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Pregnancy- and Birth-Related Experiences among Postpartum Women during the Third Wave of the COVID-19 Pandemic—A Multinational European Study

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Abstract: The objective of this study was to describe pregnancy- and birth-related experiences of postpartum women during the third wave of the COVID-19 pandemic and their association with mental health outcomes. An online questionnaire was distributed in five European countries (Belgium, The Netherlands, Norway, Switzerland, UK) between June and August 2021. Participants were recruited though social media platforms including pregnancy- and motherhood-related websites, pregnancy fora, and apps. Postpartum women were asked eleven specific questions about pregnancy- and birth-related changes and the presence of support during delivery. The Edinburgh Depression Scale was used to assess depressive and anxiety symptoms. Covariates included sociodemographics, health and reproductive characteristics, and COVID-19 status. Associations were estimated with logistic regression. The study included 1730 postpartum women. Frequent changes included the exclusion of the partner from pregnancy care appointments (83.2%), changed prenatal care settings (64.4%), and cancellation of hospital information visits (42.7%). Few women, however, were without support apart from medical staff during delivery (1.4%). The number of pregnancy- and birth-related changes was associated with each woman's mental health status, as well as the type of change. Experiencing changes related to delivery and cancellation or reduction of prenatal examination was associated with a doubling in the odds of symptoms of major depression and anxiety postpartum. These findings highlight the importance of ensuring adequate maternity care for women's mental health postpartum, as well as during a pandemic.

Keywords: birth experience; mental health; depression; anxiety; postpartum; coronavirus: COVID-19; SARS-CoV-2; Edinburgh Depression Scale

1. Introduction

The COVID-19 pandemic has significantly impacted women's birth experiences [1–3]. To reduce the spread of SARS-CoV-2 in society, restrictions have led to considerable changes in health care. Many parents have reported perinatal care changes and birthing interventions, e.g., no partner support during delivery [3] and more frequent reports of caesarean sections [1].

Studies attribute the worsening of birth experiences to the increase in mental illness symptoms' incidence [1,2,4]. Still, there is limited information on the pregnancy and birth experiences of women living in Europe during the third wave of the COVID-19 pandemic and their association with mental health outcomes.

Having a positive childbirth experience is recognised by the World Health Organization (WHO) as an important objective for all pregnant women [5]. Critical factors associated with a positive birth experience are, amongst others, having a sense of control, support from partners and medical staff; consistency in the information provided; and a sense of security [6]. On the other hand, negative birth experiences are reported in relation to fluctuating guidance, inconsistency in the information provided [1,6], absence of partner during delivery, uncertainty regarding partners' visiting policies [3,7,8], and unexpected changes [2]. Studies describe a significant number of birth plan alterations during the pandemic [1,7,9]. For example, in one cross-sectional study with 1400 participants, birth plan changes due to COVID-19 (e.g., birthing place, visiting policies, mode of delivery) were reported by 45.2% of postpartum women living in the US [7]. Other studies describe limited birthing options [1] and uncertainty or restrictions regarding partners' visiting policies [1–3].

Existing literature on mental health focuses mainly on the pregnancy period. The postpartum period is equally important to better understand the postpartum mental health needs of women and to ensure their health and well-being. Negative birth experiences have been related to stress and increased risks of postpartum depression and anxiety [2,3,10]. Importantly, in rare cases, postpartum depression and anxiety contribute to the increased risk of self-harm or suicide [11]. Symptoms of mental illness are common in pregnant and postpartum women. The estimated prevalence of mood and anxiety symptoms in birthing populations ranges between 10 and 20% [12–15]. Several studies suggest a substantial effect of the COVID-19 pandemic on the mental health status of pregnant and postpartum women [8,10,12,13,16,17]. Longitudinal analyses describe an increase in depressive and anxiety symptoms among pregnant and postpartum women compared to pre-COVID-19 measurements [10]. In a prior multinational European study on perinatal mental health covering the first pandemic wave, we found that approximately 15% of pregnant and 13% of breastfeeding women had symptoms of major depression (Edinburgh Depression Scale (EDS) $\geq$ 13) [17]. Furthermore, a systematic review of perinatal mental health studies during the pandemic showed that eleven out of nineteen studies reported elevated levels of depression and anxiety compared to pre-COVID-19 levels [13]. Still, changes in birth experiences and mental health status have varied among countries. One study in the Netherlands during the first wave reported a decreased fear of childbirth among the birthing population. They explained it with increased COVID-19-related information, more time to process this information, and a better work–life balance [18]. Numerous studies have been conducted on postpartum women's birth experience and subsequent mental health effects during the pandemic [1,2,4,19]. However, present studies are mainly limited to the first and second waves of the pandemic, often including few participants and few questions and performed in a single country or region.

The primary aim of this multinational, cross-sectional study was to describe pregnancy and birth-related experiences among postpartum women living in five European countries during the third wave of the COVID-19 pandemic and what factors characterised women having experienced these changes. The secondary aim was to investigate the association between pregnancy and birth-related changes and mental health status among postpartum women.

