Research paper

# COVID-19 and delayed antenatal care impaired pregnant women's quality of life and psychological well-being: What supports should be provided? Evidence from Vietnam

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A B S T R A C T

*Background:* This study explored the associations between different structural and functional supports with the quality of life (QOL) and mental well-being of pregnant women whose antenatal care was delayed due to the COVID-19 pandemic in Vietnam.
*Methods:* A multi-center cross-sectional study was performed on 868 pregnant women. The pregnant women's quality of life questionnaire (QOL-GRAV), the Edinburgh Postnatal Depression Scale (EPDS), and the Perinatal Infant Care Social Support (PICSS) instruments were employed. The satisfaction with care from different sources was measured. Multivariate Tobit Regression models were used.
*Results:* Seventy pregnant women (8.1%) reported that their antenatal care was influenced by the COVID-19. In this group, a higher level of satisfaction with the care of parents-in-law and a higher score of emotional support were associated with a better "Physical and Emotional changes" domain, while a higher level of appraisal support was related to poorer "Physical and Emotional changes" domain. A higher level of satisfaction with relatives' care and a higher score of emotional support were correlated with a better "Life Satisfaction" domain. EPDS score was negatively correlated with satisfaction with parents-in-law care and appraisal support.
*Conclusions:* Our study highlighted that intervention programs to improve the QOL and psychological well-being of pregnant women in epidemics such as COVID-19 or other diseases in the future should involve other family members such as parents-in-law and relatives as sources of support.
*Limitations:* The cross-sectional design was unable to draw causal relationships. Recall bias might occur. The convenient sampling method might limit the generalizability of findings.

## 1. Introduction

Pregnant women are recognized as one of the most vulnerable populations to the COVID-19 pandemic (Moore and Suthar, 2021). Due to significant changes in the immune system, pregnant individuals have a higher risk of severe illness and death compared to non-pregnant women (Ellington et al., 2020; Jering et al., 2021; Lokken et al., 2021; Zambrano et al., 2020). In addition, in comparison with pregnant women without COVID-19, individuals with the COVID-19 have a higher risk of pregnancy complications such as preterm delivery, preeclampsia,

premature fetal membrane rupture, or venous thromboembolism (Ben-hamou et al., 2020; Figliozzi et al., 2020; Mendoza et al., 2020), which are remarkably contributed by the extrapulmonary pathologies (Dela-hoy et al., 2020; Dubey et al., 2020). This situation is more likely to be exacerbated when the COVID-19 pandemic disrupts access to essential maternal health care services and delays treatment (Ombere, 2021a; World Health Organization, 2020). In addition to physical problems, during the pandemic, pregnant women face a significant burden of mental disorders, for example, depression or anxiety (Kajdy et al., 2020; Lebel et al., 2020; Rashidi Fakari and Simbar, 2020; Salehi et al., 2020). Response measures such as social distancing and strict quarantine can isolate pregnant women from needed instrumental and emotional support (Kotlar et al., 2021). Negative psychological impacts were also observed in infertile women whose in vitro fertilization treatment was postponed because of the pandemic (Barra et al., 2020; Tokgoz et al., 2020). Studies also documented an increase in domestic violence (Kot-lar et al., 2021; Ombere, 2021b), and negative emotions such as anger, fear, and despair during the pandemic, especially in areas where implement social distancing or lockdown measures (Milne et al., 2020; Ren et al., 2020).

