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Perinatal depression and labour anxiety during the COVID-19 pandemic in Poland

Depresja okołoporodowa i lęk porodowy w czasie pandemii COVID-19 w Polsce

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Abstract

Introduction and objective: Multiple studies worldwide have shown that during the COVID-19 pandemic, there was an increased risk of depression and anxiety in women during the perinatal period. This study aimed to assess the severity of this phenomenon in the Polish population, and to investigate the potential risk factors and their relationship with COVID-19 related anxiety and labour anxiety. **Materials and methods:** Between February and November 2021, 122 women in the perinatal period were recruited to complete three sets of surveys: two during pregnancy and one during puerperium. The questionnaires used to evaluate the anxiety and depressive symptoms included Edinburgh Postnatal Depression Scale, Labour Anxiety Questionnaire and COVID-19 Pandemic-Related Anxiety Questionnaire. **Results:** It was shown that 26.2% of participants had symptoms indicating at least mild depression, and 61.4% of participants had increased labour anxiety. Women with a documented history of COVID-19 infection had significantly higher level of labour anxiety, whereas the severity of depression was not higher in their case. A positive correlation between COVID-19 related anxiety score and Edinburgh Postnatal Depression Scale score was found. The main concern associated with COVID-19 was the anxiety about the separation from the new-born baby, which was even higher than the fear of potential harm to the new-born resulting from COVID-19. **Conclusions:** These findings suggest that the percentage of women with perinatal depression during COVID-19 pandemic may have been higher than previously reported and it may be vital to improve perinatal screening of depression in Poland.

Keywords: COVID-19 pandemic, perinatal depression, depression screening, labour anxiety

Streszczenie

Wprowadzenie i cel: Liczne badania na całym świecie wykazały, że w okresie pandemii COVID-19 wzrosło ryzyko wystąpienia depresji i lęku u kobiet w okresie okołoporodowym. Cele niniejszego badania to: zidentyfikowanie skali tego zjawiska w polskiej populacji, wyodrębnienie potencjalnych czynników ryzyka oraz ocena powiązań z lękiem pandemicznym i lękiem porodowym. **Materiał i metody:** W okresie od lutego do listopada 2021 roku do badania zakwalifikowano 122 kobiety w okresie okołoporodowym, które miały za zadanie wypełnić trzy zestawy ankiet: dwa w okresie ciąży i jeden w okresie porodu. Ankiety zostały zaprojektowane w celu oceny objawów lęku i depresji i zawierały Edynburską Skalę Depresji Poporodowej, Kwestionariusz Lęku Porodowego oraz własny Kwestionariusz Lęku Związanego z Pandemią COVID-19. **Wyniki:** Wykazano, że 26,2% uczestniczek miało objawy wskazujące na co najmniej łagodną depresję, z kolei 61,4% wykazywało podwyższony poziom lęku porodowego. Kobiety z udokumentowanym wcześniejszym zakażeniem COVID-19 miały istotnie wyższy poziom lęku przed porodem, ale nie wyższą depresyjność. Stwierdzono pozytywną korelację między wynikiem skali lęku związanego z COVID-19 a osiągniętą punktacją Edynburskiej Skali Depresji Poporodowej. Główną obawą związaną z COVID-19 był lęk przed rozdzieleniem od nowo narodzonego dziecka, który był nawet wyższy niż obawa przed potencjalną szkodliwością samego zakażenia COVID-19. **Wnioski:** Uzyskane wyniki sugerują, że odsetek kobiet z depresją okołoporodową w czasie pandemii COVID-19 mógł być wyższy, niż wcześniej raportowano. W tym kontekście usprawnienie badań przesiewowych w kierunku depresji okołoporodowej wydaje się kluczowe.

Słowa kluczowe: pandemia COVID-19, depresja okołoporodowa, screening depresji, lęk porodowy

INTRODUCTION

Perinatal depression (PD) is a relatively common psychiatric disease, with an estimated prevalence of 12–20% (O'Hara and Wisner, 2014; Woody et al., 2017). In the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), PD is classified as “Major Depressive Disorder, with peripartum onset”, which is defined as the most recent episode occurring during pregnancy or in the four weeks following delivery (American Psychiatric Association, 2022). However, clinicians and researchers tend to view 1-year postpartum as the time of increased risk for postpartum depression (Shah and Kornstein, 2021). In addition, while suicide deaths and attempts are lower during pregnancy and the postpartum period than in the general population of women, when deaths do occur, suicides account for up to 20% of postpartum deaths. Suicide was found to be the second or the leading cause of death in the population with PD (Lindahl et al., 2005).

