Maternal Mental Health and Social Support from Online Communities During Pregnancy*

Lingqing Jiang†

University of Essex

Zhen Zhu‡

University of Kent

Abstract

Social determinants of public health have gained increasing attention. This paper studied whether social support from online communities related to maternal mental health. We focused on online maternity communities that group users with a similar prenatal status to facilitate their exchange of personal experiences and knowledge about maternal caring during pregnancy. Such online maternity communities are getting increasingly popular and can be found across countries and societies. We invited users - currently pregnant and gave birth within one year at the time of the study - from one such community in China to participate in a survey. The survey measured their perceived social support (PSS) exclusively from the peer group in the online community, their mental health, and newborns' birth outcomes (N=500). Users reported high score in PSS from the online peer group which was comparable to the ones from family, significant other, and friends in other studies. We used linear regression models to examine the effects of PSS on mental health and birth outcomes. We found that a one-point increase in the PSS score was associated with a 0.19-point ($p<0.1$) decrease in the prenatal depression and a 0.26-point ($p< 0.01$) decrease in the postnatal depression, which were equivalent to 3% and 4.5% of the average, respectively. Moreover, a one-point increase in the PSS score was associated with a 14.49-gram increase in a newborn's weight ($p<0.01$).

Keywords: maternal mental health, perceived social support, online community, peer groups.

* We obtained ethical approval for this study from the University of Essex.

† Department of Economics, University of Essex, Wivenhoe Park, Colchester, Essex CO4 3SQ, United Kingdom. Tel: +44(0)1206 872132. Email: lingqing.jiang@essex.ac.uk.

‡ Corresponding author, Kent Business School, University of Kent, Parkwood Road, Canterbury, Kent CT2 7FS, United Kingdom. Tel: +44 (0)1227 827726. Email: z.zhu@kent.ac.uk.

What is known about this topic?

- Worldwide about 10% of pregnant women and 13% of women who have just given birth experience mental health problems, and this share is even higher in developing countries.

- Lack of prenatal social support presents a strong risk factor for depression during pregnancy and the postpartum period, as well as the mental health of the next generation.

- Interventions such as the Home Visiting Program can partially compensate the lack of social support during maternity but are only targeted to a small fraction of disadvantaged mothers.

What does this paper add?

- Investigates to what extent the information and knowledge exchange during pregnancy in online maternity communities is perceived as social support by the pregnant users.

- Presents evidence that perceived social support from the online maternity communities is positively associated with both prenatal and postnatal mental health of the mothers, as well as newborns' birth weight.

- Gains a better understanding of an emerging and increasingly popular source of social support and suggests that more cost-effective interventions can be designed and targeted to the online maternity communities.

1 Introduction

Childbearing is one of the most significant life events that brings not only joy but also anxiety and stress. The World Health Organization (WHO, 2004) reported that worldwide about 10% of pregnant women and 13% of women who had just given birth experience a mental disorder, primarily depression. In developing countries this share was even higher, i.e., 15.6% during pregnancy and 19.8% after childbirth. Moreover, perinatal depression and stress are also related to several adverse child outcomes (Aizer et al., 2016; Carlson, 2015; Persson & Rossin-Slater, 2018).

One well-known intervention to improve maternal well-being and child development was the Home Visiting Program (HVP) that offered perinatal and parental support to disadvantaged first-time mothers. It had been implemented in the US (Olds et al., 2019), the UK (Robling et al., 2016), Ireland (Doyle et al., 2015), and Germany (Sandner et al., 2018). Sandner et al. (2018) suggested that one of the mechanisms behind the success of HVP was compensating the lack of social support during maternity. Literature also showed that lack of prenatal social support presented a strong risk factor for depression during pregnancy and the postpartum period, as well as the mental health of the next generation (Collins et al., 1993, 2004; Elsenbruch et al., 2007; Hodnett & Fredericks, 2003).

In this paper we investigated an emerging source of prenatal social support: online maternity communities that are open to the general population of pregnant women with internet access. The main feature of such online communities is to group users according to their pregnancy status to facilitate their information exchange of personal experiences, information, and knowledge about maternal caring during pregnancy. Such online maternity communities are getting increasingly popular and can be found across countries and societies. We invited users who were currently (or had been) members of a large online maternity community in China to participate in a survey. We first measured how users perceived the social support from the peer groups in the online community. Subsequently, we used linear regression models and empirically analysed how perceived social support from these peer groups related to the maternal mental health and newborns' health outcomes.

This online maternity community studied here is one of the largest in China. Its core service is to provide a platform that allows geographically heterogeneous women, who have no prior acquaintance, to connect and exchange advice, information and support about maternal caring. At its root, the online community is built upon dedicated online peer groups (aka *birth clubs*) at monthly frequency. Each online peer group is essentially an internet forum with an allocated

URL within the domain of the community platform. For example, http://domain-name/community/club201803/ is for the peer group of March 2018. The users of such a peer group can hold conversations (aka *threads*) by posts and responses and the web page is presented as a list of hyperlinked conversations in reverse-chronological order. Each peer group has a few moderators who help manage and organise the conversations when needed (e.g., promoting instructive or informative content or responding to issues reported by users).

The online community assigns pregnant users into peer groups based on the month of their estimated due date (EDD). The main activity in the online peer groups is exchanging information and experiences about maternal caring. A user can exchange information in the peer groups by either initiating a post or responding to a post. A post typically initiates information exchange by either sharing own experience or asking a question; A response typically extends information exchange by either answering a question or asking a follow-up question.

To give a picture of the content and intensity of the activities in the peer groups, we tracked the online activities of three peer groups, March 2018, April 2018, and May 2018 with a complete pregnancy cycle (i.e., 10 months). We focused on posts with at least one response (which helps filter out those with commercial purposes), which yielded 68,079 anonymous posts in the peer groups. We used these posts to generate a word cloud in the original language presented in Figure 1(a). Figure 1(b) lists the top 20 most frequent words (in Chinese original followed by English translation) mentioned in the posts in the peer groups. Apart from the most frequent words “pregnant, baby, and mom(s)”, other frequently discussed topics were “last menstrual period, four-dimensional ultrasound, belly size, fetal heart, fetal pole, and gender”. The verbs such as “whether (be), take a look, and help” were clear demonstration of asking for confirmation, consultation, and help from peers.

[Insert Figure 1 here]

To give an idea of how the amount of information exchange was distributed among users in the peer groups, we looked at the distribution of all the posts and responses among the 67,774 anonymous users in the three tracked peer groups. On average, there were 85,754.3 posts and 433,621.3 responses per peer group over the period of 10 months. Figure 2 plots the cumulative posts and responses for each percentile of the users (Lorenz curves). If every user contributed equally to the information exchange in the peer groups, it would plot a 45 degree line. However, the curves show that the majority of the posts and responses were concentrated within a few users. The Gini coefficients of posts and responses were 0.588 and 0.822, respectively, indicating a high level of inequality in the active exchange among users.

[Insert Figure 2 here]

2 Methods

Our study was based on an online survey. We obtained ethical approval from the Social Sciences Ethics Committee of the University of Essex (ETH1920-1453). Each online survey participant provided informed consent before proceeding to the questionnaire.