2. Results

2.1. Characteristics of the Study Participants

In total, 1730 postpartum women were included in this study. Of these, 1522 (88.0%) women had experienced 0–4 birth-related changes and 208 (12.0%) women had experienced >4 pregnancy and birth-related changes (Figure 1).

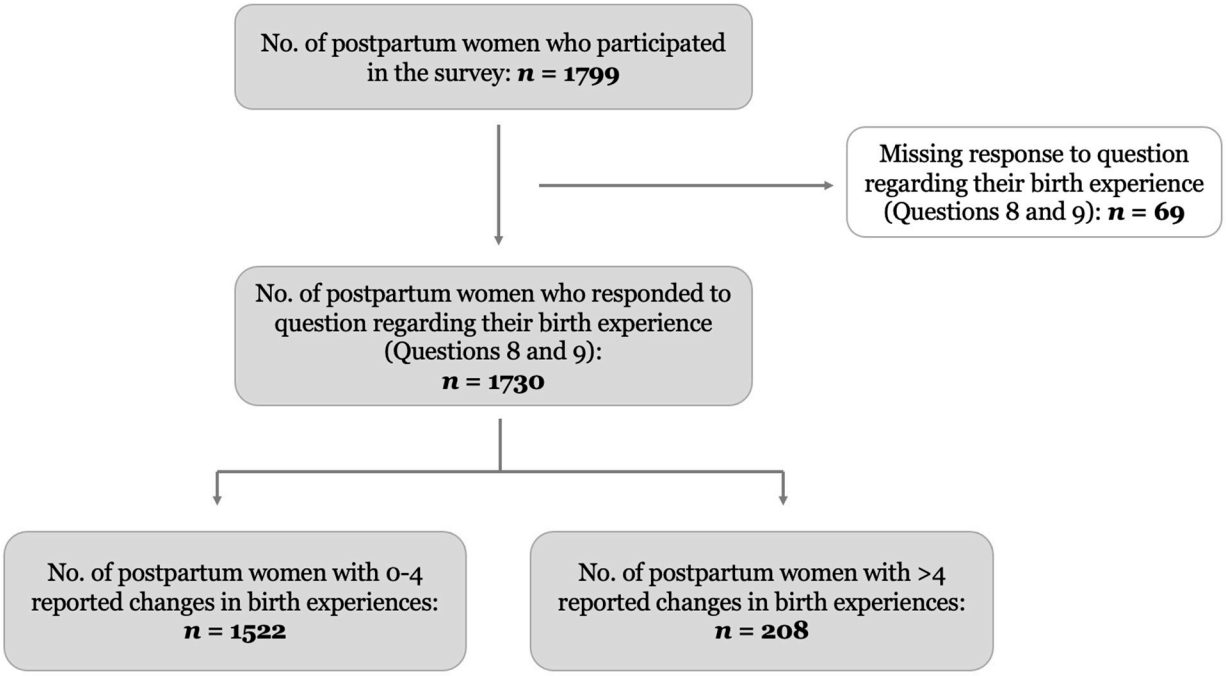

Figure 1. Flowchart of the study participants.

Most responses were collected from Norway (64.3%), followed by Belgium (12.3%), Switzerland (9.2%), the Netherlands (8.4%), and the UK (5.7%). Respondents were predominately professionally active (82.7%) and had a high educational level (73.9%). There was also a high percentage of participants working in healthcare (28.1%). In total, 91.1% of the study population was breastfeeding at the time of study completion. Regarding COVID-19 status, 5.4% of the study population reported having had a positive test for SARS-CoV-2 (Table 1). Allergy was the most-reported chronic somatic illness in the study population (13.3%).

Table 1. Characteristics of the study participants according to pregnancy and birth-related change categories, *n* = 1730.

	Total	**Pregnancy and Birth-Related Changes**	
	***n* = 1730**	**0–4 *n* = 1522**	**>4 Changes *n* = 208**
	***n* (%)**	***n* (%)**	***n* (%)**
Socio-demographic characteristics			
Country *			
Norway	1113 (64.3)	959 (63.0)	154 (74.0)
Belgium	213 (12.3)	192 (12.6)	21 (10.1)
Switzerland	160 (9.2)	149 (9.8)	11 (5.3)
The Netherlands	146 (8.4)	131 (8.6)	15 (7.2)
UK	98 (5.7)	91 (6.0)	7 (3.4)
Maternal age (years)			
18–30	675 (39.0)	581 (38.2)	94 (45.2)
31–40	897 (51.8)	796 (52.3)	101 (48.6)
>40	44 (2.5)	38 (2.5)	6 (2.9)
Relationship status			
Married/cohabiting/partner	1595 (92.2)	1398 (91.9)	197 (94.7)
Single	21 (1.2)	17 (1.1)	4 (1.9)