Ensuring QOL of pregnant women is important for good pregnancy outcomes (Diego et al., 2004; Lagadec et al., 2018). Several previous studies have shown that during the COVID-19 pandemic, pregnant women had a considerably lower QOL than non-pregnant individuals and the general population (Alaya et al., 2021; Mirzaei et al., 2021; Zeng et al., 2020). A previous study in Spain reported that pregnant women who were confined due to COVID-19 had a significantly low QOL (Biviá-Roig et al., 2020). The need for interventions and policies to help improve the QOL of pregnant women is highlighted, and factors such as improving the quality of maternity care services and increasing support from family and society have central roles (Alaya et al., 2021; Jago et al., 2020; Mirzaei et al., 2021). The stress-buffering hypothesis underlines the importance of social support in mediating the negative consequences of stressors on health (Cohen and Wills, 1985). Social support includes functional (e.g., instrumental or emotional support) and structural (e.g., type of relationships) aspects. Previous literature revealed that appropriate social support was associated with good health and pregnancy outcomes (Akiki et al., 2016; Azimi et al., 2018; Collins et al., 1993; Gümüşsoy et al., 2021; Nath et al., 2019). Moreover, pregnant individuals who are highly satisfied with their marital re-lationships are more likely to have healthy behaviors (Waite, 1997). Regarding QOL, a previous systematic review showed that having good family and friend relations was positively related to the QOL of pregnant women (Lagadec et al., 2018). Another study found that providing instrumental and emotional support was associated with higher QOL in psychological, social, and environmental domains (Iwanowicz-Palus et al., 2019). During the COVID-19 pandemic, a study in Israel showed that pregnant women who delivered during the COVID-19 pandemic were less likely to develop post-partum depression compared to those delivering before the pandemic, which might be contributed by a higher level of family cohesiveness (Pariente et al., 2020). Another study in Ethiopia found that social support was positively related to high QOL among pregnant individuals (Dule et al., 2021).

Vietnam is one of the countries having a well-controlled COVID-19 epidemic in the first year of the pandemic (Institute, 2021), resulting in less disruption to health and maternity care activities at health facilities (Tran et al., 2020). However, COVID-19 pandemic response strategies may delay access to healthcare in pregnant women during certain periods due to social distancing policies. This study explored the associations between different structural and functional supports with the QOL and mental well-being of pregnant women under different influences of COVID-19 in antenatal care in Vietnam. The study may provide information for the development of interventions to improve the QOL of pregnant women in the context of the COVID-19 epidemic, as well as during similar pandemics in the future.

## 2. Methods

### 2.1. Study design and participants

This is a secondary analysis of a multicenter cross-sectional survey that was performed in Hanoi and Ca Mau provinces from January to February 2021. During this period, Vietnam experienced the third wave of COVID-19 (from January to March 2021) with 413 confirmed cases. Before this period, Hanoi underwent city-wide social isolation in April 2020, while Ca Mau province had not yet implemented social isolation because the epidemic was not serious. Hanoi Obstetrics Hospital and Ca Mau Obstetrics and Pediatrics Hospital were selected as study settings. The former was locked down once in April 2020, while the latter hospital had not been locked down due to no COVID-19 cases.

The description of the study design had been published elsewhere (Nguyen et al., 2021). In brief, we included pregnant women who were aged 18 years or above, agreed to participate in the study by giving written informed consent and had no physical and mental impairment that affected the ability to answer the questionnaire. Pregnant individuals withdrawing before completing the survey were excluded. We used a convenient sampling method for participant recruitment. Among 1019 pregnant women who were invited to the study, 868 answered the question about the effects of the COVID-19 pandemic on antenatal care (response rate 85.2%). The differences in age, number of children, and different functional supports according to the Perinatal Infant Care Social Support (PICSS) instrument were not statistically significant. The study ethical consideration was granted by the Institutional Review Board of the Hanoi Obstetrics and Gynecology Hospital (code 07 QD/PS-TTDT CDT dated January 6, 2021). Respondents had the right to refuse to participate in the study or stop answering during the interview for any reason. All participants' information was kept confidential and only used for research purposes.

### 2.2. Data collection and measurement

A structured questionnaire was developed for the face-to-face in-terviews. Pregnant individuals were firstly screened for the eligibility criteria by the physicians and nurses, then they were invited to become study participants and go to a counseling room for data collection. They were provided a brief introduction about the purpose and design of the study and asked to give written informed consent. The questionnaire contained the following sections:

*Demographic and pregnancy characteristics:* We collected information about age, education level, living arrangement, number of children, pregnancy status (pregnant women/recently delivered), frequency of antenatal care visit in this pregnancy, and ever having pregnancy complications.

*COVID-19 and delayed antenatal care:* In this study, we asked the following question "Has the COVID-19 pandemic affected your mater-nity care?" with three options:

- When I was pregnant, there was no local COVID-19 epidemic;
- There was a local COVID-19 outbreak when I was pregnant, but my maternity care has not been affected;
- My maternity care has been affected by COVID-19.

