Self-reported mental health status of pregnant women in Sweden during the COVID-19 pandemic: A cross-sectional survey

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Abstract

Background: The COVID-19 pandemic has contributed to unprecedented worries and challenges for pregnant women due to social restrictions and changes in maternity care provision. We aimed to investigate the mental health impact of COVID-19 pandemic on pregnant women in Sweden and explore factors associated with poor perinatal mental health in this specific context.

Method: This was a nation-wide cross-sectional survey of pregnant women living in Sweden. Validated questionnaires were distributed through non-profit organizations´ websites and social media channels from May 2020 to February 2021. Perinatal depression, anxiety, and acute stress reaction were assessed using the Edinburgh Postnatal Depression Scale (EPDS), Generalized Anxiety Disorder-7(GAD-7) and Impact Event Scale (Revised)(IES-R), respectively. Sociodemographic characteristics and self-perceived mental well-being were also obtained. Factors associated with mental health outcomes were analyzed using multivariate logistic regression model.

Results: Among a total of 522 participants, 42.5% (n=222) reported depression (EPDS ≥13**)**, 25.3% (n=132) moderate to severe anxiety (GAD-7 score≥10), and 23.4% (n=122) moderate to severe acute stress reaction (IES-R ≥33). 27.4% participants (n=143, 27.4%) expressed concerns regarding their mental well-being during the pandemic. Pregnant mothers who had sick family members reported more severe poor mental health outcomes than those who did not (median [Interquartile range (IQR)] EPDS scores: 14.0 [8.75 – 18.0] vs 10.0 [6.0 – 14.0], p<.001; median [IQR] GAD7 scores: 7.0 [4.0 – 12.25] vs 5.0 [3.0 – 9.0], p<.001; median (IQR) IES-R scores: 20.0 [9.0 – 38.0] vs 15.0 [7.0 – 28.0], p=.008). Logistic regression analyses revealed that risk factors for poor mental health outcomes were having a sick family member with any illness, unemployment, giving birth, and experiencing an exceptional stressful life event. Having a higher educational level, younger age, and changing career during the pandemic were protective.

Conclusion: Depression and anxiety were highly prevalent among pregnant women in Sweden during the COVID-19 pandemic, indicating a need for professional mental health support for this vulnerable group of population. Unemployment was an associated risk factor whereas younger age and higher educational level were protective suggesting an important role of socio-economic factors in modulating the impact of COVID-19 pandemic on perinatal mental health.

Key words: COVID-19, pregnancy, perinatal care, mental health, depression, anxiety, stress

Background

The consequences of the COVID-19 pandemic on global mental health are significant and its long-term impact on the global burden of disease is likely to be high. The COVID-19 pandemic has a profound impact on healthcare systems and potentially on pregnancy outcomes (Thapa et al., 2020; Yan et al., 2020). Rapid changes to the delivery of maternity health care services have occurred in many countries across the globe in response to the COVID-19 pandemic. Maternity care provisions are facing a challenge in their attempt to balance the needs and safety of pregnant women and their care providers (Palatnik & McIntosh, 2020).

Globally, maternal and perinatal outcomes have worsened, with an increase in maternal deaths, stillbirths, ruptured ectopic pregnancies, and maternal depression (Chmielewska et al., 2021). During a situation of acute crisis, such as the COVID-19 pandemic, pregnant women are even more vulnerable than the general population in terms of susceptibility to mental health disorders (López-Morales et al., 2021) and the state of partial immune suppression (WHO, 2020). Prenatal distress and psychiatric symptomatology have also been shown to be more prevalent among pregnant women during the COVID-19 pandemic compared to the pre-pandemic period (Berthelot et al., 2020).

Mental disorders are a common cause of morbidity during pregnancy. In Sweden, the prevalence of perinatal depression pre-pandemic was 13.7% (women with high EPDS scores, i.e. $\geq$ 12) (Rubertsson et al., 2005; Silverman et al., 2017). Swedish pre-pandemic prevalence of anxiety symptoms in early pregnancy was 15.6 % (HADS-A scores $\geq$8) (Rubertsson et al., 2014). Approximately, 12.0% of pregnant women report symptoms of posttraumatic stress in Sweden. Assed by post-traumatic stress symptoms (3-item). The result is not based on a diagnostic questionnaire or a clinical diagnosis (Wangel et al., 2016), while the estimated lifetime prevalence of PTSD among the general female population in Sweden is 7.4% (Persson et al., 2020).

Sweden chose a different approach in mitigating the impact of the COVID-19 pandemic, compared to other neighboring Scandinavian countries (Engjom et al., 2021). Society remained open, while masks were not recommended until the end of 2020. Pregnant women were not considered a vulnerable group initially and until recently were excluded from being vaccinated. Husbands/partners of pregnant women have not been welcomed at the antenatal visits and in some counties not been allowed to attend the delivery. We hypothesized that such changes and adjustments in routine maternity care might have a negative impact on maternal mental health. This study aimed to investigate the impact of the COVID-19 pandemic on the mental wellbeing of pregnant women in Sweden and explore risk factors for poor perinatal mental health in this specific context.

