Psychological well-being and worries among pregnant women in the first trimester during the early phase of the COVID-19 pandemic in Denmark compared with a historical group: A hospital-based cross-sectional study

Lotte Broberg1,2, Ane L. Rom1,2,3, Mie G. de Wolff1,2, Stinne Høgh1,2,4, Nina O. Nathan1,2, Louise D. Paarlberg1,2, Karl B. Christensen5, Peter Damm1,6, Hanne Kristine Hegaard1,2

1Department of Obstetrics, Copenhagen University Hospital – Rigshospitalet, Copenhagen, Denmark
2The Research Unit for Women’s and Children’s Health, Copenhagen University Hospital – Rigshospitalet, Copenhagen, Denmark
3Research Unit of Gynecology and Obstetrics, Institute of Clinical Research, University of Southern Denmark, Odense, Denmark
4Neurobiology Research Unit, Copenhagen University Hospital – Rigshospitalet, Copenhagen, Denmark
5Section of Biostatistics, Department of Public Health, University of Copenhagen, Copenhagen, Denmark
6Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark

Correspondence
Lotte Broberg, Department of Obstetrics, section 4031, Copenhagen University Hospital – Rigshospitalet, Blegdamsvej 9, 2100 Copenhagen, Denmark.
Email: lotte.broberg@regionh.dk

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Abstract
Introduction: A pandemic may negatively influence psychological well-being in the individual. We aimed to assess the potential influence of the first national lockdown in Denmark (March to June 2020) due to the COVID-19 pandemic on psychological well-being and the content and degree of worries among pregnant women in early pregnancy.

Material and methods: In this hospital-based cross-sectional study based on self-reported data we compared psychological well-being and concerns among women who were pregnant during the first phase of the pandemic (COVID-19 group) (n = 685), with women who were pregnant the year before (Historical group) (n = 787). Psychological well-being was measured by the five-item World Health Organization Well-being Index (WHO-5), using a score ≤50 as indicator of reduced psychological well-being. Differences in WHO-5 mean scores and in the prevalence of women with score ≤50 were assessed using general linear and log-binomial regression analyses. The Cambridge Worry Scale was used to measure the content and degree of major worries. To detect differences between groups, Pearson’s Chi-square test was used.

Results: We found no differences in mean WHO-5 score between groups (mean difference 0.1 [95% CI -1.5 to 1.6]) or in the prevalence of women with WHO-5 score ≤50 (prevalence ratio 1.04, 95% CI 0.83–1.29) in adjusted analyses. A larger proportion of women in the COVID-19 group reported major worries about Relationship with husband/partner compared with the Historical group (3% [n = 19] vs 1% [n = 6], p = 0.04), and 9.2% in the COVID-19 group worried about the possible negative influence of the COVID-19 restrictions.

Abbreviations: CI, confidence interval; COVID-19, Coronavirus disease 2019; CWS, Cambridge Worry Scale; SD, standard deviation; WHO, World Health Organization; WHO-5, the five-item World Health Organization Well-Being Index.

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1 | INTRODUCTION

On 11 March 2020, the World Health Organization (WHO) declared a global pandemic and countries worldwide locked down to contain the spread of the coronavirus disease 2019 (COVID-19). In Denmark, daycare and educational institutions closed, public employees not performing critical functions were sent home, and private employees were encouraged to work from home. Thus, to a large extent, the Danish population was physically isolated from family, friends and their social community. National and international health authorities defined specific groups being at high risk of severe illness from the “COVID-19” and, as a precaution, from 16 March 2020, pregnant women were classified as a high-risk group.

WHO emphasizes that uncertainties and a changed daily life due to the severity of the COVID-19 may negatively influence psychological well-being. A systematic review (n = 93,569) including 19 studies showed a higher prevalence of anxiety, depression and distress in the general population during the COVID-19 pandemic compared with before the pandemic. These associations were stronger in women than in men. Similarly, in systematic reviews and meta-analyses, the COVID-19 pandemic was found to increase the risk of anxiety, depression and distress during pregnancy and the postpartum period. However, the majority of the included studies were either online surveys based on convenience sampling or did not include an appropriate comparison group.