After that, we asked participants to report the frequency of the following delayed antenatal care activities in this pregnancy:

- Unable to call the physicians for advice;
- Unable to buy necessary food and supplements for maternity care (such as vitamins, medicine, milk or others);
- No vehicles available for visiting hospitals for maternity examination;
- Unable to have regular maternity check-ups as scheduled;
- Unable to meet physicians for antenatal care when visiting hospitals;

- Unable to use necessary maternity care services (such as tests, ul-trasounds, etc.);
- Unable to participate in seminars and clubs on maternity as scheduled;
- Read untruthful maternity information on the Internet;

Each activity had five options for responses from 1= Never; 2=Sometimes; 3=Often; 4=Usually and 5=Always. Participants answering options 2 to 5 were classified into the "Experiencing delayed antenatal care" group; while others were categorized into "Not experiencing delayed antenatal care". The Cronbach's alpha of these items was excellent at 0.929.

*Quality of life*: We employed the pregnant women's quality of life questionnaire (QOL-GRAV) for measuring the QOL. This is a validated instrument with nine items about different physical and psychological changes and life satisfaction during pregnancy in the last two weeks (Vachkova et al., 2013). These items included:

1. To what extent do you feel that your physical changes associated with this pregnancy do not allow you to do what you need? (Q1)
2. To what extent do you feel that your psychological changes associated with this pregnancy do not allow you to do what you need? (Q2)
3. How worried are you about not being able to handle household chores? (Q3)
4. How worried are you about carrying out the pregnancy successfully? (Q4)
5. How worried are you about not being able to handle labor and delivery? (Q5)
6. Have you been forced to cut down on your physical activity during this pregnancy? (Q6)
7. How satisfied are you with your partner now? (Q7)
8. How satisfied are you with your social life now? (Q8)
9. How satisfied are you with how you manage to adapt to this pregnancy? (Q9)

Each item had five response options from 0 = Not at all; 1 = A little; 2 = A middle; 3 = A lot; 4=Absolutely. The scores of the last three items were reversed. The total score of this instrument ranged from 0 to 36, with a higher score indicating lower QOL. The Cronbach's alpha of these items was good at 0.854.

*Mental well-being*: We used the Edinburgh Postnatal Depression Scale (EPDS) to screen the perinatal depression among pregnant women. This is the most widely used instrument for measuring depression in pregnant individuals in the last two weeks (Levis et al., 2020). This instrument included 10 items with a score ranging from 0 to 3 in each item. The total score of this instrument ranged from 0 to 30, with a higher score indicating a higher level of depression. The Cronbach's alpha of these items was satisfactory at 0.759.

*Family and Social support*: In this study, we examined both structural and functional social support for pregnant women. For functional support, we employed the PICSS instrument to evaluate maternal social support (Leahy-Warren et al., 2019). There were 22 items in this instrument, and each item had four options for response: 1=Strongly disagree, 2=Disagree, 3=Agree; 4=Strongly agree. These items were used to measure four functional supports including appraisal support (score 4–16), emotional support (score 4–16), information support (score 7–28) and instrument support (score 7–28) (Leahy-Warren et al., 2019). A higher score revealed higher support (Leahy-Warren et al., 2019). The Cronbach's alpha of these items was excellent at 0.9743. For structural support, we asked participants to rate their satisfaction with care from different sources, including partners, parents-in-law, parents, siblings, relatives, and friends. Each source was rated with an 11-point scale from 0=Completely dissatisfaction to 10 =Completely satisfaction. The Cronbach's alpha of these questions was excellent at 0.978.

### 2.3. Statistical analysis

The post-hoc calculation of power was calculated with the reference of QOL-GRAV values from a previous study in the Slovak Republic (Mazúchová et al., 2018) (mean=13.8, standard deviation = 2.7 after transformation), the total score of QOL-GRAV in our study (mean=15.20), the alpha value ($\alpha$=0.05), and the sample size in our study ($n$ = 868). The result showed 100% power, suggesting that the sample size in this study was sufficiently significant (Rosner, 2015). Stata software version 16.0 (StataCorp LLC, Texas, USA) was utilized. Descriptive analysis of the variables was performed including frequency, percentage, mean and standard deviation (SD). Comparisons in delayed antenatal care activities, QOL, and EPDS scores were conducted between those being affected and those not being affected by the COVID-19 pandemic by using the Chi-squared test and Mann-Whitney test. Exploratory factor analysis (EFA) with the principal component analysis was carried out to examine the construct validity of the QOL-GRAV instrument. By using scree plot and parallel analyses, we identified two factors for this instrument. Orthogonal varimax rotation with Kaiser normalization was used with a value of 0.4 as a cut-off threshold for factor loading. We then calculated the total score of each factor and explored the ceiling effect, floor effect, and internal consistency reliability.