2.1 The survey

The survey was conducted in June 2020. We used the Chinese professional online survey platform https://idiaoyan.com/ to invite mothers-to-be or mothers on a voluntary basis. The participants of our survey needed to meet either of the following criteria: 1) currently pregnant and was a member of the studied online maternity community, or 2) had been a member of the studied online maternity community and gave birth within one year at the time of the survey. Note that we controlled the numbers of the two types of participants, with the quotas of 300

and 200, respectively. That is, the survey was automatically closed once the quota was met. As a result, our whole sample had 500 participants. The two sub-samples allowed us to measure the well-being of users who were during pregnancy as well as users who just gave birth, and the newborns' birth outcomes of the latter. Before the survey went alive to collect data, the commissioned online survey platform https://idiaoyan.com/ implemented standard pilot tests to ensure question clarity, user interface consistency, and data quality. The full questionnaire can be found in Section A.1 in the Appendix.

The key instruments in the questionnaire are i) users' perceived social support in the peer groups measured by a modified *Multidimensional Scale of Perceived Social Support*, ii) their mental health measured by the *Edinburgh Depression Scale*, and iii) newborns' birth outcomes (weight, whether breastfeeding, and whether planned natural birth) among those who gave birth within one year.

Table 1 reports the background statistics of the survey participants. Column (1) is the sub-sample of 300 pregnant users, Column (2) is the sub-sample of 200 participants who gave birth within one year and were users during their pregnancy, and Column (3) is the full sample of 500 participants. The average day of EDD was about 16. The pregnant users were, on average, in their 6th month of the pregnancy. Note that the average day of EDD was around the middle of a month and the pregnancy month average was around the middle of the pregnancy cycle (typically 10 months in total), which suggests that our samples were representative as they were uniformly distributed along these dimensions. The users rated an average of 6.1 in both samples for the statement "This community is my main source of knowledge and information about pregnancy." on a scale from 1 to 7. This indicates that the users had a high level of trust in the source of pregnancy-related information in this community. The average age of the users was slightly above 28 years old in both samples. Finally, we also asked about three health indicators: a binary variable of whether smoke or drink, and two categorical variables for hours

of sleep and hours of physical exercise. Only two users (0.67%) smoked or drank during pregnancy and none after childbirth. Most users had adequate sleep and moderate exercise both during pregnancy and after childbirth.

[Insert Table 1 here]

2.2 Instruments

2.2.1 Measuring perceived social support in peer groups

There has been a surge in the evaluation of social support as a well-being indicator. The *Multidimensional Scale of Perceived Social Support* (MSPSS) (Zimet et al., 1988) has evolved as one of the most extensively translated and validated measures for social support outcome (Chou, 2000; Dahlem et al., 1991; Ma, 2020; Zhang & Norvilitis, 2002). The original test consisted of twelve items and was designed to assess the perceptions of social support from three specific sources: family, friends, and significant other. The original twelve items can be found in Section A.2 in the Appendix, where four items referred to the family, four items referred to friends, and four items referred to the significant other/a special person. Some of the items are overlapping in the main content except for the sources of the support, e.g., "*My family* really tries to help me." and "*My friends* really try to help me." Therefore, we only selected five relevant items and replaced the original sources with the *people in the peer group* which is the source of interest in our study. The detailed rationale for the added and modified items is provided below. We highlight the content that is relevant for our context in **bold**, which is the main reason why these items are selected.

1) I have **learned useful information** from others in the peer group. [added item]

   The reasons why we added item 1) to the measure are: i) the core of this online community is an information-sharing network. It provides a common space for pregnant women to exchange information and knowledge among themselves

throughout the entire pregnancy; ii) The information exchange constitutes the essence of social support, defined as interpersonal exchange of potentially useful information or things (Cohen & Syme, 1985).

2) There are some people in the peer group who are **a real source of comfort** to me. [modified item]

   This item is linked to the original item [5] where we replaced "*a special person*" with "*some people in the peer group*".

3) There are some people in the peer group who are **around when I am in need**. [modified item]

   This item is linked to the original item [1] where we replaced "*a special person*" with "*some people in the peer group*".

4) I get the **emotional help and support** I need from others in the peer group. [modified item]

   This item is linked to the original item [4] where we replaced "*my family*" with "*others in the peer group*".

5) I can **talk about my problems** in the peer group. [modified item]

   This item is linked to the original item [8,12] where we replaced "*with my family/friends*" with "*in the peer group*".

6) People in the peer group are willing to **help me make some decisions**. [modified item]

   This item is linked to the original item [11] where we replaced "*my family*" with "*people in the peer group*".

Therefore, the perceived social support we measured using the modified MSPSS items exclusively refer to the *peer groups* in our context. The amount of social support was rated on a seven-point Likert scale, with responses ranging from "very strongly disagree" (=1) to "very strongly agree" (=7), i.e., the higher the score, the greater the amount of perceived social support.

Figure 3 presents the scores of each item in the two sub-samples. Overall, there was no significant difference between the two sub-samples in the scores. The scores were also comparable to the ones from the female sample in the work by Zimet et al. (1988) which were 5.9 from family, 6.08 from the significant other, and 6.16 from friends. The item means of the MSPSS all fell well above the midpoint of 4, suggesting that online social support was well received by the participants in the peer groups.

[Insert Figure 3 here]

2.2.2 Measuring mental health

We used the *Edinburgh Depression Scale* (EDS) (Murray & Cox, 1990) to measure users' mental health. Initially, this 10-item self-report measure was developed for postnatal period (Cox et al., 1987) and was called *Edinburgh Postnatal Depression Scale*. Later, Murray and Cox (1990) validated it also for prenatal period and renamed to *Edinburgh Depression Scale*. Since then, it was used to screen for symptoms of emotional distress both during pregnancy and in the postnatal period. The EDS was translated and validated in a wide range of languages (Marshall & Bethell, 2006). We used the Chinese version that was validated by Lee et al. (1998) in our survey. The test was referred to the feeling in the past seven days. Therefore, in our survey, it screened for *prenatal depression* in the sample of users during pregnancy and *postnatal depression* in the sample of users after childbirth, respectively. Each item has a range of score from 0-3 and the total score is 30. A score between 10-12 depression indicates presence

of symptoms of distress that may be discomforting; A score above 12 requires further evaluation and possible referral to a perinatal mental health specialist. The complete items of the EDS in our survey sample can be found in Section A.3 in the Appendix.

Figure 4 shows the distribution of the scores of each item in the EDS for both sub-samples. The size of each bubble indicates the number of participants. The average total EDS score for users during pregnancy (after childbirth) in our survey was 6.69 (5.78) with a standard deviation of 4.26 (3.74), suggesting a healthy level of mental status overall.

[Insert Figure 4 here]

Note that both instruments provided comparable results to previous studies. We further checked the internal consistency of the instruments with Cronbach's alpha (Cronbach, 1951). The alpha coefficient of reliability was valued at 0.67 for the modified MSPSS items and 0.83 for the EDS items respectively, both being above the acceptable level in the literature (Wongpakaran et al., 2011). The detailed statistics are reported in Table 2 and Table 3 below. Therefore, the validity and reliability of the instruments were well justified.