Hopefully, screening related to this issue gives an opportunity to intervene early. A 2016 systematic review found a lower prevalence of postpartum depression at follow-up for those screened four to eight weeks after delivery (O'Connor et al., 2016). If postpartum depression had been diagnosed, improvement or remission of symptoms at follow-up was 11% greater in patients who were screened than in those who were not. Particularly useful for this purpose is the Edinburgh Postnatal Depression Scale (EPDS) since it is easy to administer and has proven to be an effective screening tool (Levis et al., 2020).

The strongest risk factors associated with PD are maternal anxiety, life stressors, natural disasters and lack of social support (Lancaster et al., 2010; Roddy Mitchell et al., 2023); therefore, during the COVID-19 pandemic, new studies regarding prevalence, and novel, pandemic-related risk factors of PD were needed.

Prenatal anxiety has been demonstrated to be associated with adverse outcomes for both the mother and the child. In pregnant women this may be a risk factor for antenatal and postpartum depression (Biaggi et al., 2016; Rwakarema et al., 2015) or for anxiety disorders later in life (Huizink et al., 2014). More specifically, the prevalence of fear of childbirth varies across European countries, ranging from 1.9% to 14% (Ayers, 2014). Addressing and understanding labour anxiety is crucial to ensure the overall well-being of expectant mothers and promote a positive birth experience. This is particularly important, also because this type of anxiety often becomes a significant factor leading women to request a caesarean section (Nilsson et al., 2018).

Pregnant women did not appear to be more at risk of COVID-19 infection than the general population (Smith et al., 2020), and the majority of pregnant women who tested positive for COVID-19 were asymptomatic (Breslin et al., 2020). However, obstetric complications were detected in infected pregnant women; these included the risk of premature delivery, caesarean delivery and maternal

complications in the postpartum period (Rodríguez-Blanco et al., 2020). Moreover, numerous other COVID-19 related factors were commonly reported during the pandemic, and these might have contributed to psychological distress of individuals in the perinatal period. The most common concerns reported by the participants of the study conducted by Basu et al. (2021) included the family being unable to visit after delivery, the baby contracting COVID-19 and lack of a supporting person during delivery.

The previous research findings suggest that prevalence of mental disorders significantly increased in pregnant women after the outbreak of COVID-19 (Davenport et al., 2020; King et al., 2023; Lebel et al., 2020; Molgora and Accordini, 2020; Wu et al., 2020). However, the significance of this phenomenon varies across studies and populations. The largest systematic review and meta-analysis, taking into account 589 studies and over 600,000 women, found that PD was reported in the case of 1 in 4 women (24.7% overall, 25.4% for the European population). The highest prevalence was found in lower-to-middle income countries, with a pooled prevalence of 25.5%. Additionally, a notable prevalence of PD, amounting to 34.8%, was observed among women who had experienced a natural disaster (Roddy Mitchell et al., 2023).

Having summarised both the known risk factors for PD and the possible pandemic-related stressors, we developed a survey made of existing and original questionnaires. The primary aim of our study was to determine the rate of depression in the Polish population of women during the perinatal period amid the COVID-19 pandemic based on EPDS. The secondary aims included:

1. estimation of the percentage of women with labour-related anxiety during the pandemic;
2. estimation of the level of pandemic-related anxiety, using an original tool;
3. assessment of the association between PD and labour-related anxiety;
4. assessment of the association between PD and pandemic-related anxiety;
5. identification of risk factors for PD, labour-related anxiety, and pandemic-related anxiety – demographic, clinical, and related to COVID-19.

The hypothesis posits that the prevalence of PD in the Polish population during the COVID-19 pandemic was higher than before the outbreak of COVID-19.

MATERIALS AND METHODS

Design and population

This descriptive cross-sectional study, involving perinatal population in Poland, was conducted between 17.02.2021 and 25.11.2021. Participation in this study was voluntary. All participants were informed about the research objectives and standards of confidentiality regarding the usage of the obtained data. Participants consented to the study

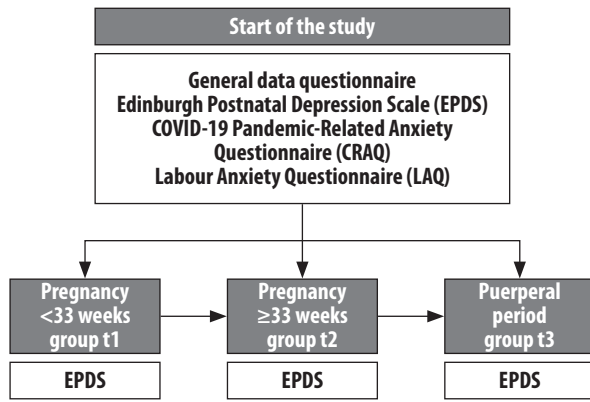


Fig. 1. Study protocol

by completing an online survey and clicking the submit button at the end. Before the start they were informed that they could withdraw at any time.