Cohen's D effect size was computed to evaluate the clinical difference in QOL and EPDS scores between pregnant women who were and were not affected by the COVID-19 pandemic. The effect size value of more than 0.2 was considered significant differences (Cohen, 1977). As data of QOL and EPDS scores were censored, we used multivariate Tobit regression to analyze the associations between social support and QOL and EPDS. Three regression models were conducted with three outcomes: QOL-GRAV Factor 1 score; QOL-GRAV Factor 2 score; and EPDS score. A listwise deletion strategy was applied to handle the missing data. The independent variables consisted of levels of satisfaction with care from partner, parents-in-law, parents, siblings, relatives, and friends; and four domains of PICSS instrument including appraisal support, emotional support, information support, and instrument support. We stratified our sample into two groups: under COVID-19′s influence and not under COVID-19′s influence to identify the appropriate support in each context. These models were adjusted for other variables. Statistical significance was detected when a p-value was less than 0.05.

**Table 1**
Factor loading for QOL-GRAV instrument.

| Items | Mean | SD | Factor loading | |
|---|---|---|---|---|
| | | | Factor 1: Physical and Emotional Changes | Factor 2: Life Satisfaction |
| Q1 | 1.56 | 0.78 | 0.799 | |
| Q2 | 1.55 | 0.76 | 0.828 | |
| Q3 | 1.31 | 0.79 | 0.644 | |
| Q4 | 1.64 | 0.85 | 0.789 | |
| Q5 | 1.70 | 0.86 | 0.766 | |
| Q6 | 1.63 | 0.79 | 0.728 | |
| Q7 | 2.10 | 0.97 | | 0.889 |
| Q8 | 2.01 | 0.86 | | 0.892 |
| Q9 | 2.10 | 0.92 | | 0.853 |
| Ceiling effect (%) | | | 2.2% | 4.2% |
| Floor effect (%) | | | 0.0% | 1.10% |
| Cronbach's alpha | | | 0.895 | 0.927 |
| Mean | | | 9.40 | 5.79 |
| SD | | | 3.91 | 2.57 |

Abbrev: QOL-GRAV: Pregnant women's quality of life questionnaire.

## 3. Results

Results of factor analysis are presented in Table 1. There were two new factors including "Physical and Emotional Changes" (6 items – scoring from 0 to 24) and "Life Satisfaction" (3 items – scoring from 0 to 12). The Cronbach's alpha was good and excellent at 0.895 and 0.927, respectively. The mean scores of Factor 1 and Factor 2 were 9.40 (SD=3.91) and 5.79 (SD=2.57), respectively.

Of 868 pregnant women, most of the participants aged 26–30 years (40.1%) and received antenatal care in Hanoi (55.9%). The majority of them had above high school education (52.0%). There were 73.3% of respondents already having one child or above, and 66.8% of women were not delivered. The proportion of pregnant women following physician's instructions for the frequency of antenatal care visits was the highest at 48.4%. Approximately 13% of respondents ever experienced any pregnancy complication in this pregnancy. For structural support, the lowest satisfaction with care was for parents-in-law (mean=7.8, SD=2.4), whereas the highest satisfaction was for parents (mean=8.2, SD=2.2). Meanwhile, in terms of functional support, the mean scores of appraisal support, emotional support, information support, and instrument support were 12.2 (SD=1.4), 12.3 (SD=1.5), 21.5 (SD=2.7), and 21.5 (SD=2.6), respectively (Table 2).

Seventy pregnant women (8.1%) reported that their antenatal care

was influenced by the COVID-19 pandemic. The significant differences were found only in two problems "Unable to call the physicians for advice" and "Read untruthful maternity information on the Internet" ($p<0.05$). (Table 3)

Table 4 depicts that pregnant women who were affected by the COVID-19 pandemic had significantly higher QOL scores (in both factors and total score), which means a lower level of QOL, and higher EPDS scores compared to their counterparts ($p<0.01$). Results of Cohen's D effect size were above 0.2 in all QOL and EPDS scores, suggesting the significant difference between pregnant women who were and were not affected by the COVID-19 pandemic. The effect was the highest in "Physical and Emotional changes" domain, following by EPDS score and "Life satisfaction" domain.