[Insert Table 2 here]

[Insert Table 3 here]

2.3 Hypotheses

Figure 5 illustrates the four hypotheses to be tested in the linear regression models. The question of key interest is whether the information exchange in online peer groups during pregnancy serves as genuine prenatal social support. First, as we have seen in Figure 2, the majority of the active information exchange was concentrated within a few users. This suggests that although the information exchange serves as a public good in the peer groups, most of the users were passive information recipients or lurking (i.e., possibly read but rarely post or

respond) in the peer groups. Therefore, having access to the information exchange may not necessarily equal to having received social support. Second, the observed information exchange in the peer groups is just a proxy of quantitative measures of social support. Lin (1986, 2017) distinguishes the objective and subjective dimension, and emphasises "perceived or actual" social support. Most studies find perceived social support to be a better predictor of psychological status than objectively measured social support (see a summary by Zimet et al. (1988)).

[Insert Figure 5 here]

Our first hypothesis thus bridges the objective information exchange and subjective social support. We hypothesised that the information exchange among pregnant users in online peer groups provided effective social support.

Hypothesis 1: The information exchange in online peer groups during pregnancy is well perceived as social support.

Social support is one of the most well-documented psychosocial factors linked to both physical health and mental health (Berkman et al., 2000; Holt-Lunstad et al., 2010). (Also see a critical and comprehensive review of evidence linking social support to health outcome by Uchino et al., (2012).) Overall, a positive relationship between social support and health is found in various populations and contexts (Irwin et al., 2008; Kumar et al., 2012; Langford et al., 1997; S. Lee et al., 2018; S.-Y. D. Lee et al., 2004; McKenzie et al., 2002; Mulvaney-Day et al., 2007; Schroevers et al., 2003). Our second and third hypotheses thus related perceived social support during pregnancy to maternal mental health during pregnancy and after childbirth.

Hypothesis 2: Greater levels of prenatal social support from the online peer groups are associated with better prenatal mental health (contemporaneous effects).

Hypothesis 3: Greater levels of prenatal social support from the online peer groups are associated with better postnatal mental health (lasting effects).

Finally, the literature in child development suggests that prenatal environment and maternal well-being have significant consequences for children's health and development (Doyle et al., 2009, 2015; Francesconi & Heckman, 2016; Heckman & Mosso, 2014). We thus linked the perceived social support during pregnancy to three birth outcomes - weight, whether breastfeeding, and whether planned natural birth - according to the WHO technical consultation on newborn health indicators (WHO & UNICEF, 2015). We expected that a higher level of prenatal social support was associated with heavier birth weight, and a higher likelihood of breastfeeding and planned natural birth.

Hypothesis 4: Greater levels of prenatal social support from the virtual peer groups are associated with better newborns' birth outcomes.

3 Linear Regression Models and Results

3.1 Perceived social support and maternal mental health

We regressed mental health on perceived social support from the peer groups as in Equation 1. The main explanatory variable is the total score of perceived social support from the peer groups during pregnancy, measured by the MSPSS. We controlled for three health indicators (whether smoke or drink alcohol, hours of sleep, and physical exercise), age, as well as the fixed effects of the X-th month since pregnancy in one of the specifications.

$$Mental\ health_i = \beta_0 + \beta_1 MSPSS_i + \beta_2 Health\ indicators_i + \beta_3 Age_i + \alpha_m + \varepsilon_i \quad (1)$$

As explained in Section 2.2.2, the EDS test screened for *prenatal depression* in the sample of users during pregnancy and *postnatal depression* in the sample of users after childbirth,

respectively. In other words, there are two versions of Equation 1: the first version associates the contemporaneous role of perceived social support from the peer groups with prenatal mental health when the peer groups were still active (i.e., during pregnancy); the second version associates its lasting role with postnatal mental health when the peer groups were no longer active (i.e., after childbirth).

Table 4 reports the results. Columns (1)-(2) are the sub-sample of the users during pregnancy without and with the fixed effects of the X-month since pregnancy, Column (3) is the sub-sample of the users after childbirth, and Column (4) is the full sample. In the sample of the users during pregnancy, a one-point increase in the MSPSS score was associated with a 0.19-point ($p< 0.1$) decrease in the EDS score which was equivalent to 3% of the mean EDS. That is, higher perceived social support from the peer groups was associated with lower prenatal depression. In the sample of the users after childbirth, a one-point increase in the MSPSS score was associated with a 0.26-point ($p<0.01$) decrease in the EDS score which was equivalent to 4.5% of the mean EDS. That is, higher perceived social support from the peer groups during pregnancy was also associated with lower postnatal depression.

[Insert Table 4 here]

Finally, the users who smoked or drank alcohol score around 6 points higher in the prenatal depression, and the users who had more hours of sleep had lower scores in both prenatal and postnatal depression. Physical exercise and age did not seem to matter for depression either during or within one year after pregnancy.

To provide further insight, we regressed mental health on each item of the MSPSS, individually. Since there were six items, the probability of having at least one significant result at the significance level of 0.05 due to pure chance is $1-(1-0.05)^6$ which was above 26%.

For the sake of caution, we applied the Bonferroni correction for the multiple testing (Bland & Altman, 1995).

Table 5 reports the results in the full sample. All six items had negative coefficients, however, only the coefficients of items 1, 4 and 5 were statistically significant. This was an interesting pattern. What items 1, 4, and 5 have in common and differ from other items is that the subject pronouns are "I". While we did not intend to overinterpret this pattern, it seemed that the items where the ego was presented more salient such as "I can learn; I get help and support; I can talk" had a stronger and more significant association with the mental health. Other variables remain qualitatively the same as in Table 4 where the aggregated score was used as the explanatory variable.

[Insert Table 5 here]

3.2 Perceived social support and newborns' birth outcomes

We selected three newborns' birth outcomes according to the WHO technical consultation on newborn health indicators (WHO & UNICEF, 2015): birth weight, whether being breastfed, and whether planned natural birth. We regressed newborns' birth outcomes on perceived social support from the peer groups during pregnancy, using the sample of users after childbirth as in Equation 2.

$$Birth\ outcomes_i = \delta_0 + \delta_1 MSPSS_i + \delta_2 Health\ indicators_i + \delta_3 Age_i + \alpha_m + \mu_i \quad (2)$$

Table 6 reports the results. The babies born to the mothers with higher perceived social support during pregnancy were heavier. A one-point increase in the MSPSS score was associated with a 14.49-gram increase in the newborns' weight ($p<0.01$). All the newborns' weight in our sample was within the normal range of birth weight reported in previous studies (Dai et al., 2014; Janssen et al., 2007). The mothers doing more physical exercises had lighter newborns.

Perceived social support from the peer groups during pregnancy and other control variables did not seem to affect the decisions of breastfeeding and planned natural birth.