The study has received approval of the Ethics Committee at the Medical University of Lodz, Poland (RNN/39/21/KE, 9 February 2021).

The anonymous survey, hosted on docs.google.com/forms/, was advertised primarily in social media channels. We established a dedicated page (https://www.facebook.com/BadanieKobiet/) and shared invitations to the study on pages of maternal and parenting on-line groups. The advertisements and the questionnaire were available in Polish language. We also developed short leaflets which were available at the Obstetrics and Gynaecology Clinics in Lodz Voivodeship. Additionally, printed copies of the survey were distributed.

The inclusion criterium was a declaration of being pregnant or in the postpartum period (up to six weeks) at the time of the study.

Detailed protocol of the study is presented in Fig. 1. The manuscript has been prepared according to the STROBE Statement (von Elm et al., 2008).

Methods

General data questionnaire included basic questions addressing the sociodemographic background, medical history, COVID-19 status and personal COVID-19 history. The full content of the questionnaire is shown in Tab. 1 (sociodemographic data) and Tab. 2 (COVID-19-related data). The EPDS is a self-report questionnaire, originally developed to screen for postpartum depression. According to the original manual, individuals in the postnatal period scoring 13 or more are likely to be suffering from a depressive illness of a varying severity (Cox et al., 1987). Nevertheless, because of the lack of items specific to the postpartum period, the EPDS has been validated additionally for the use with pregnant women and it remains the most widely applied self-report tool designed to identify women at risk for antenatal depression (Hewitt et al., 2010). Optimal scoring of the scale is still under discussion, however, in perinatal

	N = 122, number (%)
Age [years]: • mean ± SD • Min–max	30.9 ± 4.1 20–40
Education: • higher • secondary	108 (88.5%) 14 (11.5%)
Place of residence: • city >100,000 • city <100,000 • rural area	74 (60.7%) 24 (19.7%) 24 (19.7%)
Gestational age reported at the start of the study: • I trimester • II trimester • III trimester • postnatal	7 (5.7%) 39 (32.0%) 71 (58.2%) 5 (4.1%)
Previous pregnancies: • 0 • 1 • 2 • 3 • 4 or more	51 (41.8%) 39 (32.0%) 23 (18.9%) 7 (5.7%) 2 (1.6%)
Number of children: • 0 • 1 • 2	52 (42.6%) 56 (45.9%) 14 (11.5%)
Complications of the current pregnancy: • yes • no • postnatal	42 (34.4%) 75 (61.5%) 5 (4.1%)
Previous psychiatric treatment: • yes • no	24 (19.7%) 98 (80.3%)

Tab. 1. Sample characteristics

	N = 122, number (%)
Documented COVID-19 infection: • yes • no	27 (22.1%) 95 (77.9%)
Severity of COVID-19 infection: • mild (no difficulties during daily activity) • medium (difficulties during daily activity) • high	13 (10.7%) 14 (11.5%) 0 (0.0%)
Currently existing complications of COVID-19 infection: • yes • no	4 (3.3%) 23 (18.9%)
Vaccination status: • vaccinated • not vaccinated • registered for vaccination	34 (27.9%) 85 (69.7%) 3 (2.5%)
Death of a family member due to COVID-19: • yes • no	10 (8.2%) 112 (91.8%)
Time from the COVID-19 infection: • 0–5 months • 6–12 months • >12 months	13 (48.1%) 8 (29.6%) 5 (18.5%)

Tab. 2. COVID-19 related characteristics

care, the most often applied cut-off values are the scores of 10 or higher and 13 or higher (Hewitt et al., 2010). The Polish version of the EPDS, validated for the population during the postnatal period, is available, with a cut-off score of 13/14 demonstrating the highest sensitivity (96%) and

	N = 122, number (%)
CRAQ:	
• mean score ± SD	58.9 ± 14.1
• min–max	19–86
• 0–20	1 (0.8%)
• 21–40	14 (11.5%)
• 41–60	47 (38.5%)
• 61–80	52 (42.6%)
• 80 or more	8 (6.6%)
	Mean score (0–10)
How much are you afraid of the COVID-19 infection?	5.1
How much are you worried that exposure to COVID-19 will harm your unborn/newborn baby?	6.5
How much are you afraid of the separation from the loved ones while you are in hospital?	7.2
How much are you afraid of the separation from the new-born baby after delivery?	8.1
	Mean score (1–6) 1 (I strongly disagree) to 6 (I strongly agree)
I have limited my contacts with my family and friends due to concerns about mine and my baby's health	3.7
I have limited going out from home (e.g. for shopping/walking) due to concerns about my own and my child's health	3.5
I have limited contacts with healthcare professionals due to concerns about getting infected	2.0
I am frustrated when I see people disobeying social distancing rules or people not wearing masks	4.4
When I see someone standing closer than 2 m from me, I move away	4.3
I feel anxious when I see current data about new COVID-19 infections and deaths caused by SARS-CoV-2 virus	3.4
I am afraid that I or my partner will suffer or die because of SARS-CoV-2	3.7
My heart beats faster when I watch news related to COVID-19 pandemic	2.9
I stress out when I hear reports from people who severely suffered from COVID-19	3.6
I cannot sleep because I am worried that something bad will happen to me or my baby due to COVID-19	2.2