In this study, we aimed to assess the potential influence of this first national lockdown on psychological well-being and the content and degree of worries among pregnant women in early pregnancy.

2 | MATERIAL AND METHODS

In a hospital-based cross-sectional study using routinely collected self-reported data, we compared women who were pregnant during the first phase of the national COVID-19 lockdown in Denmark (COVID-19 group) with a group of women from the same period in 2019 (Historical group). The setting of the study was the Department of Obstetrics, Rigshospitalet, which is a tertiary referral center and a primary birth facility of central Copenhagen with more than 5000 births annually. When booking a first-trimester ultrasound scan as part of routine antenatal care, women receive a questionnaire link including questions on sociodemographic characteristics, reproductive history, lifestyle, and information on current or previous mental and chronic medical conditions. As part of the national prenatal screening program, all pregnant women are offered this scan, and more than 90% attend. On average, the women respond to the questionnaires at a mean of 10.2 (standard deviation [SD] 2.1) weeks of gestation.

All pregnant women who received a questionnaire link from 12 March to 8 June 2020 (n = 993) or in the corresponding period of 2019 (n = 972) were eligible (Figure 1). We excluded women who had a miscarriage, moved to another birth facility, or registered with an incorrect social identification (ID) number. From 12 March to 8 June 2020, 76.4% of the 897 remaining women responded, leaving 685 women in the COVID-19 group. From 12 March to 8 June 2019, 87.2% of the 903 remaining women responded, leaving 787 women in the Historical group (Figure 1).

The end date of the first phase of the COVID-19 period was set at 8 June 2020, as from this date, public gatherings of more than 50 people were allowed. Accordingly, women who received a link to the questionnaire on 8 June were included if they responded before 18 June in 2019 and 2020, respectively (Figure 1).

2.1 | Measures

2.1.1 | Psychological well-being

Psychological well-being was measured by the five-item World Health Organization Well-being Index (WHO-5), which is a short,
2.1.2 | Worries

Worries were measured by the Cambridge Worry Scale (CWS). The CWS was developed and validated to measure content and degree of worries across gestational ages of pregnancy and has demonstrated good reliability and validity. The CWS consists of 16 items that reflect the content of possible worries: Your housing, Money problems, Relationship with husband/partner, Relationship with friends/family, Own health, Health of someone close, Employment problems, Possibility of something wrong with the baby, Going to hospital, Internal examinations, Giving birth, Coping with new baby, Giving up work, Whether partner at birth, Labor too soon, Possibility of miscarriage. To detect the degree of worries, items were rated on a 6-point Likert scale ranging from 0 points (not a worry) to 5 points (major worry), with the total score ranging from 0 to 80 points. Further, an additional open-ended item, where responders were given the option to describe other worries, was added to the scale. The outcomes of interest were prevalence (%) of major worry (≥4 points) at item level and Other worries (open-ended item). The text descriptions in Other worries were coded, and the codes were organized into categories to capture the essence of the text.

2.1.3 | Participant characteristics

From the questionnaires, we obtained information on the woman’s age, their body mass index (BMI) and whether they were cohabitating. Further, the women reported their highest obtained educational level, their occupational status, Danish language skills, parity, assisted reproductive technology, previous miscarriage, and previous complicated pregnancy or birth (defined as one or more of the following: gestational diabetes, preeclampsia, cesarean section, instrumental delivery, obstetric anal sphincter injury or stillbirth). Finally, information about chronic medical condition(s) and previous contact with a psychiatrist and/or a self-reported psychiatric condition was obtained. The variables were categorized as shown in Table 1.
2.2 Statistical analyses

Numbers (n) and proportions (%) were reported for categorical data and mean and SD for continuous data. To detect differences between groups, Pearson’s Chi-square test (categorical variables) or independent samples t-test (continuous variables) were used.