[Insert Table 6 here]

4 Discussion

The online maternity community we focused on in this study assigned pregnant users into peer groups according to the month of their estimated due date (EDD). The peer groups were active throughout the entire pregnancy. The creation of peer groups provided a common space for users who were at the same stage of pregnancy to exchange relevant information among themselves. The users typically exchanged information about their pregnancy symptoms and pregnancy status. The exchange often involved asking for confirmation, consultation and help from other peers in the group. Such information exchange among pregnant women constituted the essence of social support defined as *interpersonal exchange of potentially useful information or things* (Cohen & Syme, 1985; Shumaker & Brownell, 1984).

Our study added new evidence to the literature that links social support and individual well-being (Berkman et al., 2000; Holt-Lunstad et al., 2010; Irwin et al., 2008; Kumar et al., 2012; Langford et al., 1997; S. Lee et al., 2018; S.-Y. D. Lee et al., 2004; McKenzie et al., 2002; Mulvaney-Day et al., 2007; Schroevers et al., 2003). The social science literature has long recognised the important role of peer groups in various contexts (Bruhin et al., 2020; Cornelissen et al., 2017; Jiang, 2020; Sacerdote, 2001). The users in the peer groups studied here were not only the recipients but also the providers of the support as they used their own experiences and knowledge to help themselves and others. To some extent, it was a self-contained form of social support which differed from the third-party support (e.g., home visiting programs) where individuals were typically solely the recipients. With the development of digital technologies, online peer support has emerged and become more and

more widely accepted. Recently, more studies have looked at online social support (Drentea & Moren-Cross, 2005; Han et al., 2018; Oh et al., 2014; Utz & Breuer, 2017; White, 2001). In a study closely related to ours, Drentea and Moren-Cross (2005) examined a women's online board and found qualitative evidence that the online community provided the means for instrumental and emotional support and enhances mothers' social capital. Han et al. (2018) found that a population with HIV perceive significantly higher levels of online social support than through offline social support from family and friends, and both forms of perceived social support were positively associated with their subjective well-being. Utz and Breuer (2017) found that social network sites users reported more online social support than non-users did in a longitudinal study. However, online social support was not related to higher life satisfaction or reduced stress 6 months later. Our study instead focused on a well-defined emerging source of online social support. We specifically measured the perceived social support from self-contained peer groups in a large online maternity community by surveying 500 users.

We contributed especially to the vibrant literature that investigates the link between maternal social support and the well-being of mothers as well as child development (Collins et al., 1993, 2004; Cunha et al., 2006; Elsenbruch et al., 2007; Francesconi & Heckman, 2016; Heckman & Mosso, 2014; Hodnett & Fredericks, 2003). Norbeck et al. (1996) conducted a randomised trial of a social support intervention (four standardised face-to-face sessions at two week intervals and telephone contact in the intervening weeks) and found that the intervention was effective in reducing the rate of low birth weight among low-income African American pregnant women. Harley and Eskenazi (2006) found that higher social support was associated with better quality of diet, increased likelihood of using prenatal vitamins, and decreased likelihood of smoking during pregnancy among women of Mexican descent living in the US. Olds et al. (2019) investigated the long term effects of prenatal and infancy nurse home visiting on mothers. However, they did not find evidence that the program affects maternal substance abuse and

depression. Our study added value to the literature by establishing the link between prenatal perceived social support and both prenatal and postnatal well-being as well as newborns' birth outcomes at the same time.

Our study also has a few limitations. First, while we found significant links between perceived social support from peer groups and mental health in two different stages of maternity, we did not claim causality. The causality could be identified with carefully designed randomised controlled trials (RCT) or longitudinal study with an instrumental variables approach. Second, an ideal study would have included a direct comparison with the offline counterparts of the peer groups where members can meet and interact with each other in person. Traditional events and activities providing social support have been increasingly transformed into digital versions. The online peer groups studied here are just one example. Whereas both virtual and real communities could function as platforms for social support, they differ in important ways. While it is relatively convenient and non-costly to organise large groups of individuals in the online platform, the capacity of arranging comparable groups offline is often much more limited. The offline counterparts, although having their unique advantages, are likely to be much smaller, more homogeneous, interact less frequently (potentially more intensively), and subject to other physical constraints for the meet-up.

5 Conclusions

Social support is one of the key social determinants of health as emphasised by the (WHO, 2004). In this paper, we investigated a potential source of prenatal social support from online peer groups formed by pregnant women and its link to their maternal mental health. We designed a survey questionnaire targeting users of a large online maternity community. Our empirical analysis based on linear regression models yielded three main findings. First, the information and knowledge exchange during pregnancy within the online peer groups was well

perceived as social support by the members in the groups. The scores in the MSPSS from the peer groups were comparable to the ones from family, significant other, and friends in other studies. Second, the perceived social support from the peer groups was positively associated with not only the prenatal but also the postnatal mental health of the mothers. In particular, among all the items in the scale of perceived social support, the items in which the ego was presented more salient seemed to have a stronger and more significant association with the mental health. Third, a higher level of perceived social support was associated with heavier weights of the newborns.

The online community studied here is a large-scale anonymous platform whereas there are other popular but smaller-scale online maternity peer groups based on social media applications such as Facebook and WhatsApp. Future research can explore different online settings and investigate how they may affect the effectiveness of the provision of social support and individual well-being.

References

Aizer, A., Stroud, L., & Buka, S. (2016). Maternal stress and child outcomes: Evidence from siblings. *Journal of Human Resources, 51*(3), 523–555.

Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine, 51*(6), 843–857.

Bland, J. M., & Altman, D. G. (1995). Multiple significance tests: The Bonferroni method. *Bmj, 310*(6973), 170.

Bruhin, A., Goette, L., Haenni, S., & Jiang, L. (2020). Spillovers of prosocial motivation: Evidence from an intervention study on blood donors. *Journal of Health Economics, 70*, 102244.

Carlson, K. (2015). Fear itself: The effects of distressing economic news on birth outcomes. *Journal of Health Economics, 41*, 117–132.

Chou, K.-L. (2000). Assessing Chinese adolescents' social support: The multidimensional scale of perceived social support. *Personality and Individual Differences, 28*(2), 299–307.

Cohen, S., & Syme, S. L. (1985). Issues in the study and application of social support. *Social Support and Health, 3*, 3–22.

Collins, N. L., Dunkel-Schetter, C., Lobel, M., & Scrimshaw, S. C. (1993). Social support in pregnancy: Psychosocial correlates of birth outcomes and postpartum depression. *Journal of Personality and Social Psychology, 65*(6), 1243.

Collins, N. L., Dunkel-Schetter, C., Lobel, M., & Scrimshaw, S. C. (2004). *Social support in pregnancy: Psychosocial correlates of birth outcomes and postpartum depression.*

Cornelissen, T., Dustmann, C., & Schönberg, U. (2017). Peer effects in the workplace. *American Economic Review, 107*(2), 425–456.

Cox, J. L., Holden, J. M., & Sagovsky, R. (1987). Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *The British Journal of Psychiatry*, *150*(6), 782–786.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297–334.

Cunha, F., Heckman, J. J., Lochner, L., & Masterov, D. V. (2006). Interpreting the evidence on life cycle skill formation. *Handbook of the Economics of Education*, *1*, 697–812.

Dahlem, N. W., Zimet, G. D., & Walker, R. R. (1991). The multidimensional scale of perceived social support: A confirmation study. *Journal of Clinical Psychology*, *47*(6), 756–761.