Tab. 3. COVID-19 related anxiety

specificity (93%) (Kossakowska, 2013). Based on this, and considering the detailed interpretation suggested by the BC Reproductive Mental Health Program and Perinatal Services BC, we have adopted the following intervals for subgrouping of the results on the EPDS scale: 0–8, 9–13, 14 or more (Williams, 2014). In our study, women who scored 13 or more, or admitted having thoughts of self-harm, received warning e-mails providing detailed information about their score and the specificity of the scale, as well as advice suggesting that psychological or psychiatric consultation was needed. A clinically significant increase in the EPDS score was defined as a 3-point elevation (Mao et al., 2021). Self-report Labour Anxiety Questionnaire (LAQ; *Kwestionariusz Lęku Porodowego, KLP-II*) was developed to assess

the level of labour anxiety in pregnant women. This short tool consists of 9 items which address attitudes toward labour and fear of labour. The validation of the LAQ in a Polish population indicated that the scale was a reliable and valid method to identify pregnant women with elevated level of labour anxiety. Scores of 0 to 13 are indicative of low labour anxiety, 14 to 15 slightly increased labour anxiety, 16 to 17 high labour anxiety, and scores ≥18 reflect very high labour anxiety (Putyński and Paciorek, 2008). The self-report COVID-19 Pandemic-Related Anxiety Questionnaire (CRAQ) was developed by a multidisciplinary team comprised of psychiatrists and psychologists. The questionnaire contains 14 questions, the first part referring specifically to the COVID-19 concerns, and the second part addressing the changes in daily life and participants' attitudes towards them. The full content of the questionnaire is shown in Tab. 3. With regard to the results distribution, it has been decided that the best scoring intervals are 0–59 (no or mild anxiety), 60–69 (moderate anxiety), 70 or more (severe anxiety).

Data analysis

Statistical procedures were performed with STATISTICA 13.1 (TIBCO Software Inc., USA). Descriptive statistics (means, medians, standard deviations) were generated for continuous variables. For discrete variables, number of patients and percentages were given. Normality of distribution was tested with Shapiro–Wilk test. *U* Mann–Whitney test as well as Kruskal–Wallis test were used to examine inter-group differences. Repeated measures ANOVA was applied to verify if there were statistically significant differences between EPDS scores over time. Associations were tested with Spearman's correlation coefficients. The significance level was set at *p* < 0.05.

RESULTS

Sample characteristics

A total of 122 women were included. Participants were aged 30.9 ± 4.1 years. Majority of the participants reported higher education background and a place of residence in a city with a population bigger than 100,000. Forty-seven (38.5%) participants reported complications during the current pregnancy, most commonly risks of premature delivery or miscarriage, as well as diabetes. Data collected in the general questionnaire are presented in Tab. 1.

COVID-19-related characteristics

Tab. 2 shows general data related to COVID-19. Of the 122 women, 27 (22.1%) had been diagnosed with COVID-19 infection before entering the study but none of these participants reported a severe case of the infection, 4 (3.3%) reported complications of COVID-19 infection. Ten (8.2%)

LAQ (n = 122) • mean score \pm SD • min–max • 0–13 • 14–15 • 16–17 • 17 or more • missing	14.4 \pm 5.4 0–27 45 (36.9%) 26 (21.3%) 17 (13.9%) 32 (26.2%) 2 (1.6%)
EPDS t1 (n = 71): • mean score \pm SD • min–max • 0–8 • 9–13 • 14 or more	9.3 \pm 5.4 0–25 37 (52.1%) 18 (25.4%) 16 (22.5%)
EPDS t2 (n = 50): • mean score \pm SD • min–max • 0–8 • 9–13 • 14 or more	8.5 \pm 5.6 0–24 26 (52.0%) 16 (32.0%) 8 (16.0%)
EPDS t3 (n = 21): • mean score \pm SD • min–max • 0–8 • 9–13 • 14 or more	10.6 \pm 5.2 2–20 7 (33.3%) 9 (42.9%) 5 (23.8%)
EPDS questionnaire at the start of the study (n = 122): • mean score \pm SD • min–max • 0–8 • 9–13 • 14 or more • 12 or more • 13 or more	9 \pm 5.5 0–25 61 (50.0%) 35 (28.7%) 26 (21.3%) 39 (32.0%) 32 (26.2%)

Tab. 4. Depressiveness and anxiety

participants reported a COVID-19 related death in their family.