Using a general linear regression model mean WHO-5 scores were compared between the COVID-19 group and the Historical group, and mean differences and corresponding 95% confidence intervals (95% CI) were reported. The prevalence of women with WHO-5 score ≤50 was compared across groups using a log-binomial regression model estimating prevalence ratios (PRs) and corresponding 95% CIs. Crude and adjusted estimates were reported. In the simple adjusted analysis, we adjusted for maternal age, parity, highest obtained educational level, and previous contact with a psychiatrist and/or a self-reported psychiatric condition. In the fully adjusted analysis, we further adjusted for previous miscarriage, previous complicated pregnancy or birth, and chronic medical condition. The potential confounders were selected a priori based on existing evidence. Prespecified sub-group analyses were made. First, analyses were restricted to women who reported a previous contact with a psychiatrist and/or a self-reported psychiatric condition.15 Secondly, analyses were stratified by time of answering the questionnaire (March to April and May to June, respectively).

Missing data were imputed using multiple imputations (by chained equations, 20 imputations) under the assumption of missing at random. The age category was used in the imputation model.

### TABLE 1 Sociodemographic and reproductive characteristics of the COVID-19 group and the Historical group

|                      | COVID-19 group | Historical group |
|----------------------|----------------|-----------------|
|                      | n = 685        | n = 787         |
| Maternal age        |                |                 |
| 18–24                | 27 4.0         | 20 3.0          |
| 25–29                | 189 28.0       | 257 33.0        |
| 30–34                | 307 45.0       | 317 40.0        |
| ≥35                  | 161 24.0       | 193 25.0        |
| Body mass index (BMI) (kg/m²) |                |                 |
| Underweight (<18.5) | 24 4.0         | 38 5.0          |
| Normal (18.5–24.9)  | 511 75.0       | 578 73.0        |
| Overweight (25–29.9) | 95 14.0        | 105 13.0        |
| Obese (≥30)         | 36 5.0         | 36 5.0          |
| Missing              | 19 3.0         | 30 4.0          |
| Cohabiting           | 640 93.0       | 713 91.0        |
| Missing              | 0 0.0          | 2 0.0           |
| Highest obtained educational level |    |                 |
| Master’s, ≥5 years  | 413 60.0       | 472 60.0        |
| Bachelor’s, 3–4 years | 39 6.0        | 43 5.0          |
| Tertiary, 1–2 years | 14 2.0         | 22 3.0          |
| Skilled worker       | 186 27.0       | 195 25.0        |
| No education         | 29 4.0         | 42 5.0          |
| Missing              | 4 1.0          | 13 2.0          |
| Occupation           |                |                 |
| Employed             | 508 74.0       | 615 78.0        |
| Unemployed           | 47 7.0         | 39 5.0          |
| Student              | 85 12.0        | 86 11.0         |
| Other                | 47 7.0         | 39 5.0          |
| Missing              | 3 0.0          | 8 1.0           |
| Danish language skills | 638 93.0     | 737 94.0        |
| Missing              | 11 2.0         | 10 1.0          |
| Parity²              |                |                 |
| Nullipara            | 452 66.0       | 531 67.0        |
| Assisted reproductive technology | 90 13.0    | 123 16.0        |
| Missing              | 1 0.0          | 5 1.0           |

²Variables with no missing data.
¹Previously complicated pregnancy/birth (gestational diabetes or preeclampsia, cesarean section, instrumental birth, obstetric anal sphincter injury or stillbirth).
³Self-reported psychiatric condition before or during pregnancy.
We dichotomized the scores of each CWS item as originally suggested by Green et al.\textsuperscript{12} and reported major worry (≥4 points) on item level as prevalence (%), using clustered bar charts. To detect differences between groups, Pearson’s Chi-square test was used, and statistically significant p values are reported along with p values adjusted for multiple testing using the Benjamini–Hochberg correction adjusting the false discovery rate method at 5%.\textsuperscript{16}

Analyses were performed using SAS 9.4.

2.3 | Ethical approval

The National Data Protection Agency approved the study (file no.: RH 2017-346. I-suite nr.: 06055, on 18 December 2017). Informed patient consent was waived as the Danish Patient Safety granted permission to disclose patient information from medical records for the purpose of research use (file no. 31-1521-399, 10 June 2020) and permission was granted by Medical Records Research, Health Research, and Innovation Center for Regional Development, The Capital Region of Denmark (file no. R-20066400, 30 November 2020).