Table 1. *Cont.*

	Total	Pregnancy and Birth-Related Changes	
	***n* = 1730**	**0–4 *n* = 1522**	**>4 Changes *n* = 208**
	***n* (%)**	***n* (%)**	***n* (%)**
Professional status			
Professionally active	1430 (82.7)	1249 (82.1)	181 (87.0)
Not professionally active	176 (10.2)	157 (10.3)	19 (9.1)
Education level			
Low	34 (2.0)	29 (1.9)	5 (2.4)
Medium	290 (16.8)	259 (17.0)	31 (14.9)
High	1279 (73.9)	1114 (73.2)	165 (79.3)
Healthcare worker			
Yes	486 (28.1)	423 (27.8)	63 (30.3)
No	947 (54.7)	828 (54.4)	119 (57.2)
Smoking status			
Smoking in pregnancy	6 (0.3)	5 (0.3)	1 (0.4)
Smoking postpartum	18 (1.0)	16 (1.1)	2 (1.0)
Both	13 (0.8)	12 (0.8)	1 (0.4)
None	1579 (91.3)	1382 (90.8)	197 (94.7)
COVID-19 characteristics			
COVID-19 status [a] *			
Positive test	93 (5.4)	87 (5.7)	6 (2.9)
Symptomatic [b]	154 (8.9)	128 (8.4)	26 (12.5)
None	1425 (82.4)	1255 (82.5)	170 (81.7)
Severity of the infection			
No or mild symptoms	94 (5.4)	83 (5.5)	11 (5.3)
Moderate symptoms	69 (4.0)	61 (4.0)	8 (3.9)
Hospitalized/long-term symptoms	29 (1.7)	24 (1.6)	5 (2.4)
Family member with COVID-19			
Yes	343 (19.8)	304 (20.0)	39 (18.8)
No	1387 (80.2)	1218 (80.0)	169 (81.3)
Health and reproductive characteristics			
Chronic mental illness [c]	34 (2.0)	30 (2.0)	4 (1.9)
Chronic somatic illness [d]	457 (26.4)	390 (25.6)	67 (32.2)
Infant age			
≤6 weeks	653 (37.7)	584 (38.4)	69 (33.2)
6–12 weeks	1077 (62.3)	938 (61.6)	139 (66.8)
Currently breastfeeding [e]			
Yes	1576 (91.1)	1387 (91.1)	189 (90.9)
No	154 (8.9)	135 (8.9)	19 (9.1)
Previous breastfeeding experience *			
Yes	651 (37.6)	593 (39.0)	58 (27.9)
No	925 (53.5)	794 (52.2)	131 (63.0)

Table 1. *Cont.*

	Total	Pregnancy and Birth-Related Changes	
	***n* = 1730**	**0–4 *n* = 1522**	**>4 Changes *n* = 208**
	***n* (%)**	***n* (%)**	***n* (%)**
Presence of support during delivery			
Partner	1529 (88.4)	1343 (88.2)	186 (89.4)
Relative, friend or other	27 (1.6)	22 (1.4)	5 (2.4)
None [f]	24 (1.4)	19 (1.2)	5 (2.4)

* Chi-square *p*-value < 0.05 when tested for association between respective characteristics and pregnancy and birth-related changes (0–4 or >4). [a] Refers to COVID-19 status since the start of the pandemic (not limited to pregnancy or postpartum). [b] Refers to a negative test, but presence of symptoms. [c] Chronic mental illness includes anxiety and depression. [d] Chronic somatic illness includes asthma, allergy, cardiovascular diseases, diabetes, epilepsy, hypothyroidism, rheumatic illness, inflammatory bowel disease, and other diseases. [e] Refers to breastfeeding at the time of survey completion. [f] Only 1 of the 24 women who answered "None" on Presence of support during delivery was single. Numbers may not add up due to missing values; missing values are: maternal age, relationship status, and smoking status, *n* = 114 (6.6%); professional status, *n* = 124 (7.2%); educational level, *n* = 127 (7.3%); healthcare worker, *n* = 297 (17.2%); COVID-19 status, *n* = 58 (3.4%); severity of the infection, *n* = 55 (22.3%); previous breastfeeding experience, *n* = 154 (8.9%); and presence of support during delivery, *n* = 150 (8.7%).

A comparison of participant characteristics with the general birthing population data is included in Supplementary Table S1. This showed that study participants more often had higher education, were more professionally active, and more often worked in healthcare compared to the general birthing population in each country.

2.2. Pregnancy- and Birth-Related Changes during the COVID-19 Pandemic

A total of 1730 participants reported their birth experiences. Table 2 summarises the birth-related changes (see also Supplementary Figure S2). The most frequent change in birth experience was exclusion of the partner from pregnancy care appointments (83.2%). More than half of the study population also experienced changed settings for prenatal care (64.4%), and 42.7% experienced cancellation of hospital visits for information (see Supplementary Table S2 for reported changes in birth experiences for each participating country).