Dai, L., Deng, C., Li, Y., Zhu, J., Mu, Y., Deng, Y., Mao, M., Wang, Y., Li, Q., & Ma, S. (2014). Birth weight reference percentiles for Chinese. *PloS One*, *9*(8), e104779.

Doyle, O., Fitzpatrick, N., Lovett, J., & Rawdon, C. (2015). Early intervention and child physical health: Evidence from a Dublin-based randomized controlled trial. *Economics & Human Biology*, *19*, 224–245.

Doyle, O., Harmon, C. P., Heckman, J. J., & Tremblay, R. E. (2009). Investing in early human development: Timing and economic efficiency. *Economics & Human Biology*, *7*(1), 1–6.

Drentea, P., & Moren-Cross, J. L. (2005). Social capital and social support on the web: The case of an internet mother site. *Sociology of Health & Illness*, *27*(7), 920–943.

Elsenbruch, S., Benson, S., Rücke, M., Rose, M., Dudenhausen, J., Pincus-Knackstedt, M. K., Klapp, B. F., & Arck, P. C. (2007). Social support during pregnancy: Effects on maternal depressive symptoms, smoking and pregnancy outcome. *Human Reproduction*, *22*(3), 869–877.

Francesconi, M., & Heckman, J. J. (2016). Child development and parental investment: Introduction. *The Economic Journal*, *126*(596), F1–F27.

Han, X., Li, B., Qu, J., & Zhu, Q. (2018). Weibo friends with benefits for people live with HIV/AIDS? The implications of Weibo use for enacted social support, perceived social support and health outcomes. *Social Science & Medicine*, *211*, 157–163.

Harley, K., & Eskenazi, B. (2006). Time in the United States, social support and health behaviors during pregnancy among women of Mexican descent. *Social Science & Medicine*, *62*(12), 3048–3061.

Heckman, J. J., & Mosso, S. (2014). The economics of human development and social mobility. *Annu. Rev. Econ.*, *6*(1), 689–733.

Hodnett, E. D., & Fredericks, S. (2003). Support during pregnancy for women at increased risk of low birthweight babies. *Cochrane Database of Systematic Reviews*, *3*.

Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine*, *7*(7), e1000316.

Irwin, J., LaGory, M., Ritchey, F., & Fitzpatrick, K. (2008). Social assets and mental distress among the homeless: Exploring the roles of social support and other forms of social capital on depression. *Social Science & Medicine*, *67*(12), 1935–1943.

Janssen, P. A., Thiessen, P., Klein, M. C., Whitfield, M. F., MacNab, Y. C., & Cullis-Kuhl, S. C. (2007). Standards for the measurement of birth weight, length and head circumference at term in neonates of European, Chinese and South Asian ancestry. *Open Medicine*, *1*(2), e74.

Jiang, L. (2020). Splash with a teammate: Peer effects in high-stakes tournaments. *Journal of Economic Behavior & Organization*, *171*, 165–188.

Kumar, S., Calvo, R., Avendano, M., Sivaramakrishnan, K., & Berkman, L. F. (2012). Social support, volunteering and health around the world: Cross-national evidence from 139 countries. *Social Science & Medicine*, *74*(5), 696–706.

Langford, C. P. H., Bowsher, J., Maloney, J. P., & Lillis, P. P. (1997). Social support: A conceptual analysis. *Journal of Advanced Nursing*, *25*(1), 95–100.

Lee, D. T., Yip, S. K., Chiu, H. F., Leung, T. Y., Chan, K. P., Chau, I. O., Leung, H. C., & Chung, T. K. (1998). Detecting postnatal depression in Chinese women: Validation of the Chinese version of the Edinburgh Postnatal Depression Scale. *The British Journal of Psychiatry*, *172*(5), 433–437.

Lee, S., Chung, J. E., & Park, N. (2018). Network environments and well-being: An examination of personal network structure, social capital, and perceived social support. *Health Communication*, *33*(1), 22–31.

Lee, S.-Y. D., Arozullah, A. M., & Cho, Y. I. (2004). Health literacy, social support, and health: A research agenda. *Social Science & Medicine*, *58*(7), 1309–1321.

Lin, N. (1986). Conceptualizing social support. In *Social support, life events, and depression* (pp. 17–30). Elsevier.

Lin, N. (2017). Building a network theory of social capital. *Social Capital*, 3–28.

Ma, C. M. (2020). Measurement Invariance of the Multidimensional Scale of Perceived Social Support Among Chinese and South Asian Ethnic Minority Adolescents in Hong Kong. *Frontiers in Psychology*, *11*, 596737.

Marshall, J., & Bethell, K. (2006). Edinburgh Postnatal Depression Scale (EPDS): Translated Versions–Validated. *Perth, Western Australia: StatePerinatal Mental Health Reference Group*, *1*(2), 8–10.

McKenzie, K., Whitley, R., & Weich, S. (2002). Social capital and mental health. *The British Journal of Psychiatry*, *181*(4), 280–283.

Mulvaney-Day, N. E., Alegria, M., & Sribney, W. (2007). Social cohesion, social support, and health among Latinos in the United States. *Social Science & Medicine*, *64*(2), 477–495.

Murray, D., & Cox, J. L. (1990). Screening for depression during pregnancy with the Edinburgh Depression Scale (EDDS). *Journal of Reproductive and Infant Psychology*, *8*(2), 99–107.

Norbeck, J. S., DeJoseph, J. F., & Smith, R. T. (1996). A randomized trial of an empirically-derived social support intervention to prevent low birthweight among African American women. *Social Science & Medicine*, *43*(6), 947–954.

Oh, H. J., Ozkaya, E., & LaRose, R. (2014). How does online social networking enhance life satisfaction? The relationships among online supportive interaction, affect, perceived social support, sense of community, and life satisfaction. *Computers in Human Behavior*, *30*, 69–78. https://doi.org/10.1016/j.chb.2013.07.053

Olds, D. L., Kitzman, H., Anson, E., Smith, J. A., Knudtson, M. D., Miller, T., Cole, R., Hopfer, C., & Conti, G. (2019). Prenatal and Infancy Nurse Home Visiting Effects on Mothers: 18-Year Follow-up of a Randomized Trial. *Pediatrics*, *144*(6), e20183889. https://doi.org/10.1542/peds.2018-3889

Persson, P., & Rossin-Slater, M. (2018). Family Ruptures, Stress, and the Mental Health of the Next Generation. *American Economic Review*, *108*(4–5), 1214–1252. https://doi.org/10.1257/aer.20141406

Robling, M., Bekkers, M.-J., Bell, K., Butler, C. C., Cannings-John, R., Channon, S., Martin, B. C., Gregory, J. W., Hood, K., Kemp, A., Kenkre, J., Montgomery, A. A., Moody, G., Owen-Jones, E., Pickett, K., Richardson, G., Roberts, Z. E. S., Ronaldson, S., Sanders, J., … Torgerson, D. (2016). Effectiveness of a nurse-led intensive home-visitation programme for first-time teenage mothers (Building Blocks): A pragmatic randomised controlled trial. *The Lancet*, *387*(10014), 146–155. https://doi.org/10.1016/S0140-6736(15)00392-X