Table 5 illustrates the results of multivariate regression analysis. Among pregnant women being affected by COVID-19, higher satisfaction with parents-in-law's care (Coef. = −1.05, 95%CI=−1.94; −0.15) and a higher score of emotional support (Coef. = −1.93, 95%CI= −3.42; −0.44) were associated with better "Physical and Emotional changes", while a higher level of appraisal support was related to poorer "Physical and Emotional changes" (Coef.= 1.74, 95%CI=0.02; 3.47). Meanwhile, a higher level of satisfaction with relatives' care and a higher score of emotional support were correlated with a better "Life Satisfaction" domain . EPDS score was negatively correlated with satisfaction with parents-in-law care and appraisal support.

In individuals without the influence of COVID-19, while no support was associated with "Life satisfaction", higher satisfaction with care of partner, parents-in-law and higher appraisal support were negatively associated with the "Physical and Emotional changes" score. Higher satisfaction with siblings and higher information support were positively related to "Physical and Emotional changes". Meanwhile, a higher level of satisfaction with parents-in-law's care (Coef.= −1.13; 95%CI= −2.05; −0.22) and a higher score of emotional support (Coef.= −2.35; 95%CI= - 3.88; −0.82) were negatively associated with EPDS score.

**Table 2**
Demographic characteristics, pregnancy characteristics, family and social support ($n = 868$).

| Characteristics | | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Age groups | ≤ 25 years | 253 | 29.7 |
| | 26–30 years | 342 | 40.1 |
| | 31–35 years | 178 | 20.9 |
| | 36–40 years | 66 | 7.8 |
| | ≥ 41 years | 13 | 1.5 |
| Location | Hanoi | 483 | 55.9 |
| | Ca Mau | 381 | 44.1 |
| Education | < High school | 128 | 14.8 |
| | High school | 287 | 33.2 |
| | > High school | 449 | 52.0 |
| Living arrangement | Parents | 88 | 10.1 |
| | Parents-in-law | 392 | 45.2 |
| | Only spouse and/or children | 452 | 52.1 |
| Number of children | None | 223 | 26.7 |
| | One or above | 612 | 73.3 |
| Pregnancy status | Pregnant women | 576 | 66.8 |
| | Recently delivered | 286 | 33.2 |
| Frequency of antenatal care visit | Once a week | 72 | 8.4 |
| | Once a month | 215 | 24.9 |
| | Less than once per month | 158 | 18.3 |
| | Follow physician's instructions | 417 | 48.4 |
| Ever having pregnancy complications | No | 756 | 87.1 |
| | Yes | 112 | 12.9 |
| | | **Mean** | **SD** |
| Satisfaction with care | Partner (0–10) | 8.1 | 2.2 |
| | Parents-in-law (0–10) | 7.8 | 2.4 |
| | Parents (0–10) | 8.2 | 2.2 |
| | Siblings (0–10) | 8.0 | 2.3 |
| | Relatives (0–10) | 7.9 | 2.3 |
| | Friends (0–10) | 7.9 | 2.3 |
| Perinatal Infant Care Social Support (PICSS) | Appraisal support (4–16) | 12.2 | 1.4 |
| | Emotional support (4–16) | 12.3 | 1.5 |
| | Information support (7–28) | 21.5 | 2.7 |
| | Instrument support (7–28) | 21.5 | 2.6 |

Abbrev: PICSS: Perinatal Infant Care Social Support.