Table 2. Pregnancy and birth-related changes during the third wave of the COVID-19 pandemic.

	n	**%**
Partner not allowed to accompany me to pregnancy care appointments (e.g., ultrasound)	1439	83.2
Changed settings for prenatal care (e.g., no more group classes)	1114	64.4
Cancellation of hospital visits for information	739	42.7
Change in schedule of persons (e.g., midwife, gynaecologist) providing pregnancy care	403	23.3
Cancellation or reduction of appointments for prenatal examination	370	21.4
Change from in-person prenatal visits to virtual visits	358	20.7
Other [a]	168	9.7
No pregnancy or birth-related changes	80	4.6
Change in schedule for C-section or induction of labour	61	3.5
Change of plan: from one selected hospital/birth centre to another	58	3.4
Change of plan: from hospital birth to home birth	30	1.7
Change of plan: from home birth to hospital birth	24	1.4

[a] Other includes open-ended answers (see Supplementary Table S3).

In total, 12.0% of the postpartum women reported > 4 pregnancy and birth-related changes (*n* = 208/1730). As shown in Table 1, the maternal characteristics associated with >4 pregnancy and birth-related changes were as follows: country of residence, COVID-19 status, having a chronic somatic illness, and prior breast-feeding experience.

The majority of women had their partner present at delivery (n = 1529, 88.4%). Only 24 women did not have anyone else other than the health care professionals present at delivery (1.4%) (Table 1). Only 1 of these 24 women was single.

2.3. Mental Health Status of Postpartum Women

Overall, 31.1% (n = 538; CI 29.5–33.9) and 16.7% (n = 289; CI 15.2–18.8) of the postpartum women had symptoms of moderate or major depressive symptoms, respectively, as measured by the EDS. Moreover, 33.4% (n = 577; CI 31.8–36.3) scored over the cut-off for anxiety symptoms. A descriptive overview of the EDS and EDS-3A results for postpartum women by birth-related changes and partner support is shown in Table 3. There was a higher proportion of women with moderate (41.3% vs. 29.7%) and major (25.0% vs. 15.6%) depressive symptoms as well as anxiety symptoms (41.3% vs. 32.3%) among women with >4 pregnancy and birth-related changes compared to women with fewer birth-related changes.

Table 3. Number and percentage of women scoring above the cut-off for symptoms of depression and anxiety, by (i) pregnancy and birth-related changes and (ii) presence of support at delivery.

	Pregnancy and Birth-Related Changes				**Presence of Support During Delivery [a]**			
	0–4 Changes		**>4 Changes**		**Yes**		**No**	
	(n = 1522)		**(n = 208)**		**(n = 1556)**		**(n = 24)**	
	N	**% (95% CI)**	**N**	**% (95% CI)**	**N**	**% (95% CI)**	**N**	**% (95% CI)**
Depression								
Moderate Score ≥ 10	452	29.7 (28.0–32.7)	86	41.3 ** (34.8–48.3)	487	31.3 (29.0–33.6)	10	43.5 (27.4–65.3)
Major Score ≥ 13	237	15.6 (14.1–7.8)	52	25.0 ** (19.2–31.1)	256	16.5 (14.7–18.4)	6	26.1 (14.6–49.8)
EDS-3A								
Anxiety	491	32.3 (30.6–35.4)	86	41.3 * (34.8–48.3)	521	33.5 (31.2–35.9)	10	43.5 (27.5–65.4)

[a] Includes partner, relative, friend, and other. * $p < 0.05$, ** $p < 0.01$, Chi-squared test, mental health measure, and 0–4 vs. >4 changes.

EDS = Edinburgh Depression Scale, total score from 0 to 30, cut-off of ≥10 indicating moderate symptoms of depression, cut-off ≥ 13 indicating symptoms of moderate to severe depression (18); EDS-3A = Edinburgh Depression Anxiety Subscale, score ≥ 5 on the subscale was considered as high risk for anxiety. Missing data were n = 34 (2.0%) for both EDS and EDS-3A. See score distribution for EDS and EDS-3A scales in Supplementary Figures S3–S6.

2.4. Factors Associated with Major Depressive and Anxiety Symptoms

Postpartum women who experienced > 4 pregnancy and birth-related changes were more likely to experience major depressive symptoms (EDS ≥ 13) than women with 0–4 changes in crude analyses. This association remained significant after adjusting for confounding factors (see Table 4, aOR 1.75; CI 1.20–2.55).

Likewise, postpartum women with more than 4 pregnancy and birth-related changes were more likely to experience anxiety symptoms (EDS-3A ≥ 5) compared to women with 0–4 changes. Effect estimates remained significantly elevated after adjustment for unbalanced background characteristics, i.e., country, COVID-19 status, and breastfeeding experience before the pandemic (aOR 1.55; CI 1.13–2.12).

The few women who reported not having any support during delivery did not have increased odds of major depressive symptoms (EDS ≥ 13) nor anxiety symptoms (EDS ≥ 5) after adjustment for confounding factors (Table 4). Effect estimates, however, were highly imprecise.

The results of the individual analyses exploring associations between specific birth-related changes and major depressive and anxiety symptoms are shown in Table 5. Changes

in birth plan (e.g., birthing location or change in schedule for C-section), and changes related to prenatal care visits and care were associated with major depressive and anxiety symptoms.