Sacerdote, B. (2001). Peer Effects with Random Assignment: Results for Dartmouth Roommates. *The Quarterly Journal of Economics*, *116*(2), 681–704. https://doi.org/10.1162/00335530151144131

Sandner, M., Cornelissen, T., Jungmann, T., & Herrmann, P. (2018). Evaluating the effects of a targeted home visiting program on maternal and child health outcomes. *Journal of Health Economics*, *58*, 269–283. https://doi.org/10.1016/j.jhealeco.2018.02.008

Schroevers, M. J., Ranchor, A. V., & Sanderman, R. (2003). The role of social support and self-esteem in the presence and course of depressive symptoms: A comparison of cancer patients and individuals from the general population. *Social Science & Medicine*, *57*(2), 375–385. https://doi.org/10.1016/S0277-9536(02)00366-0

Shumaker, S. A., & Brownell, A. (1984). Toward a Theory of Social Support: Closing Conceptual Gaps. *Journal of Social Issues*, *40*(4), 11–36. https://doi.org/10.1111/j.1540-4560.1984.tb01105.x

Uchino, B. N., Bowen, K., Carlisle, M., & Birmingham, W. (2012). Psychological pathways linking social support to health outcomes: A visit with the "ghosts" of research past, present, and future. *Social Science & Medicine*, *74*(7), 949–957. https://doi.org/10.1016/j.socscimed.2011.11.023

Utz, S., & Breuer, J. (2017). The Relationship Between Use of Social Network Sites, Online Social Support, and Well-Being: Results From a Six-Wave Longitudinal Study. *Journal of Media Psychology*, *29*(3), 115–125. https://doi.org/10.1027/1864-1105/a000222

White, M. (2001). Receiving social support online: Implications for health education. *Health Education Research*, *16*(6), 693–707. https://doi.org/10.1093/her/16.6.693

WHO. (2004). *Maternal Mental Health*. https://www.who.int/mental_health/maternal-child/maternal_mental_health/en/

WHO, & UNICEF. (2015). *Every newborn action plan: Progress report, May 2015*. World Health Organization.

Wongpakaran, T., Wongpakaran, N., & Ruktrakul, R. (2011). Reliability and validity of the multidimensional scale of perceived social support (MSPSS): Thai version. *Clinical Practice and Epidemiology in Mental Health: CP & EMH*, *7*, 161.

Zhang, J., & Norvilitis, J. M. (2002). Measuring Chinese psychological well-being with Western developed instruments. *Journal of Personality Assessment*, *79*(3), 492–511.

Zimet, G. D., Dahlem, N. W., Zimet, S. G., & Farley, G. K. (1988). The Multidimensional Scale of Perceived Social Support. *Journal of Personality Assessment*, *52*(1), 30–41. https://doi.org/10.1207/s15327752jpa5201_2

A. Appendix

A.1 Full Questionnaire

Start of the questionnaire

Which one of the following fits your current situation

- You are pregnant with your first baby, and you are now a user of this community.
- Your first baby has been born within one year, and you were a user of this community during pregnancy.
- None of the above. [end of survey]

Participation information sheet and consent form

- Agree
- Disagree [end of survey]

Perceived social support in the peer groups, rate from 1 to 7 (modified MSPSS)

1) I have learned useful information from others in the peer group.
2) There are some people in the peer group who are a real source of comfort to me.
3) There are some people in the peer group who are around when I am in need.
4) I get the emotional help and support I need from others in the peer group.
5) I can talk about my problems in the peer group.
6) People in the peer group are willing to help me make some decisions.

Rate from 1 to 7 ("very strongly disagree" to "very strongly agree") the statement "This community is my main source of knowledge and information about pregnancy."

Mental health measured by EDS (see Section A.3)

In the past 7 days, how much time did you spend on physical exercise every day (e.g. walking, swimming, yoga, badminton, etc)?

- Less than 30 minutes
- 30-60 minutes
- 60-120 minutes
- More than 120 minutes

In the past 7 days, how many hours of sleep per day did you have on average?

- Less than 5 hours
- 5-6 hours
- 6-7 hours
- More than 7 hours

Have you ever smoked or drank alcohol during pregnancy?

- Yes
- No

What is your estimated due date (If the baby has been born, please refer to the estimated due date rather than the actual date of birth)?

- Scrolling choices

Your birth year is 19--?

- Scrolling choices

If the baby has been born, what is the actual date of birth?

- Scrolling choices

Which of the following is true?

- My delivery was planned natural birth.
- My delivery was unplanned Cesarean.
- My delivery was planned Cesarean.

What is the birth weight of your baby? (If multiple babies, please fill for each baby)

- Scrolling choices

Are/were you breastfeeding in the first 6 months?

- Yes
- No

End of the questionnaire

A.2 Original items in the Multidimensional Scale of Perceived Social Support (Zimet et al., 1988)

1. There is a special person who is around when I am in need.
2. There is a special person with whom I can share my joys and sorrows.
3. My family really tries to help me.
4. I get the emotional help and support I need from my family.
5. I have a special person who is a real source of comfort to me.
6. My friends really try to help me.
7. I can count on my friends when things go wrong.
8. I can talk about my problems with my family.
9. I have friends with whom I can share my joys and sorrows.
10. There is a special person in my life who cares about my feelings.
11. My family is willing to help me make decisions.
12. I can talk about my problems with my friends.

A.3 Questionnaire of Edinburgh Depression Scale (Murray & Cox, 1990)

In the *last seven* days

1. I have been able to laugh and see the funny side of things:

- As much as I always could [0]
- Not quite as much now [1]
- Definitely not so much now [2]
- Not at all [3]

2. I have looked forward with enjoyment to things:

- As much as I ever did [0]
- Rather less than I used to [1]
- Definitely less than I used to [2]
- Hardly at all [3]

3. I have blamed myself unnecessarily when things went wrong:

- Yes, most of the time [3]
- Yes, some of the time [2]
- Not very often [1]
- No, never [0]

4. I have been anxious or worried for no good reason:

- No, not at all [0]
- Hardly ever [1]
- Yes, sometimes [2]
- Yes, very often [3]

5. I have felt scared or panicky for no very good reason:

- Yes, quite a lot [3]
- Yes, sometimes [2]
- No, not much [1]
- No, not at all [0]

6. Things have been getting on top of me:

- Yes, most of the time I haven't been able to cope at all [3]
- Yes, sometimes I haven't been coping as well as usual [2]
- No, most of the time I have coped quite well [1]
- No, I have been coping as well as ever [0]

7. I have been so unhappy that I have had difficulty sleeping:

- Yes, most of the time [3]
- Yes, sometimes [2]
- Not very often [1]
- No, not at all [0]

8. I have felt sad or miserable:

- Yes, most of the time [3]
- Yes, quite often [2]
- Not very often [1]
- No, not at all [0]

9. I have been so unhappy that I have been crying:

- Yes, most of the time [3]
- Yes, quite often [2]
- Only occasionally [1]
- No, never [0]