**Table 3**
COVID-19 pandemic and delayed antenatal care ($n = 868$).

| Characteristics | COVID-19 pandemic affected antenatal care | | | | | | p-value |
|---|---|---|---|---|---|---|---|
| | No | | Yes | | Total | | |
| | n | % | n | % | n | % | |
| **Total** | 798 | 91.9 | 70 | 8.1 | 868 | 100.0 | |
| **Delayed antenatal care** | | | | | | | |
| Unable to call the physicians for advice | 264 | 33.2 | 34 | 48.6 | 298 | 34.5 | 0.01 |
| Unable to buy necessary food and supplements for maternity care (such as vitamins, medicine, milk, etc.) | 216 | 27.1 | 16 | 22.9 | 232 | 26.8 | 0.44 |
| No vehicles available for visiting hospitals for maternity examination | 207 | 26.0 | 12 | 17.1 | 219 | 25.3 | 0.10 |
| Unable to have regular maternity check-up as scheduled | 246 | 30.9 | 26 | 37.1 | 272 | 31.4 | 0.28 |
| Unable to meet physicians for antenatal care when visiting hospitals | 215 | 27.0 | 22 | 31.4 | 237 | 27.4 | 0.43 |
| Unable to use necessary maternity care services (such as tests, ultrasounds, etc.) | 198 | 24.9 | 13 | 18.6 | 211 | 24.4 | 0.24 |
| Unable to participate in seminars and clubs on maternity as scheduled | 304 | 38.2 | 34 | 48.6 | 338 | 39.0 | 0.09 |
| Read untruthful maternity information on the Internet | 287 | 36.1 | 37 | 52.9 | 324 | 37.5 | <0.01 |

**Table 4**
Quality of life and depression regarding the influence of the COVID-19 epidemic ($n = 868$).

| Characteristics | COVID-19 pandemic affected antenatal care | | | | | | | p-value |
|---|---|---|---|---|---|---|---|---|
| | No | | Yes | | Total | | Cohen's D effect size | |
| | Mean | SD | Mean | SD | Mean | SD | | |
| QOL-GRAV | | | | | | | | |
| Physical and Emotional changes (0–24) | 9.20 | 3.79 | 11.89 | 4.44 | 9.40 | 3.91 | 0.70 | <0.01 |
| Life satisfaction (0–12) | 5.87 | 2.61 | 4.82 | 1.78 | 5.79 | 2.57 | 0.41 | <0.01 |
| Total (0–36) | 15.09 | 4.09 | 16.66 | 4.10 | 15.20 | 4.11 | 0.38 | <0.01 |
| EPDS score (0–30) | 7.74 | 3.78 | 10.44 | 4.97 | 7.94 | 3.94 | 0.69 | <0.01 |

Abbrev: QOL-GRAV: Pregnant women's quality of life questionnaire; PICSS: Perinatal Infant Care Social Support; EPDS: Edinburgh Postnatal Depression Scale.

## 4. Discussion

This analysis provided insights into delayed antenatal due to COVID-19, effects of these delays on QOL and mental well-being, and the relevance of different aspects of family and social support to these outcomes of pregnant women in Vietnam. Study results showed that the difference in QOL between pregnant individuals with and without being influenced by COVID-19 was significant. Furthermore, in addition to the partners' support, this study explored the critical roles of other sources of support, such as parents-in-law and relatives, in affecting the QOL of pregnant women. These findings are critical for further implications to improve the QOL of women during pregnancy during COVID-19 and other epidemics that might occur in the future.

The family has a significant role in Vietnamese culture (Hirschman and Minh, 2002). Normally, couples have three choices after marriage, including living with the husband's parents, living with the wife's parents, and not living with anyone (Hirschman and Minh, 2002). In which, the first and the third types are the two most common (Hirschman and Minh, 2002), which was supported by the results of this study. Thus, when women live with their partner's family, they are exposed to other people such as their parents-in-law and partner' relatives, as well as are influenced by the rules set in the family. On the other hand, for women who live only with their partners, even though they are not directly affected by their partner's family members, these women may be partly influenced when they communicate and share experiences with their partners' family, particularly about maternal care. Previous studies revealed that traditional experiences and beliefs of the partner's parents and relatives in maternity care can put great pressure on pregnant women, which then affected their QOL and mental well-being (Gammeltoft, 2018; Murray et al., 2015).

Findings of this study showed that, among pregnant women whose maternity care was affected by COVID-19, there was no association between partners' care and QOL and mental well-being. This was different from some other studies where the support from partners was the most important source of support, and a good marital relationship was the main predictor in the improvement of pregnant women's QOL (Lagadec et al., 2018; Nohara and Miyagi, 2009). This phenomenon could be explained by several factors. First, the sample size in this group was small, which might reduce the power of the analysis. Therefore, although the results of the analysis showed that a higher level of partner's care satisfaction was associated with improved QOL of pregnant women in all aspects, the association was not significant. Second, there might be homogeneity in the partner care in this pregnant women group, leading to no association between this factor and the QOL of these women.