3 | RESULTS

Sociodemographic and reproductive characteristics were comparable between groups, except for the proportion of women who reported a previous contact with a psychiatrist and/or having a psychiatric condition: 11% in the COVID-19 group and 7% in the Historical group, p = 0.02 (Table 1).

3.1 | Psychological well-being

The mean WHO-5 scores were comparable across groups; 63.9 (SD 15.1) in the COVID-19 group and 64.0 (SD 15.5) in the Historical group. In the simple adjusted analysis, the mean difference was 0.0 (95% CI −1.6 to 1.6) and did not change in the fully adjusted model 0.1 (95% CI 0.83–1.29).

Similarly, no difference in the prevalence of women with a WHO-5 score ≤50 was found between groups. We found that 18% (n = 124) in the COVID-19 group and 17% (n = 131) in the Historical group had a WHO-5 score ≤50. The fully adjusted prevalence ratio was 1.04 (95% CI 0.83–1.29) (Table 2).

No differences were found in mean WHO-5 score or in the prevalence of women with WHO-5 score ≤50 when comparing women who responded to the questionnaire from March to April 2020, with women responding from May to June 2020 in the fully adjusted model (data not shown). Similarly, when comparing the sub-groups of women answering March to April 2020 and May to June 2020 with March to April 2019 and May to June 2019, respectively, no statistically significant difference was found in the fully adjusted model (data not shown). However, a tendency towards lower psychological well-being in the sub-group answering May to June 2020 (end of the first lockdown) compared with May to June 2019 were detected in the fully adjusted model (prevalence ratio 1.36, 95% CI 1.00–1.85).

In the fully adjusted sub-analyses including only women with a previous contact with a psychiatrist and/or psychiatric condition, we found no difference in mean WHO-5 score (mean difference −3.4, 95% CI −8.8 to 1.9; p = 0.2) or in the prevalence of women with WHO-5 score ≤50 (prevalence ratio 1.44, 95% CI 0.80–2.61; p = 0.2) across groups (Tables S1 and S2).

3.2 | Worries

The prevalence of women with major worry is shown for each CWS item in Figure 2. In both groups, the most frequently reported major worries were Possibility of miscarriage, Possibility that something might be wrong with the baby and Giving birth (Figure 2).

We found no difference between groups except from item 3, Relationship with husband/partner; where 3% (n = 19) in the COVID-19 group reported major worry compared with 1% (n = 6) in the Historical group (p = 0.003; false discovery rate 0.04).

The item Other worries (text descriptions) was reported by 27% (n = 186) in the COVID-19 group and 21% (n = 163) in the Historical group, (p = 0.005; false discovery rate 0.04). Further, 63 of the 186

| Table 2 | Prevalence ratio of WHO-5 score ≤50 in the COVID-19 group compared with the Historical group |
|---------|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| Variable | Group          | n   | Crude | Simple adjusted\textsuperscript{b} | Fully adjusted\textsuperscript{c} |
| WHO-5 ≤50\textsuperscript{a} | COVID-19 | 685 | 1.08 | 0.86–1.35 | 1.04 | 0.83–1.29 |
|         | Historical | 787 | 1.00 | — | 1.00 | — |

Cl, confidence interval; PR, prevalence ratio.
\textsuperscript{a}WHO-5 score ≤50 indicates reduced psychological well-being. Reported as PR, obtained using a log-binomial regression model.
\textsuperscript{b}Adjusted for maternal age, parity, highest obtained educational level, and previous contact with a psychiatrist and/or a self-reported psychiatric condition.

\textsuperscript{c}Adjusted for maternal age, parity, highest obtained educational level, previous contact with a psychiatrist and/or a self-reported psychiatric condition, previous miscarriage, previous complicated pregnancy or birth, and chronic medical condition.
women, and thus 9.2% of the total COVID-19 group, reported 87 worries concerning COVID-19, and these were condensed into six sub-categories: (1) Not receiving the correct and desired treatment in the healthcare system, (2) Exclusion of the partner or other support person, (3) General worries related to the COVID-19 pandemic, (4) Risks following infection with COVID-19 for own, fetus, partner or relative’s health, (5) Loneliness and isolation and (6) Socioeconomic uncertainties (6) (Figure 3).