Depressiveness

The findings show that depression in the Polish population of women in the perinatal period during the COVID-19 pandemic, measured with the EPDS scale, was at a rate of 26.2% with a cut-off of ≥ 13 , and 21.3% with a cut-off of ≥ 14 . Such a score indicates a high probability of a depressive illness of varying severity. The EPDS scores in particular time points are shown in Tab. 4. The total EPDS score between t2 and t3 time-points revealed a strong significant correlation ($p = 0.018$, $r = 0.76$). We also analysed individual EPDS scores longitudinally between t1, t2, and t3 time-points; a statistically significant increase was found between t2 and t3 EPDS ($T = 2.00$, $Z = 2.24$, $p = 0.025$) (Fig. 2 A). Mean individual EPDS increase between the first assessment in pregnancy and puerperium was found to be 47.1%. To reveal possible associations involving the change in EPDS score, a correlation analysis was performed taking into account the change in the EPDS score and depression t1, t2, t3 scores, age category, place of residence, psychiatric diagnosis, number of previous pregnancies, LAQ and time from the COVID-19 infection. Correlation was found only between the EPDS score change and the t3 EPDS score

($p = 0.075$, $r = 0.64$). We did not find any associations between a clinically relevant EPDS increase (≥ 3) and any of the variables assessed. Additionally, participants with documented COVID-19 infection did not exhibit higher levels of depressiveness.

Labour anxiety

As regards anxiety associated with labour, the mean score on the LAQ scale was 14.4, reflecting slightly increased labour anxiety. As many as 61.4% of women in perinatal period scored ≥ 14 , which indicates increased labour anxiety. The LAQ scores are shown in Tab. 4. Women who reported previous psychiatric treatment had higher LAQ score than those previously untreated ($U = 888$, $Z = -2.48$, $p = 0.01$). Women who reported a diagnosed COVID-19 infection also had significantly higher LAQ score than those who did not ($U = 766.6$, $Z = -3.08$, $p = 0.002$) (Fig. 2 B). LAQ score was positively correlated with t1 EPDS ($p < 0.0001$, $r = 0.47$), however, no correlation was found with t3 depressiveness. The LAQ score reflected significant differences among the three groups categorised by EPDS scores at the start of the study ($p = 0.0013$) (Fig. 2 C). Interestingly, the findings show no association between LAQ score and age, trimester of pregnancy, CRAQ score or death of a relative due to COVID-19 infection. Cronbach's alpha coefficients of the questionnaires applied indicate high internal consistency and are as follows: $\alpha(\text{EPDS}) = 0.87$, $\alpha(\text{LAQ}) = 0.81$.

COVID-19-related anxiety

We found that the mean score on the CRAQ was 58.9, corresponding to mild COVID-19-related anxiety. As many as 49.2% of women in perinatal period scored ≥ 61 , which suggests at least moderate anxiety. The main COVID-19 related concern was the fear of being separated from the new-born baby, 70% of participants estimating that concern as ≥ 8 on a scale up to 10 (mean score 8.1 out of 10). The fear of separation from the loved ones while being in hospital was rated as ≥ 8 on a scale up to 10 by 54.1%. The fear of COVID-19 infection or potential new-born's COVID-19 related harm was much lower, 48.4% reporting their worries that exposure to COVID-19 would harm their unborn/newborn baby as ≥ 8 on a scale up to 10 (mean score 6.5 out of 10) (Tab. 3). CRAQ scores followed a normal distribution (Fig. 3).

Interestingly, participants with documented history of COVID-19 did not have higher CRAQ score than those who reported no COVID-19 infection. This study also found no association between severity of COVID-19 infection and CRAQ score.

To identify possible associations between the anxiety related to the COVID-19 pandemic and severity of depressive symptoms, we performed a correlation analysis taking into account the EPDS score. The findings showed a weak positive correlation between the CRAQ score and the total