Nonetheless, the study's findings suggested the role of two other sources of support: supports from parents-in-law in improving "Physical and Emotional Changes" and reducing depression during pregnancy; and supports from relatives in improving "Life satisfaction". These findings can be explained through the involvement of these two groups in maternity care in traditional Vietnamese culture as discussed above (Murray et al., 2015). In general, the pregnancy period puts great pressure on women both physically and mentally, as well as greatly affects their life satisfaction. Pressures from others in maternity care can quickly damage women's health (Diego et al., 2004; Lagadec et al., 2018). Being affected by the COVID-19 pandemic could more exacerbate these negative physical and psychological changes among pregnant women (Alaya et al., 2021; Mirzaei et al., 2021; Rashidi Fakari and Simbar, 2020; Salehi et al., 2020; Zeng et al., 2020). The results of this study showed that positive supports from parents-in-law and relatives, specifically emotional support, were of the most important support to improve the QOL of pregnant women. Specific emotional supports included sharing feelings, care, and concern, as well as providing advice on problem-solving (Leahy-Warren et al., 2019). On the other hand, findings indicated that providing high appraisal support could decrease QOL in terms of "Physical and Emotional Changes" despite the improvement of depression. Appraisal support refers to the sharing of experience, recognition of maternity care skills, and an understanding of a mother's need for support (Leahy-Warren et al., 2019). This support could be a critical source in improving QOL when the pregnant women were not influenced by the COVID-19 pandemic, as shown in the regression model. However, during the pandemic, when experiences in maternity care changed rapidly to adapt to the change of environment, this negative association might be explained by the matter that high appraisal support might create stress for women in need of self-improvement in maternity care (Jago et al., 2020; Ombere, 2021a). Therefore, for pregnant women who were influenced by COVID-19, it is necessary to offer appropriate support strategies for each pregnancy period to avoid creating unnecessary pressure on pregnant women.

This study has several clinical and public health implications. First, obstetricians should identify pregnant women who were affected by the COVID-19 since they were remarkably vulnerable to lower QOL and higher psychological problems. Telehealth counseling and examination should be provided to these women to ensure that they would have sufficient care and attention during their pregnancy. Moreover, physicians should also raise the importance of social and family relationships to antenatal care during the COVID-19 pandemic. Second, the findings of this study emphasized that during this pandemic, for pregnant women, besides partners, the role of others such as parent-in-law and relatives was critical for maternal care. Therefore, health education communication strategies are essential to raising awareness among those about maternity health care.

Our study had strengths including a large sample size at multiple centers and applying validated international scales with high reliability. However, several limitations in this study should be noted. Firstly, we used a cross-sectional study design, which was unable to draw a causal relationship between social support factors with QOL and mental well-being. Longitudinal studies should be performed to examine these relationships. Second, participants needed to recall their information to answer the structured questionnaire, leading to an increased risk of recall bias. We used techniques and cross-checking questions to help them recall this information to minimize this bias. Third, this study uses a convenient sampling method in two hospitals; therefore, the application of these results to other study settings is limited.