Table 4. Associations between (i) pregnancy- and birth-related changes and (ii) presence of support during delivery and mental health outcomes in postpartum women during the third wave of the pandemic.

	N	Major Depressive Symptoms (EDS ≥ 13)		Anxiety Symptoms (EDS-3A ≥ 5)	
		cOR 95% CI	aOR [a] 95% CI	cOR 95% CI	aOR [b] 95% CI
Changes in pregnancy and birth experience					
0–4 changes	1522	Ref	Ref	Ref	Ref
>4 changes	208	1.77 (1.25–2.48)	1.75 (1.20–2.55)	1.44 (1.07–1.94)	1.55 (1.13–2.12)
Presence of support during delivery					
Yes	1556	Ref	Ref	Ref	Ref
No	24	2.09 (0.86–5.09)	1.12 (0.31–3.96)	1.68 (0.78–3.78)	1.15 (0.42–3.16)

Abbreviations: CI = confidence interval; cOR = crude odds ratio; aOR = adjusted odds ratio; Ref: reference category. [a,b] Adjusted for country, COVID-19 status, and prior breastfeeding experience.

Table 5. Associations between specific pregnancy and birth-related changes and mental health outcomes.

Pregnancy and Birth-Related Changes (Yes vs. No, Reference Category: No) [a]	Major Depressive Symptoms (EDS ≥ 13)		Anxiety Symptoms (EDS-3A ≥ 5)	
	aOR	95% CI	aOR	95% CI
Change of plan: from home birth to hospital birth	3.46	1.31–8.72	2.27	0.90–5.78
Change of plan: from one selected hospital/birth centre to another	3.01	1.59–5.51	2.32	1.29–4.16
Change in schedule for C-section or induction of labour	2.63	1.41–4.75	2.64	1.50–4.67
Cancellation or reduction of appointments for prenatal examination	2.43	1.79–3.28	1.78	1.38–2.31
Change in schedule of persons (e.g., midwife, gynaecologist) providing pregnancy care	1.70	1.26–2.29	1.50	1.17–1.92
Changed settings for prenatal care (e.g., no more group classes)	1.50	1.10–2.06	1.28	1.01–1.64
Change from in-person prenatal visits to virtual visits	1.46	1.05–1.99	1.37	1.05–1.77
Cancellation of hospital visits for information	1.36	1.02–1.82	1.26	1.00–1.58
Partner not allowed to attend pregnancy care appointments (e.g., ultrasound)	1.06	0.73–1.59	1.21	0.89–1.65
Change of plan: from hospital birth to home birth	0.92	0.30–2.31	0.77	0.32–1.71
Other	0.88	0.52–1.41	0.75	0.50–1.10

Abbreviation: aOR = adjusted odds ratio; CI = confidence interval; [a] Adjusted for COVID-19 status, prior breastfeeding experience and presence of support during delivery. Country was removed due to multicollinearity.

3. Discussion

The main finding of this multinational study was that more than 95% of postpartum women during the third pandemic wave had experienced at least one birth-related change during their pregnancy. This clearly demonstrates the profound impact the pandemic continues to have on pregnant women across several European countries. The most common change by far was the exclusion of the partner from pregnancy care appointments (e.g., ultrasound), which was reported by more than 80% of women in the study. However, this change didn't seem to be associated with women's mental health. Less common changes, e.g., change in schedule for C-section (3.5%), change in birth centre (3.4%), and change from home to hospital birth (1.4%) were more strongly associated with postnatal depression and anxiety symptoms. This is in line with prior study findings from the first wave of the pandemic [1,2]. These changes in birth management, however, may rather be the result of obstetrical constraints. For instance, a change in schedule for C-section might occur in the event of pregnancy complications, which could likely have mental health implications independently of a pandemic. A recent prospective study performed during the first wave of the pandemic found that a postpartum EPDS score ≥13 was associated with maternal hypertension/preeclampsia, emergency caesarean section, and neonatal complications [20].

It is concerning that maternity care during the third pandemic wave has not been more normalised given that more knowledge about COVID-19 mitigation measures and the importance of partner support and adequate maternity care for maternal–infant health has become available [1–4,9,16,17]. This includes the women's mental health during pregnancy and postpartum. The fact that more than 95% of our study population experienced at least one birth-related change exceeds the estimates from prior studies on birth experiences during the early phases of the pandemic, where typically over 45% of women reported at least one birth plan alteration [1,2,7]. Thus, it may indicate that few "lessons learned" have been carried over from earlier waves to the third COVID-19 wave and that returning to normality within the maternity care system takes time. Importantly, as our study measured the type and number of birth-related changes, we were able to expand on current knowledge by providing a more in-depth description of individual birth-related changes, associated factors, and mental health consequences. Interestingly, birth-related changes were associated with the country of residence, COVID-19 status and prior breastfeeding experience. The latter was probably due to higher parity rather than prior breastfeeding experience and thus could be interpreted as a proxy for more experienced women. Differences between countries [8,17,18,21] and COVID-19 status [8,13,20] have also previously been associated with changes in birth plan and poor birth experiences during the early phases of the COVID-19 pandemic.