10. The thought of harming myself has occurred to me:

- Yes, quite often [3]
- Sometimes [2]
- Hardly ever [1]
- Never [0]

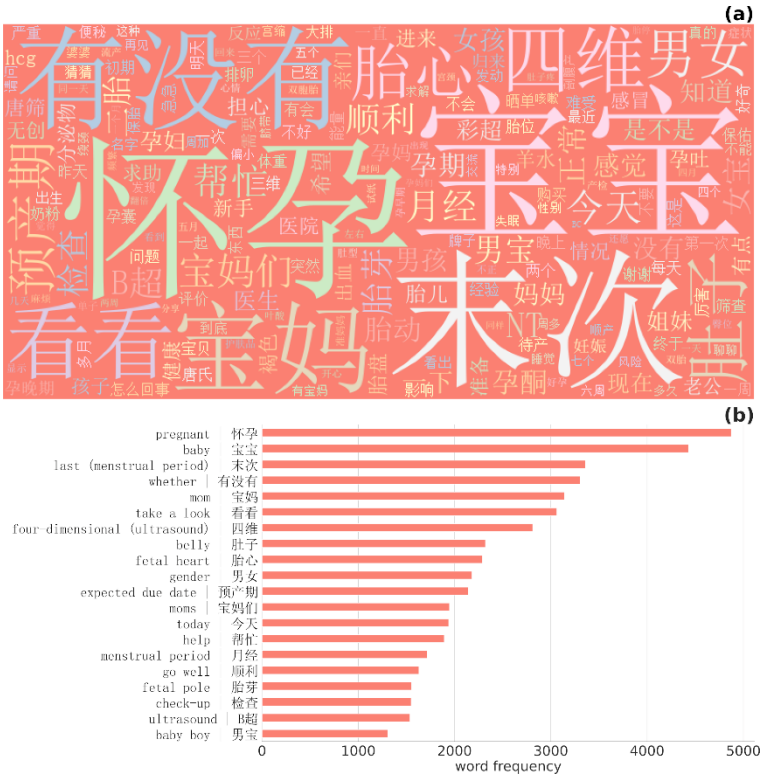

Figure 1: Word cloud

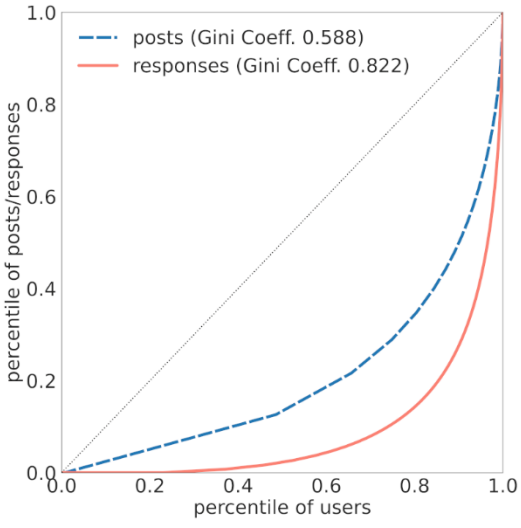

Figure 2: Lorenz curves of posts and responses

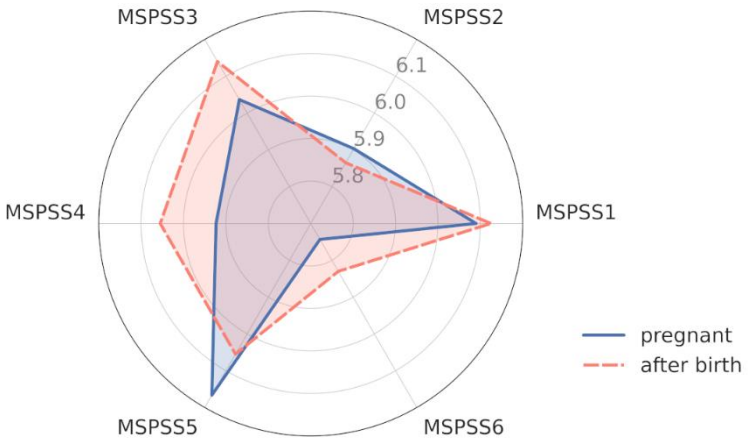

Figure 3: MSPSS by item

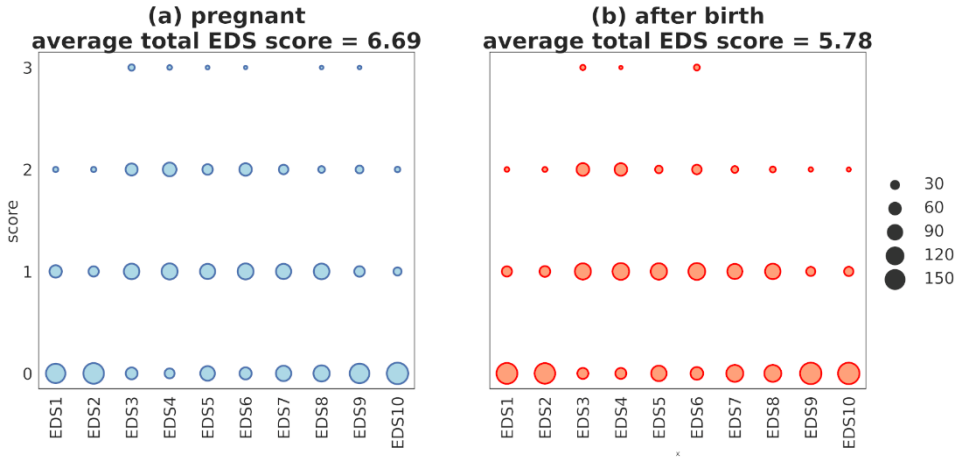

Figure 4: EDS by question

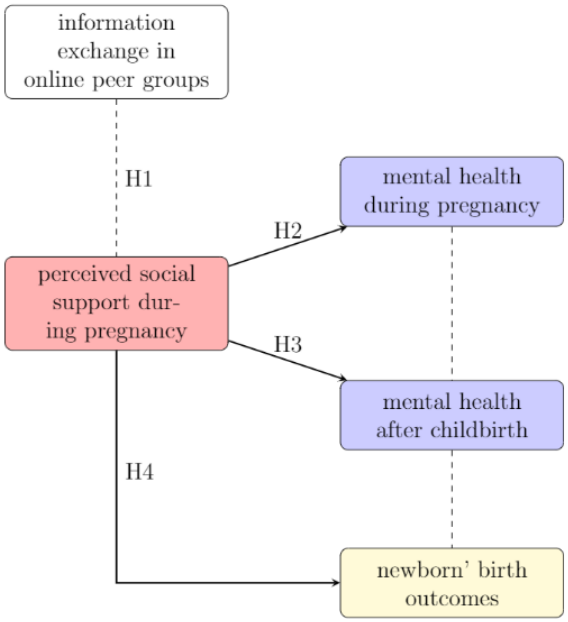

Figure 5: Hypotheses

Table 1: Survey descriptive statistics

VARIABLES	(1) Pregnant	(2) After childbirth	(3) Full sample
Day of EDD (1st-30th/31st)	16.747	15.925	16.418
	(7.313)	(7.627)	(7.443)
Xth-Month since pregnancy[1]	6.647	16.455	10.570
	(1.539)	(2.703)	(5.241)
Community as main source of info[2]	6.127	6.130	6.128
	(0.774)	(0.804)	(0.785)
Age	28.107	28.450	28.244
	(2.006)	(2.175)	(2.080)
Health indicators[3]			
-Whether smoke or drink	0.006	0	0.004
	(0.082)	(0)	(0.063)
-Hours of sleep (categories 1-4)	3.600	3.345	3.498
	(0.617)	(0.713)	(0.668)
-Physical exercise (categories 1-4)	2.013	1.830	1.940
	(0.649)	(0.619)	(0.643)
Observations	300	200	500