**Table 5**
Associations between different supports and satisfaction with the quality of life and antenatal depression.

| Characteristics | QOL-GRAV Physical and Emotional changes Coef. (95%CI) | QOL-GRAV Life satisfaction Coef. (95%CI) | EPDS score Coef. (95% CI) |
|---|---|---|---|
| **COVID-19 affected antenatal care** | | | |
| Satisfaction with care | | | |
| Partner | −0.48 (−1.63; 0.67) | −0.01 (−0.19; 0.17) | 0.01 (−0.26; 0.28) |
| Parents-in-law | −1.05 (−1.94; −0.15)* | 0.11 (−0.07; 0.29) | −0.46 (−0.73; −0.19)* |
| Parents | 0.64 (−0.7; 1.99) | 0.11 (−0.11; 0.33) | −0.14 (−0.47; 0.2) |
| Siblings | 0.16 (−0.58; 0.9) | 0.15 (−0.14; 0.43) | 0.19 (−0.23; 0.62) |
| Relatives | −1.45 (−3.49; 0.6) | −0.39 (−0.67; −0.11)* | −0.08 (−0.51; 0.34) |
| Friends | 1.85 (−0.12; 3.82) | 0.15 (−0.07; 0.37) | −0.09 (−0.42; 0.23) |
| PICSS | | | |
| Appraisal support | 1.74 (0.02; 3.47)* | 0.15 (−0.09; 0.38) | −0.51 (−0.86; −0.16)* |
| Emotional support | −1.93 (−3.42; −0.44)* | −0.29 (−0.54; −0.03)* | 0.11 (−0.27; 0.49) |
| Information support | −0.34 (−1.14; 0.47) | −0.09 (−0.22; 0.03) | 0.11 (−0.07; 0.30) |
| Instrument support | 0.68 (−0.22; 1.57) | 0.02 (−0.14; 0.18) | −0.19 (−0.43; 0.05) |
| **COVID-19 did not affect antenatal care** | | | |
| Satisfaction with care | | | |
| Partner | −0.34 (−0.63; −0.06)* | −0.49 (−0.98; 0.00) | 0.39 (−0.72; 1.50) |
| Parents-in-law | −0.33 (−0.61; −0.04)* | 0.22 (−0.19; 0.62) | −1.13 (−2.05; −0.22)* |
| Parents | −0.13 (−0.48; 0.22) | −0.25 (−0.85; 0.34) | −0.59 (−1.94; 0.77) |
| Siblings | 0.58 (0.13; 1.03)* | −0.24 (−0.58; 0.10) | 0.39 (−0.37; 1.15) |
| Relative | −0.19 (−0.64; 0.26) | 0.35 (−0.54; 1.24) | 1.14 (−0.85; 3.13) |
| Friends | −0.04 (−0.39; 0.3) | −0.07 (−0.95; 0.81) | −0.66 (−2.62; 1.29) |
| PICSS | | | |
| Appraisal support | −0.54 (−0.91; −0.17)* | −0.42 (−1.22; 0.37) | 1.48 (−0.29; 3.25) |
| Emotional support | 0.15 (−0.25; 0.56) | 0.06 (−0.62; 0.75) | −2.35 (−3.88; −0.82)* |
| Information support | 0.23 (0.04; 0.43)* | −0.15 (−0.52; 0.22) | −0.82 (−1.65; 0.00) |
| Instrument support | −0.12 (−0.37; 0.14) | 0.18 (−0.23; 0.59) | 1.00 (0.08; 1.92) |

Models were adjusted for age; education; location, number of children; pregnancy status; frequency of antenatal care visit, and ever having pregnancy complications; * $p < 0.05$; Abbrev: QOL-GRAV: Pregnant women's quality of life questionnaire; PICSS: Perinatal Infant Care Social Support; EPDS: Edinburgh Postnatal Depression Scale.

## 5. Conclusion

Our study provided initial evidence about the relationships between different types of support with QOL and the mental wellbeing of pregnant women during the COVID-19. The development of intervention programs to improve the QOL of pregnant women in epidemics such as COVID-19 or other diseases in the future should involve other family members such as parents-in-law and relatives as sources of support.

## CRediT authorship contribution statement

**Long Hoang Nguyen:** Conceptualization, Writing – original draft, Data curation. **Lam Duc Nguyen:** Conceptualization, Writing – original draft, Data curation, Formal analysis. **Ly Thi Ninh:** Conceptualization, Writing – original draft. **Ha Thu Thi Nguyen:** Data curation, Formal analysis, Writing – original draft. **Anh Duy Nguyen:** Data curation, Formal analysis, Writing – original draft. **Vu Anh Trong Dam:** Data curation, Formal analysis, Writing – original draft. **Tham Thi Nguyen:** Data curation, Formal analysis, Writing – original draft. **Huyen Phuc Do:** Data curation, Formal analysis, Writing – original draft. **Thuc Minh Thi Vu:** Data curation, Formal analysis, Writing – original draft. **Bach Xuan Tran:** Writing – original draft. **Carl A. Latkin:** Writing – original draft. **Cyrus S.H. Ho:** Writing – original draft. **Roger C.M. Ho:** Writing – original draft.

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