We found that, among women having experienced more than four changes, 25.0% scored above the cut-off value for major depressive symptoms, compared to 15.6% of women with fewer changes. These prevalence rates coincide with findings from the first and second waves [2,13]. The percentage of high anxiety symptoms was even higher: 41.3% of women with >4 pregnancy and birth-related changes compared to 32.3% of women with 0–4 changes. The higher prevalence of anxiety symptoms among women with many birth-related changes supports previous findings of the COVID-19 pandemic being a major stressor for birthing women [4,7]. Importantly, our logistic regression models showed a statistically significant association between women having experienced >4 changes and symptoms of major depression (aOR 1.75; CI 1.2–2.55) and anxiety (aOR 1.55; CI 1.13–2.12). This clearly demonstrates the impact of the continuous substantial COVID-19 regulations on postpartum women's mental health during the third wave of the pandemic.

Using a binary outcome of pregnancy and birth-related changes makes it challenging to determine which changes have the strongest association with women's birth experiences. Further, this classification may be too simplistic as it does not account for the different importance or seriousness of the individual changes. To explore specific pregnancy and birth-related changes, we modelled the relationship between each reported experience item (from Question 8, see Supplementary Material S1) and mental health symptoms (Table 5). Using logistic regression, we found that changes in pregnancy and birth-related plans were associated with more than a two-fold increase in the odds of having postpartum major depressive symptoms. The results presented in Table 5 suggest that, in addition to the number of changes, the type of change might be even more relevant for maternal mental health postpartum. Previous findings show similar results, where unexpected changes (e.g., emergency C-sections and change from home to hospital birth) correlated with poor birth experiences and depressive symptoms [1,2]. Such unexpected changes are not necessarily related to COVID-19, but rather due to pregnancy complications. However, these studies also report that feelings of anxiety and distress regarding birth complications worsened due to COVID-19 related restrictions (e.g., lack of partner support) [1]. In addition, we found that cancellations and reductions of appointments for prenatal examinations were associated with a doubling in the likelihood of major depressive symptoms and an increase in odds of high anxiety symptoms by almost 70%. This demonstrates the importance of continued maternity check-ups, even in times of pandemic.

An important finding was that, despite the majority (>80%) being separated from their partner during pregnancy appointments, more than 88% had their partner present during delivery, clearly showing a priority given to the time of birth. In our cohort, the

absence of support at delivery was not associated with poorer mental health outcomes. These findings remain uncertain due to a lack of precision in the analyses, potentially as a result of the limited sample. They also stand in contrast to previous findings of elevated anxiety symptoms concerning lack of partner support and social support and uncertainty regarding partners' visiting policies [2,3,8,17]. Larger studies are needed to elucidate the role of partner support during pregnancy and delivery during a pandemic on women's postpartum mental health.

Strengths and Limitations

Data were collected uniformly across five European nations. Participation in each country was also nationwide, and not limited to a few cities, which was the case in some prior studies covering only one hospital or region [3,10]. Importantly, we included detailed questions about women's birth experiences, enabling in-depth analyses beyond a binary yes/no variable (i.e., evaluating each of the eleven birth experience items in addition to the number of changes). The study used internationally validated self-reported screening tools to measure postnatal depression and anxiety symptoms. We applied recommended cut-off values to detect mental health symptoms (EDS $\geq$ 13; specificity: 0.95 [22], EDS-3A $\geq$ 5, specificity: 92.2 [23]). Usage of the recommended cut-offs increases the chance of detecting participants with higher symptom levels [22]. A lower cut-off value of EDS $\geq$ 10 was also applied to detect possible false negatives.

There were also several limitations to the study that should be acknowledged. As for all web-based studies, it is not possible to calculate a conventional response rate in anonymous, web-based surveys. Moreover, the use of web-based surveys introduces self-selection bias. Hence, to assess the external validity of this study, we compared our study participants to national birthing population data in each country. Compared to national birthing population data, a higher proportion of study participants had high education, were professionally active, and worked in healthcare. Study participation was also not evenly distributed among participating countries, with an overrepresentation of postpartum women from Norway. Furthermore, maternal self-report assessments may introduce recall bias, as responses are retrospective. Because we measured mental health outcomes and birth-related changes in the same questionnaire, we cannot exclude the risk of common method bias. However, we consider this risk to be minimal as women were asked to report objective changes that occurred during prenatal follow-up and in relation to childbirth. Our distinct results for number versus type of birth-related changes corroborate the above assumption; if common method bias was substantial, we would have obtained uniform associations across analyses. Another limitation of this study is its cross-sectional design. The design limits the possibilities of inferring any temporal link between explanatory variables and response variables, e.g., >4 birth-related changes and EDS scores above 13. We did not ask about the cause of the changes, which could have been directly or indirectly due to the pandemic (due to COVID-19 infection or imposed pandemic measures during the 3rd wave) and/or been due to different reasons (e.g., pregnancy complications). In addition, the study did not measure all possible pregnancy and birth-related changes (e.g., wearing masks, hospital visits after delivery), and other possibly important changes might have been missed. Previous studies have reported that pregnant women might have experienced physiological aberrations when wearing a mask during prenatal appointments and delivery [24,25]. Moreover, not allowing siblings and other members of the family to visit the women at the hospital after delivery had a negative impact on postpartum mood [26]. Other limitations are the number of analyses conducted which may result in chance findings, the relatively small sample size for the partner support analysis, and the data-driven selection of confounders. Moreover, all analyses were complete case analyses, assuming that covariates with missing information were missing at random. Lastly, the pregnancy and birth-related experiences measured in the study are not equally important to women, and this may have affected our associations between postpartum mental health

