a gap in the literature surrounding
309 the associations between maternal mental health and breastfeeding beliefs and practices,
310 specifically in rural China. Additionally, this study includes a large sample of women with
311 newborns aged 0-6 months, a population which very few studies have focused on. Future studies
312 could include multiple survey waves to determine directionality or perform mediation or
313 interaction analysis between maternal mental health and breastfeeding. Further research should
314 also investigate why the relationship between maternal mental health and breastfeeding beliefs is
315 not associated with breastfeeding practices in this population.

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Conclusions

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Abbreviations

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WHO: World Health Organization

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LMICs: Low- and Middle-Income Countries

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DASS-21: Depression, Anxiety, and Stress Scale (short form)

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OLS: Ordinary Least Squares

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SES: Socio-Economic Status

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Declarations

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Ethics approval and consent to participate

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This study received ethical approval from the Stanford University Institutional Review Board

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(Protocol # 44312). All participants provided oral consent for participation in this study.

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Individuals found to have severe mental health problems were referred to the local hospital for

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diagnosis and treatment.

339 ***Consent for Publication***

340 Not applicable.

341 ***Availability of data and materials***

342 Datasets used in the current study are available from the corresponding author upon reasonable
343 request.

344 ***Competing interests***

345 The authors declare that they have no competing interests.

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350 ***Authors' contributions***

351 QJ, YG, EZ, NC, MO, SZ, SD and SR contributed to the conceptualization of the study. QJ, YG,
352 EZ, NC, MO, SZ, SD, and SR contributed to the acquisition, analysis or interpretation of data.
353 YG, EZ, and SZ drafted the manuscript, and NC, MO, SD, HZ, HJ, and SR made substantial
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Table 5. Heterogeneous effects of postnatal mental health on breastfeeding practices (n = 742).

	Symptoms of depression	Symptoms of anxiety	Symptoms of stress
<i>Panel A: Family income (reference group: without MH problem & high family income)</i>			
(1) with MH problem & low family income	0.75 (0.43 - 1.32)	1.10 (0.62 - 1.96)	0.90 (0.45 - 1.80)
(2) with MH problem & high family income	0.65 (0.30 - 1.40)	1.32 (0.68 - 2.59)	0.20*** (0.07 - 0.55)
(3) without MH problem & low family income	0.78 (0.56 - 1.10)	0.81 (0.57 - 1.13)	0.70** (0.50 - 0.98)
(4) p-value of test (1) = (2)	0.753	0.656	0.011
(5) p-value of test (1) = (3)	0.878	0.269	0.467
<i>Panel B: Maternal education level (reference group: without MH problem & high education level)</i>			
(6) with MH problem & low education level	0.75 (0.41 - 1.40)	1.09 (0.61 - 1.97)	0.51 (0.26 - 1.02)

(7) with MH problem & high education level	0.60 (0.29 - 1.22)	1.20 (0.61 - 2.37)	0.81 (0.32 - 2.06)
(8) without MH problem & low education level	0.72 (0.50 - 1.05)	0.76 (0.52 - 1.20)	0.80 (0.56 - 1.14)
(9) p-value of test (6) = (7)	0.596	0.825	0.409
(10) p-value of test (6) = (8)	0.891	0.189	0.178

Panel C: Maternal age (reference group: without MH problem & high maternal age)

(11) with MH problem & low maternal age	1.15 (0.66 - 2.01)	1.94** (1.14 - 3.31)	1.03 (0.55 - 1.93)
(12) with MH problem & high maternal age	0.96 (0.42 - 2.21)	1.02 (0.43 - 2.40)	0.57 (0.19 - 1.74)
(13) without MH problem & low maternal age	1.45** (1.03 - 2.03)	1.32 (0.94 - 1.85)	1.41** (1.01 - 1.96)
(14) p-value of test (11) = (12)	0.699	0.175	0.341
(15) p-value of test (11) = (13)	0.395	0.127	0.315

Panel D: Paternal education level (reference group: without MH problem & high education level)

(16) with MH problem & low education level	0.98 (0.51 - 1.88)	1.66 (0.91 - 3.05)	0.83 (0.41 - 1.67)
(17) with MH problem & high education level	0.93 (0.47 - 1.84)	1.41 (0.72 - 2.77)	0.86 (0.36 - 2.07)
(18) without MH problem & low education level	1.48** (1.05 - 2.08)	1.42** (1.00 - 2.00)	1.49** (1.06 - 2.09)
(19) p-value of test (16) = (17)	0.899	0.705	0.952
(20) p-value of test (16) = (18)	0.218	0.611	0.100

Panel E: Infant age (reference group: without mental health & high infant age)

(21) with MH problem & low infant age	1.11 (0.61 - 2.03)	2.68*** (1.40 - 5.13)	0.88 (0.43 - 1.83)
(22) with MH problem & high infant age	1.22 (0.64 - 2.31)	1.12 (0.62 - 2.00)	1.00 (0.47 - 2.13)
(23) without MH problem & low infant age	1.87*** (1.35 - 2.59)	1.60*** (1.15 - 2.22)	1.81*** (1.32 - 2.49)
(24) p-value of test (21) = (22)	0.829	0.034	0.799
(25) p-value of test (21) = (23)	0.189	0.239	0.124

Notes: *p<0.05, **p<0.01, ***p<0.001. Values shown as adjusted OR (95% CI). MH = mental health.

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