4 | DISCUSSION

By comparing self-reported data on pregnant women’s mental health during the first COVID-19 pandemic lockdown with the year before, we found no differences in self-reported psychological well-being between the two groups. Compared with the Historical group, a higher proportion in the COVID-19 group reported major worries about Relationship with husband/partner. A small percentage of the women in the COVID-19 group additionally reported worries concerning the pandemic.

Our findings are supported by a recently Danish study, which showed that pregnant women did not have an increased level of depression during the COVID-19 pandemic compared with a non-pandemic period. In contrasting, previous systematic reviews and meta-analyses showed that the COVID-19 pandemic significantly reduced psychological well-being during pregnancy. However, the majority of the studies included in the systematic reviews were
either online surveys, which may increase the risk of selection bias, or did not include a comparison group, which makes it difficult to assess the potential influence of the COVID-19 pandemic per se. In another study, following the same group of pregnant women before and during the pandemic, a significantly increased level of depression and anxiety was seen after the outbreak compared with before. However, psychological well-being changes across pregnancy and the findings may be explained by these changes rather than by the influence of the COVID-19 pandemic. It is important to note that Denmark was one of the countries in the EU with fewest patients in the intensive care unit and fewest deaths related to COVID-19 measured per inhabitant, in contrast to Italy. A well-functioning healthcare system was maintained throughout the pandemic, and the level of economic inequality and poverty in Denmark is among the lowest across OECD (Organization for Economic Co-operation and Development) member countries. Both of these factors may have had an impact on mental health in the Danish population. A study found that the preparedness of countries in terms of current health expenditure as well as the country’s degree of inequality and poverty are associated with the prevalence of mental health problems among the general population during the covid-19 pandemic.

We found mean WHO-5 scores of approximately 64 in both groups, indicating a high mean psychological well-being. This is comparable to the WHO-5 score mean level of 64.9 among pregnant women in an Iranian study. In line with this study, our study was conducted in a predominantly highly educated population. A high educational level has previously been found to be a protective factor in relation to mental health during earlier pandemics as well as the COVID-19 pandemic, which might partially explain our findings. In contrast to our findings, two systematic reviews found a high prevalence of depression, primarily measured by the Edinburgh Postpartum Depression Scale (EPDS), among pregnant women during the COVID-19 pandemic. Only first-trimester data were available for our analyses, which might partially explain our results, since a study suggests that stress levels during the COVID-19 pandemic are lower in the first trimester of pregnancy than in the later trimesters.

In the analyses performed to elucidate any differences in responses across the lockdown period, we found a tendency towards lower well-being among women answering in May to June 2020 than in the same period in 2019. It cannot be excluded that the trend is due to the impact of a longer period of isolation. However, further studies are needed to explore the extent to which the different phases of the pandemic influence mental health.

Surprisingly, in our sub-group analyses among pregnant women with previous contact with a psychiatrist and/or a self-reported psychiatric condition, we found no difference in psychological well-being between groups. In contrast, a recent study showed that pregnant women with a self-reported history of mental conditions are at higher risk of developing psychological distress during the COVID-19 pandemic. We expected to find a difference in psychological well-being, as social support has a well-recognized role in buffering the negative effects of psychological distress, and this might have been limited during the lockdown. Further, social support is part of an effective coping mechanism during pandemics. We cannot rule out that our result did not reach statistical significance due to a small number (n = 127) of women with previous contact with a psychiatrist and/or a self-reported psychiatric condition. The confidence intervals show that the difference could be substantial.

In line with previous studies, we found that the most frequently reported major worries in both groups were the possibility of miscarriage, possibility that something might be wrong with the baby, and giving birth. The two groups reported the same content and degree of worries, however, in the COVID-19 group, a larger proportion (3% vs 1%) of women reported major worries concerning relationship with husband/partner compared with the Historical group. Only a few women reported a major worry about their relationship, which is in line with the findings in an Irish study. However, the importance of addressing worries concerning the relationship with the partner in antenatal care, is emphasized by a study showing a significant association between this worry and emotional distress.