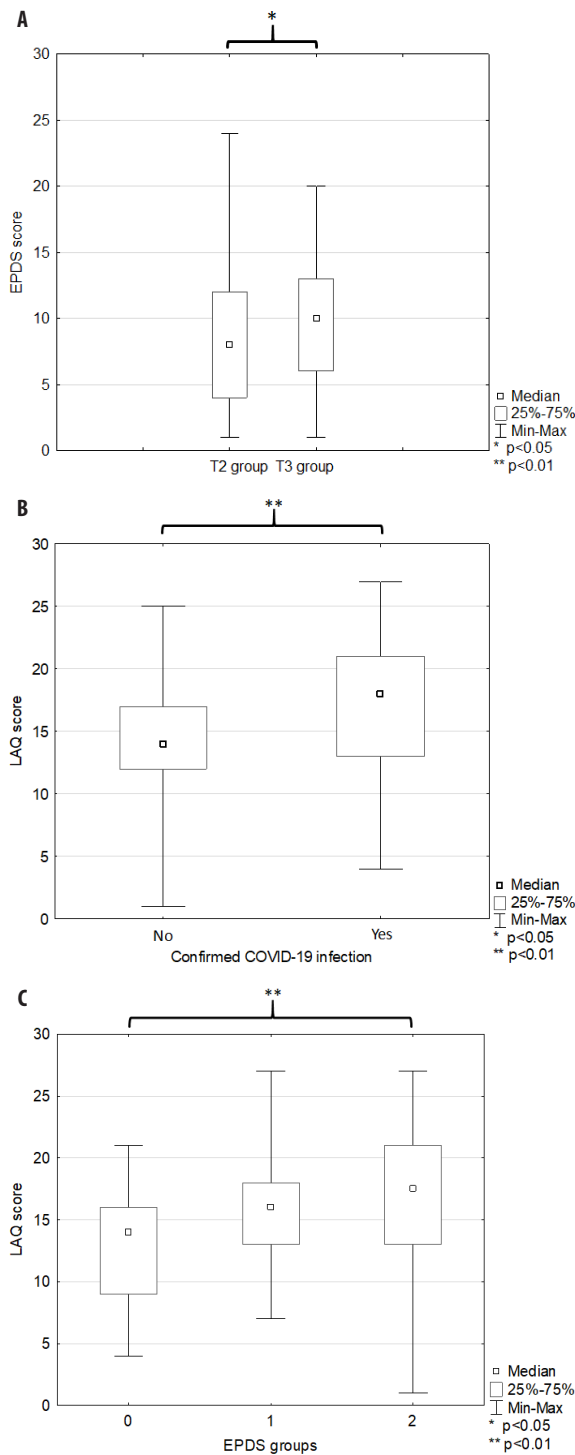


Fig. 2. **A.** EPDS score increase between t2 and t3 time-points. **B.** LAQ score and documented COVID-19 infection. **C.** LAQ score in different EPDS score groups at the start of the study, group 0: 0–8; group 1: 9–13; group 2 ≥14

EPDS score at the start of the study ($p < 0.05$, $r = 0.25$) as well as t1 EPDS score ($p < 0.05$, $r = 0.3$). No statistically significant correlation was found for LAQ score.

Cronbach's alpha coefficient of the CRAQ questionnaire shows acceptable internal consistency ($\alpha = 0.79$).

DISCUSSION

Assessment of PD increase during COVID-19 pandemic is difficult due to the lack of a perfect control group. A study in a Polish population in the perinatal period conducted shortly before the pandemic reported that 18.9% of the women scored ≥ 12 points in the EPDS scale. Furthermore, there was no significant difference between the EPDS score during pregnancy and after childbirth (Kaźmierczak et al., 2020). In our study as many as 32.0% of women scored 12 or more. Therefore, a comparison of our results with the data related to the pre-pandemic Polish population shows an increase of 13.1 percentage points, confirming the proposed hypothesis. Almost the entire group in our study were in the prenatal period (96%), therefore further discussion is based on both – prenatal and perinatal studies.

In general, other studies conducted during the COVID-19 pandemic reported higher prevalence of PD, prenatal depression, and perinatal anxiety compared to this research. Most of the recent studies used cut-off of 13 points or more for EPDS; therefore, the corresponding result in our study would be 26.2%. A study by Lebel et al. conducted in Canada during the COVID-19 pandemic and involving almost 2,000 pregnant women found substantially elevated anxiety and depression symptoms level compared to similar pre-pandemic pregnancy cohorts; 37.0% of participants had clinically elevated symptoms of depression (EPDS scores ≥ 13) and 57% reported clinically relevant symptoms of anxiety (Lebel et al., 2020). In an Italian study, 34.2% ($n = 133$) of expectant women and 26.3% ($n = 49$) of women in the postpartum period had clinically significant levels of depression as measured by the EPDS (cut-off ≥ 13) (Molgora and Accordini, 2020). Another recent investigation taking into account 900 women in the perinatal period, conducted via an online survey, showed that 40.7% of the group scored 13 or more in the EPDS (Davenport et al., 2020). The studies cited above were conducted in 2020, a period marked by numerous uncertainties, especially concerning childbirth and the effect of COVID-19 on pregnant women and infants. This may justify the elevated rates of depression. Our research was conducted in 2021, at a time when we had gained more knowledge about COVID-19 and its potential impact on pregnancy and childbirth.