outcomes and number of pregnancy and birth-related changes. Our results should be interpreted bearing in mind the strengths and limitations of the study.

4. Methods and Materials

4.1. Design and Study Population

A multinational, cross-sectional, web-based study was performed in Norway, Switzerland, the UK, the Netherlands, and Belgium. Data collection was performed using anonymous web-based questionnaires hosted on the KU Leuven Qualtrics platform and the Norwegian survey platform Nettskjema. The survey was adapted from a prior COVID-19 study in 2020 [17]. The English version of the survey was later modified and translated into five additional languages, namely, French, Dutch, Norwegian, German, and Italian. Pregnant women and women who gave birth in the last three months could participate. Participants had to be 18 years or older. Data were collected between 10 June and 22 August 2021.

In this study, aiming to investigate postpartum women's birth experiences during the third pandemic wave, the study participants were restricted to women who had responded to the postpartum version of the survey and completed the questions regarding changes in birth experiences (questions 8 and 9, Supplementary Material S1). Women who had not responded to these questions were excluded from the analyses (see Figure 1 in Results).

The questionnaire for postpartum women included questions about changes in the birth experience, sociodemographic characteristics, COVID-19-related information, standardised measures used for evaluating mental health like the EDS, and information about mental and somatic health history. A short version of the postpartum questionnaire is provided in Supplementary Material S1. National coordinators carried out recruitment in their respective countries. Summaries of country-specific information on recruitment tools utilised and internet penetration rates are provided in Supplementary Material S2. Infection status and vaccination status in the respective countries for the period of interest are summarised in Supplementary Material S3. The study findings are reported according to the STROBE guidelines for cross-sectional studies [27].

4.2. Measures

4.2.1. Women's Pregnancy and Birth-Related Experiences during the COVID-19 Pandemic

Women's pregnancy and birth-related experiences during the pandemic were measured by a 12-item multiple-choice question, "Which of the following changes are you experiencing or have experienced during the COVID-19 outbreak?" (Question 8, Supplementary Material S1). The items involved changes in birth location, assigned healthcare professional, caesarean-section or induced labour, changed settings, or cancellations of prenatal care appointments. Moreover, one question addressed specifically whether the partner was allowed to accompany the pregnant woman to pregnancy care appointments (e.g., ultrasound). Women could also choose the "Other" option to report changes not included in the questionnaire. Finally, they could report that they had not experienced any birth-related changes during the pandemic.

The number of changes was summarised and categorised into a binary variable entitled "Changes in pregnancy and birth-related experience", divided into having experienced either 0–4 changes or >4 changes using the upper quartile as the cut-off. The upper quartile was identified after plotting the number of birth-related changes (Supplementary Figure S1). We examined the number of changes in addition to type, as we assumed that multiple changes in pregnancy and birth-related experience may be of greater burden to the woman's mental health.

Participants were also asked to provide information on who was present during delivery, apart from medical staff (partner, relative, friend, or other, Question 9, Supplementary Material S1). In the mental health association analyses, presence of support during delivery was dichotomized (yes/no).

4.2.2. Mental Health Measures

The EDS was used to assess postpartum women's depressive symptoms. EDS is a self-report 10-item scale used to screen for perinatal depression [28]. The scale is widely used worldwide and has been validated in many languages, including French, Dutch, Norwegian, German, and Italian [29]. Each item is scored from 0 to 3. The scale rates the intensity of depressive symptoms during the last seven days. EDS has a total score ranging from 0 to 30. It is recommended to use a cut-off value of $\geq$13 to capture major depressive symptoms [22,28]. In this study, two cut-off values of $\geq$10 and $\geq$13 were applied to define scores of moderate and major depressive symptoms, respectively. The $\geq$13 cut-off value was used in the association analyses.

EDS also contains an anxiety subscale (EDS-3A). On the EDS-3A, a score of $\geq$5 was considered high risk for perinatal anxiety symptoms [23]. Therefore, this cut-off was applied in this study.

4.2.3. Sociodemographic Characteristics

Sociodemographic characteristics included information on country of residence, maternal age, relationship status, professional status, education level, working in healthcare, and smoking status. Education level was categorised into low, medium, or high, according to national definitions. Smoking status was categorised as either smoking exclusively during pregnancy, exclusively after delivery, smoking both during pregnancy and after delivery, or neither.