Notes: Means reported with standard deviations in parentheses.
1 For all users (pregnant or after childbirth), it indicates the number of months since they were pregnant.
2 A scale (1-7) of using this community as the main source of pregnancy-related information.
3 Hours of sleep is a categorical variable ranging from below 5, 5-6, 6-7, to above 7 hours; Physical exercise is a categorical variable ranging from below 30, 30-60, 60-120, to above 120 minutes.

Table 2: Cronbach's alpha for modified MSPSS items

Item	Obs	Sign	Inter-test correlation	Inter-rest correlation	Average interitem covariance	alpha
MSPSS1	500	+	0.6590	0.4963	.1684573	0.6003
MSPSS2	500	+	0.6851	0.4688	.1526192	0.6004
MSPSS3	500	+	0.5749	0.3581	.1839018	0.6406
MSPSS4	500	+	0.5736	0.3453	.1838032	0.6454
MSPSS5	500	+	0.5972	0.3787	.1779723	0.6339
MSPSS6	500	+	0.6045	0.3634	.1751844	0.6409
Test scale					.1736564	**0.6689**

Table 3: Cronbach's alpha for EDS items

Item	Obs	Sign	Inter-test correlation	Inter-rest correlation	Average interitem covariance	alpha
EDS1	500	+	0.5199	0.4179	.1491366	0.8191
EDS2	500	+	0.5323	0.4351	.148905	0.8178
EDS3	500	+	0.5546	0.3909	.1392947	0.8276
EDS4	500	+	0.6859	0.5709	.1300821	0.804
EDS5	500	+	0.7260	0.6242	.127321	0.7978
EDS6	500	+	0.6410	0.5089	.132877	0.8116
EDS7	500	+	0.7121	0.6131	.1300251	0.7994
EDS8	500	+	0.7092	0.6195	.1328529	0.7998
EDS9	500	+	0.6551	0.5563	.1372496	0.8062
EDS10	500	+	0.5353	0.4481	.1502806	0.8175
Test scale					.1378024	**0.8261**

Table 4: Mental health measured by EDS

VARIABLES	(1) Pregnant	(2) Pregnant	(3) After childbirth	(4) Full sample
MSPSS	-0.190*	-0.197*	-0.258***	-0.247***
	(0.104)	(0.110)	(0.0839)	(0.0667)
Whether smoke or drink	6.569***	5.918***	-	6.774***
	(0.560)	(0.957)	-	(0.467)
Hours of sleep	-1.629***	-1.668***	-1.119***	-1.212***
	(0.372)	(0.375)	(0.357)	(0.263)
Physical exercise	0.513	0.595	-0.681	0.235
	(0.369)	(0.371)	(0.459)	(0.287)
Age	-0.141	-0.107	0.192	-0.0224
	(0.133)	(0.129)	(0.133)	(0.0946)
Constant	22.26***	23.30***	14.63**	19.58***
	(5.406)	(5.455)	(5.876)	(4.011)
X-th month since pregnancy FE	No	Yes	No	No
Observations	300	300	200	500
R-squared	0.104	0.133	0.127	0.088

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
MSPSS: The total score of a modified 6-item multidimensional Perceived Social Support Scale, ranging from 0-42 points.
The variable "whether smoke or drink" is omitted in Column (3) as no users report smoking or drinking after childbirth.
Hours of sleep is a categorical variable ranging from below 5, 5-6, 6-7, to above 7 hours.
Physical exercise is a categorical variable ranging from below 30, 30-60, 60-120, to above 120 minutes.

Table 5: Mental health measured by EDS (extended)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
MSPSS1	-1.071***					
	(0.267)					
MSPSS2		-0.452				
		(0.218)				
MSPSS3			-0.297			
			(0.225)			
MSPSS4				-0.935***		
				(0.213)		
MSPSS5					-0.595*	
					(0.226)	
MSPSS6						-0.208
						(0.179)
Whether smoke or drink	7.155***	6.768***	6.834***	6.262***	6.715***	6.626***
	(0.791)	(0.362)	(0.423)	(0.393)	(0.828)	(0.508)
Hours of sleep	-1.169***	-1.253***	-1.211***	-1.295***	-1.223***	-1.232***
	(0.263)	(0.268)	(0.272)	(0.268)	(0.265)	(0.271)
Physical exercise	0.233	0.241	0.262	0.306	0.301	0.251
	(0.287)	(0.293)	(0.289)	(0.288)	(0.288)	(0.293)
Age	-0.00382	-0.0129	0.00102	-0.00726	-0.0236	0.00420
	(0.0954)	(0.0961)	(0.0971)	(0.0962)	(0.0970)	(0.0969)
Constant	16.58***	13.24***	11.81***	16.03***	14.30***	11.21***
	(3.496)	(3.428)	(3.429)	(3.278)	(3.565)	(3.280)
Observations	500	500	500	500	500	500
R-squared	0.087	0.064	0.057	0.090	0.068	0.056

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
We apply the Bonferroni correction for multiple testing, i.e., the significance levels are reported after each coefficient's p-value is multiplied by 6, the number of tests here.
MSPSS1: I have learned useful information from others in the peer group.
MSPSS2: There are some people in the peer group who are a real source of comfort to me.
MSPSS3: There are some people in the peer group who are around when I am in need.
MSPSS4: I get the emotional help and support I need from others in the peer group.
MSPSS5: I can talk about my problems in the peer group.
MSPSS6: People in the peer group are willing to help me make some decisions.

Table 6: Newborns' birth outcomes

VARIABLES	(1) Newborn's weight (gram)	(2) Breastfeeding	(3) Planned natural birth
MSPSS	14.49***	-0.0398	0.0363
	(4.552)	(0.0340)	(0.0285)
Hours of sleep	-1.872	0.156	0.150
	(37.51)	(0.139)	(0.154)
Physical exercise	-145.7***	-0.282*	0.204
	(41.09)	(0.162)	(0.198)
Age	-14.36	0.0217	0.0539
	(11.26)	(0.0497)	(0.0569)
Constant	3,494***	1.579	-2.506
	(403.5)	(2.082)	(2.069)
Observations	200	200	200
R-squared	0.083	0.027	0.035

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
The variable "whether smoke or drink" is omitted as no users report smoking or drinking after childbirth. Hours of sleep is a categorical variable ranging from below 5, 5-6, 6-7, to above 7 hours. Physical exercise is a categorical variable ranging from below 30, 30-60, 60-120, to above 120 minutes.