Importantly, some researchers launched their studies before the outbreak of COVID-19 and managed to conduct these studies in both pre-pandemic and pandemic cohorts. In a study focusing on a Chinese population of pregnant women, prevalence of the EPDS score ≥ 10 was found to be 29.6% during the COVID-19 pandemic and 26% in the control, pre-pandemic group. Moreover, a positive association was observed between EPDS scores and the number of newly confirmed COVID-19 infections per day (Wu et al., 2020). A spectacular increase in the prevalence of antenatal depression was shown by King and associates. In the latter study, 25% of the participants in the pre-pandemic cohort had probable depression, whereas 51% of the participants in

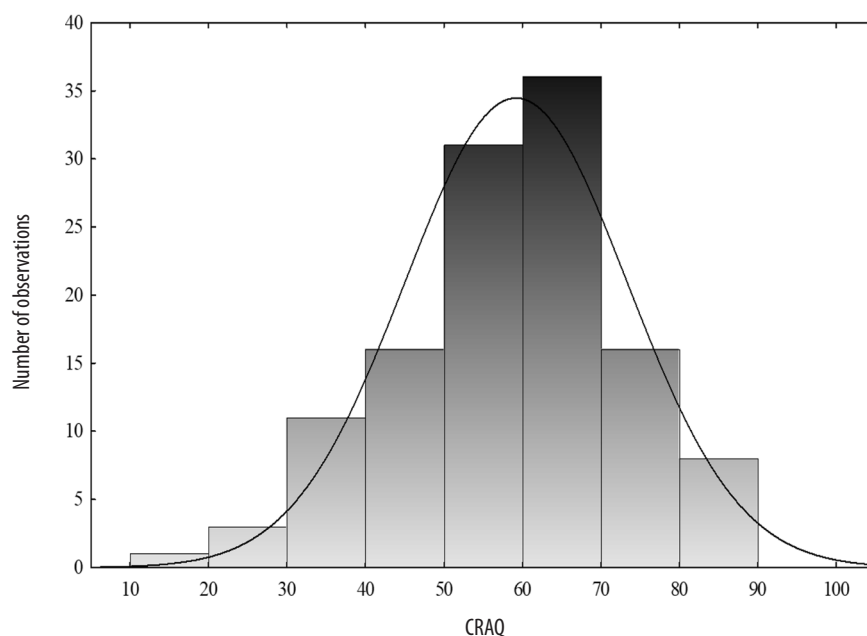


Fig. 3. Distribution of the CRAQ results

the COVID-19 cohort had similar level of symptoms, corresponding to a relative risk ratio of 1.81, 95% CI (1.20–2.75) (King et al., 2023).

Comparison of depressive symptoms during the final weeks of pregnancy and during the puerperium, conducted in our study, revealed a significant and strong correlation. Also, the statistically significant increase in the EPDS scores between these two time points is consistent with other literature findings. It is commonly suggested that postpartum depression may have onset during pregnancy (Gavin et al., 2005). Furthermore, active symptoms during pregnancy are among the strongest risk factors of postpartum depression (Stewart and Vigod, 2019). A recent study by Kee, which analysed the trajectories of maternal depressive symptoms in 11,563 pregnant women, demonstrated that mothers within and across all cohorts exhibited stable trajectories of maternal depressive symptoms from pregnancy through two-year postpartum period. Similarly, mothers with clinical levels of depressive symptoms showed stable trajectories from pregnancy into the postnatal period (Kee et al., 2023). In our study, the mean individual EPDS increase between the first assessment during pregnancy and puerperium was found to be 47.1%. Unfortunately, the EPDS scale has not been validated in a Polish population of pregnant women, yet. Therefore, we find it crucial to validate this particular tool in Polish population, and results of our study may be used further in that process. One of the secondary aims of our study was to examine the depressive and anxiety symptoms level in relation to obstetrics-related factors. Surprisingly, we did not acquire any significant findings, although, this may be linked to a small study group reporting complications during the current pregnancy.

Similarly, we did not find any relationship between the LAQ score and the CRAQ score or the death of a relative

caused by COVID-19 infection. In contrast, the study conducted by Mortazavi and associates found that women aged <30 years, those who were in the second and third trimester of pregnancy, those with a high level of fear of COVID-19, and those who reported at least one relative with COVID-19 infection, exhibited a higher level of worry in comparison with their counterparts (measured by means of the Cambridge Worry Scale) (Mortazavi et al., 2021). However, we assessed a specific area of anxiety, not a general anxiety level.