4.2.4. COVID-19 Status, Health Characteristics, and Reproductive Characteristics

The survey also collected information on the participant's COVID-19 status, including test results, the severity of illness, and whether family members had tested positive for SARS-CoV-2. Information on health and reproductive characteristics was also collected, including information on chronic mental and somatic diseases, infant age, breastfeeding status, and previous breastfeeding experience. The presence of chronic mental (i.e., anxiety, depression) and somatic diseases (i.e., asthma, allergy, cardiovascular diseases, diabetes, epilepsy, hypothyroidism, and other diseases) was recorded according to the main specific diseases and categorised into two composite covariates as having a chronic mental (yes/no) and chronic somatic disease (yes/no). Participants were allowed to report other chronic diseases in an open-ended question.

4.3. Statistical Analyses

Descriptive statistics were used to present women's reported changes in pregnancy and birth-related experiences, sociodemographic characteristics, health- and reproductive characteristics, COVID-19 status, and mental health outcomes. Associations between the postpartum women's characteristics and pregnancy and birth-related experience categories (i.e., 0–4 or >4 changes) were tested using Chi-squared tests (χ^2). p-values < 0.05 were considered statistically significant.

Univariable and multivariable logistic regression was used to estimate the associations between major depressive symptoms (EDS $\geq$ 13) and anxiety symptoms (EDS-3A $\geq$ 5) and (i) pregnancy and birth-related changes (0–4 or >4 changes) and (ii) presence of support during delivery. The sociodemographic, health-related, and reproductive characteristics that were significant ($p < 0.05$) on the initial χ^2 test, were included in the multivariable models. Only statistically significant covariates were retained in the final multivariable models. For each multivariable logistic regression model, the variance inflation factor (VIF) was used to detect multicollinearity and all variables with a VIF value < 5 were included. In additional logistic regression analyses, each pregnancy and birth-related change was analysed individually using the same approach described above. The results were presented as crude (cOR) and adjusted odds ratios (aOR) and 95% confidence intervals (CI). We used a complete case analysis approach in relation to missing data on covariates. Data were analysed in RStudio 2022.07.1+554 (RStudio Team, RStudio PBC, Boston, MA, USA).

4.4. Ethical Approval

Electronic informed consent was obtained from the participants prior to survey initiation. Because data were anonymously collected, ethical approval was waived in Norway, Switzerland, The Netherlands, and the UK. In Belgium, ethical approval was obtained from the Ethics Committee Research UZ/KU Leuven (S63966; 26 May 2021). All data were stored and handled anonymously.

5. Conclusions

An estimated 12% of postpartum women in five European countries reported extensive changes in birth experience during the third wave of the COVID-19 pandemic. We found that having more than four pregnancy- and birth-related changes increased the likelihood of experiencing major depressive and anxiety symptoms postpartum. Despite partners being commonly excluded from pregnancy care visits, most partners were present during delivery. Furthermore, experiencing changes related to delivery and cancellation or reduction of prenatal examination was associated with a doubling in the likelihood of symptoms of major depression and symptoms of anxiety postpartum. These findings highlight the importance of ensuring adequate maternity care for women's mental health postpartum, also during a pandemic.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/pharma2010006/s1, Supplementary Figure S1. Distribution of the number of birth-related changes among postpartum women during the third wave of the COVID-19 pandemic. Supplementary Figure S2. Proportion (%) of each experienced birth-related change among postpartum women during the third wave of the COVID-19 pandemic. Supplementary Figure S3. Distribution of the scores on EDS among postpartum women by changes in birth experience. Supplementary Figure S4. Distribution of total scores on EDS in postpartum women, categorized as either having presence of support or not at delivery. Supplementary Figure S5. Distribution of the scores on EDS-3A among postpartum women by changes in birth experience. Supplementary Figure S6. Distribution of total scores on EDS-3A in postpartum women, categorized as either having presence of support or not at delivery. Supplementary Table S1. Comparison between the general birthing population and the study sample of postpartum women for each country. Supplementary Table S2. Self-reported changes in pregnancy and birth management of postpartum women during the third wave of the COVID-19 pandemic by country. Supplementary Table S3. Representative statements to the open-ended questions regarding birth experiences. Supplementary Material S1. Postpartum-specific version of the survey relevant to this manuscript. Supplementary Material S2. Recruitment tools utilized and internet penetration rates. Supplementary Material S3. Overview of the infection and vaccination rates in each country during the study period 10 June and 22 August 2021.

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Institutional Review Board Statement: As the survey was anonymous, ethical approval was waived in most countries, except Belgium (S63966). All data were stored and handled anonymously (See Section 4.4 Ethical Approval).

Informed Consent Statement: Electronic informed consent was obtained from the participants prior to survey initiation.

Data Availability Statement: The collected data are presented in the manuscript and the Supplementary Material.

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Conflicts of Interest: The authors declare no conflict of interest.

Abbreviations

COVID-19	Coronavirus Disease
CI	Confidence Interval
EDS	Edinburgh Depression Scale
OR	Odds Ratio
UK	United Kingdom

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