Interestingly, only a small proportion of women in the COVID-19 group reported other worries concerning the pandemic. The most pronounced other worries reported among pregnant women in the COVID-19 group were not receiving the correct and desired treatment in the healthcare system and exclusion of the partner or other support person. Of note, it has been described that changes in antenatal care, eg telephone consultations instead of face-to-face appointments, increased the level of worry among pregnant women. Further, according to a previous study, pregnant women who were unsure of or believed that their partner could not be present during childbirth were more likely to suffer from anxiety and to have an intense fear of childbirth.

The routinely collected self-reported data provided a unique opportunity to compare psychological well-being as well as the content and degree of worries among pregnant women during the COVID-19 pandemic with a comparable group of women who were pregnant in the same period the year before. The data also included information on, for example, history of mental health conditions, reproductive and obstetric history as well as sociodemographic factors, allowing us to adjust for potential confounders. WHO-5 is widely used as an outcome measure within a Danish context, and the CWS has been tested and validated in other European populations of pregnant women, eg in Sweden. Further, both WHO-5 and CWS have shown substantial psychometric properties. The higher non-responder rate in the COVIP-19 group might reflect that pregnant women during the pandemic had less mental surplus but we have no demographic information on non-responders. It is, however, well-known that responders typically are of higher socioeconomic status and are healthier than non-responders. If the COVID-19 group included healthier responders, more women in this group might then have had higher psychological well-being compared with the Historical group, potentially underestimating the true effect of COVID-19 on mental health. Further, the difference we see in response rate may introduce differences in maternal characteristics across groups and thus introduce confounding. To reduce this risk, we adjusted for several potential confounders. However, unknown confounding may still exist.
It might have been interesting to include information on the perceived degree of social support in the analyses, as social support is known to be associated with mental health. Only data from the first trimester were available, which limits the extrapolation of findings to the second and third trimester. We only examined the potential influence of the first phase of the pandemic. However, we performed analysis to elucidate any differences in responses conditioned by whether the women responded to the questionnaire at the beginning or the end of the lockdown.

Finally, two of the 19 women in the COVID-19 group, who reported major worry in item 3 (their relationship) also described worry concerning their relationship under the item 'Other worries'.

Finally, due to possible differences in national healthcare systems and because the women in our population predominantly had a high educational level, generalization of results to other populations should be made with caution.

5 | CONCLUSION

We found no difference in psychological well-being between the COVID-19 group and the Historical group. The two groups also reported the same content and degree of worries; however, in the COVID-19 group, a larger proportion of women reported major worries concerning Relationship with husband/partner compared with the Historical group. Additionally, a small proportion of the women in the COVID-19 group worried about the negative impact of the COVID-19 pandemic on the course of pregnancy, birth and the postpartum period. The attendance of a partner is essential and the possible negative consequences of the woman worrying about her partner being excluded highlights the importance of balancing the psychosocial and biomedical considerations during a pandemic. Information and support from maternity caregivers should be given to pregnant women who worry that the COVID-19 pandemic may negatively impact their course of pregnancy, birth and the postpartum period. Future studies should focus on psychological well-being and major worry later in pregnancy as well as in later phases of the COVID-19 pandemic. Further, the associations should be assessed in populations with lower socioeconomic positions.

CONFLICT OF INTEREST

None.

AUTHOR CONTRIBUTIONS

HKH, LB, ALR, MGW, SH, NN and PD contributed to study conceptualization, HKH coordinated the funding application and all authors contributed. MGW prepared and validated the dataset for analyses, ALR did the initial planning of the data analyses in cooperation with HKH, KBC, MW and LB. KBC did the statistical analyses. LP condensed the women’s answers in the CWS item, Other worries, to categories. LB, HKH and ALR drafted the first draft of the manuscript, and all authors read, reviewed and approved the final version of the manuscript.

ORCID

Lotte Broberg https://orcid.org/0000-0002-1778-7941

Mie G. de Wolff https://orcid.org/0000-0002-9483-6559

Stinne Høgh https://orcid.org/0000-0002-8712-1088

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**SUPPORTING INFORMATION**
Additional supporting information may be found in the online version of the article at the publisher’s website.

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