In our study, the group with a documented history of COVID-19 infection had higher labour anxiety score than the group with no history of COVID-19 infection. The same was found with regard to previous psychiatric treatment. Effect of COVID-19 infection on future anxiety symptoms has not been comprehensively described in the literature, yet. On the other hand, existing psychiatric illness is a commonly found risk factor for anxiety, depression and other psychological distress (Xiong et al., 2020). We also found significant differences in the labour anxiety score between different EPDS depressiveness severity groups. The association between maternal anxiety and PD has also been demonstrated by other studies (Lancaster et al., 2010; Yang et al., 2022). Regarding pandemic-related anxiety, our research revealed that the fear of being separated from the newborn baby or the loved ones was an extremely common phenomenon. Similar finding was observed by Basu and associates; in their study, 59% of the participants reported a fear of family being unable to visit after delivery, 59% worried about the baby contracting COVID-19, and 55% were concerned about lack of a supporting person during delivery (Basu et al., 2021). These data are also consistent with another recent publication showing that separation from family and friends was one of the main factors raising

concern one month and two months postpartum (Meister et al., 2023). Moreover, it has recently been shown that concern about potential adverse impact of COVID-19 on the life of the mother and the baby, especially the risk of not getting the necessary prenatal care as well as social isolation were associated with higher severity of both depression and anxiety (Lebel et al., 2020). Our results suggest no relationship between COVID-19 related anxiety (CRAQ) and documented COVID-19 infection, or with the course of the infection. Statistically significant, although weak, positive correlation was found between CRAQ score and depression scales results (EPDS at the start of the study and t1 EPDS). It is, however, uncertain whether COVID-19 related anxiety is associated with the psychopathology in general, and specifically with depression. Correlation coefficient $r = 0.23-0.30$ is interpreted as a weak correlation; additionally, distribution of CRAQ scores was normal. In our opinion, COVID-19 anxiety may be recognised, at least partially, as a social phenomenon. Importantly, participants worried more about the social and legal implications of the infection (separation from the new-born and close relatives) than about COVID-19 infection itself (contracting the virus by themselves or the new-born). Nevertheless, some other studies also found a correlation between general psychological burden related to the COVID-19 pandemic and the perinatal EPDS score (Meister et al., 2023); participants with a high psychological burden related to the COVID-19 were found with higher EPDS values 1, 2 and 6 months postpartum. In our study, we did not find such a relationship with t3 EPDS (4–6 weeks postpartum); however, we did not assess EPDS 2 and 6 months postpartum.

STRENGTHS AND LIMITATIONS

One of the limitations of our study was the fact that the sample of the surveyed women was not very representative (122 respondents, most of them highly educated and living in big cities), which was probably due to the fact that the recruitment process was performed mostly on the Internet.

The only inclusion criterion was a self-reported pregnancy or postpartum status (up to six weeks) at the time of the study. Unfortunately, the researchers were unable to verify the accuracy of these self-reported statements. Nevertheless, the longitudinal assessment approach increased the likelihood that the provided information was truthful, by allowing for a more comprehensive evaluation over time. There were no exclusion criteria.

Additionally, since resignation for the study was possible during the whole study, some participant did not complete all the surveys. Furthermore, the study was based on an online self-report survey, which may be less trustworthy than in-person interviews. Despite this limitation, our study provides important and relevant information about the risk of PD and its relation to the COVID-19 pandemic. Another valuable aspect of our protocol was the fact that the study

was performed in three stages, which provided an opportunity to access longitudinal changes.

We firmly believe that some of our findings contain information that may be valuable for potential future pandemics other than COVID-19. Moreover, some of the reported patterns may be valid in other types of crises, this includes the investigated usefulness of mental health screening using modern mass communication channels.

CONCLUSIONS

The present study investigated the well-being and depressiveness of women in the perinatal period during the COVID-19 pandemic. The findings confirm that the prevalence of PD increased during the COVID-19 pandemic compared to the previously reported findings, and may now be affecting one-fourth of Polish pregnant women. A review of the world literature on PD provides evidence for the pervasiveness of this phenomenon. Particular attention should be given to women with a history of previous depressive episodes. Moreover, we observed a substantial increase in individual EPDS scores between pregnancy and the postpartum period, reaching 47.1%. The results suggest the importance of screening for early diagnosis of depression during pregnancy and the postpartum period, especially during crises. This screening should be introduced into clinical practice in Poland as a mandatory practice.

Conflict of interest

The authors do not report any financial or personal connections with other persons or organizations which might negatively affect the contents of this publication and/or claim authorship rights to this publication.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Author contribution

Original concept of study: MKP, O GK. Collection, recording and/or compilation of data: MKP, KP. Analysis and interpretation of data: MKP, AM, KS, O GK. Writing of manuscript: MKP, O GK. Critical review of manuscript: O GK. Final approval of manuscript: MKP, AM, KS, KP, O GK.

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