Method

Study Design and setting

This study is part of a global survey investigating the impact of the COVID-19 pandemic on pregnant women's mental health, including perinatal depression, anxiety, and acute stress reaction. This multi-national project includes an anonymous web-based survey distributed to pregnant women in China (Hong Kong SAR and Shanghai), Norway, Sweden, Switzerland, Taiwan and all states of the United States of America (USA). The Swedish part of the survey was started in May 2020 and completed in February 2021.

Pregnant women who 1) resided in Sweden during the COVID-19 pandemic and 2) could understand Swedish could participate in the study. Exclusion criteria were 1) unconfirmed pregnancy status and 2) inability to use a web-based application to answer the survey questionnaires. The pregnant women are recruited via non-profit organizations´ websites and social media channels. Via the web link, the participants were guided to the research website where they could read information about the project and answer the questionnaires anonymously if agreed to participate in the study. Informed consent was obtained from all the participants and their guardian for illiterate participants. Data were collected using Qualtrics, a widely used online survey platform for social science research.

Assessment of mental health status

The anonymous survey included assessments of symptoms of perinatal depression, anxiety and PTSD using validated instruments (Arnberg et al., 2014; Buist et al., 2011; Rubertsson et al., 2011)

Edinburgh Postnatal Depression Scale (EPDS) Depressive symptoms among pregnant mothers were assessed by EPDS (Cox et al., 1987). EPDS is a 10-item self-report scale assessing postnatal depression. Each item offers four options which are scored from 0 to 3, higher indicates more intense depressive symptoms over the past 7 days. Total score of EPDS ranges from 0 to 30. The Swedish version of Edinburgh Postnatal Scale is well validated (Rubertsson et al., 2011) and commonly used in women mental health studies, with an optimal cut-off score of ≥13. In our study, the scale demonstrated good internal consistency with a Cronbach's Alpha of .87.

Generalized Anxiety Disorder-7 (GAD7) The GAD7 is a globally used self-report scale that assesses participants' level of generalized anxiety in the past 14 days. The 7-item Likert-4 scale measures the frequency of being distressed by anxiety-related symptoms, with options ranging from *not at all* to *nearly every day* (scored from 0 to 3). Total score of GAD7 ranges from 0 to 21, higher scores indicate a higher level of generalized anxiety. The total score of GAD7 will be further categorized into severity categories of minimal (0-4), mild (5-9), moderate (10-14), and severe (15-21) anxiety. In this study, we used the Swedish version of GAD7 (Spitzer et al., 2006), which has demonstrated excellent internal consistency in previous studies.

Impact Event Scale (Revised) (IES-R). The IES-R is a 22 item self-reported measure designed to assess acute stress reactions and probable post-traumatic distress following stressful life events in the past seven days (Horowitz et al., 1979). Each item measures with a Likert-5 rating scale (from

not at all to *extremely,* 0-4). Total score of IES-R ranges from 0 to 88, higher scores indicate higher levels of distress from acute stress reactions. The total scores are further categorized into categories of minimal (0-23), mild (24-32), moderate to severe concern for PTSD (33-88). In this study, IES-R is administered as event-oriented to the covid-19 pandemic. We used the Swedish version of IES-R (Arnberg et al., 2014; Sveen et al., 2010), which has demonstrated an excellent internal consistency with a Cronbach's Alpha of .94 in this study.

Mental wellbeing and stressful life events during the pandemic. The perceived mental well-being of participants was assessed by a single 10-point Likert scale enquiring overall mental health status in the past 12 months. Participants were then asked to fill in a stressful event checklist assessing their exposures in the past one year.

Statistical Analysis
Participants' characteristics and scores obtained from mental health assessments were analyzed by descriptive statistics. Continuous variables are presented as means and standard deviations (SD), while categorical variables are presented as number (n) and percentage (%). Associations were analyzed using Chi-squared test. The total scores of the three mental health status measurement tools (EPDS, GAD7 and IES-R) were not normally distributed, and so are presented as medians with interquartile ranges (IQR). Non-parametric Mann-Whitney U test was applied to compare the severity of symptoms between families with sick family members (including COVID-19 and other illnesses) and those without sick family members. Associations between mental health outcomes (depression and anxiety, acute stress reactions) and demographic characteristics of participants were estimated by univariate and multivariate logistic regression, and are presented as odds ratios (ORs) with 95% Confidence intervals (CIs). The statistical significance was set at a *p*-value of <0.05. All statistical analyses were performed with the Statistical Package for the Social Science (SPSS) version 26 (IBM® SPSS® Statistics).

Results
Demographic Characteristics of the Participants
A total of 522 pregnant women completed the questionnaire; 31.0% (n=162) of whom had at least one sick family member. The sociodemographic characteristics of the participants, their self-perceived overall mental health status, and stressful event exposure are presented in **Table 1**. The mean age of the participants was 30.81 (± 4.39) years. Most women lived in cohabitation with a partner (55.0%) or were married (42.0%) and the majority (n=301, 57.7%) were working 40 hours a week. Two third of the participants (n=317, 60.7%) were with a bachelor's degree or above.

Table 1 Sociodemographic characteristics of participants (N=522)

Variables	Mean, SD	No. (%) Total	Family Health Status Families	Families	*P* value*

			with sick members	without sick members	
Overall		522 (100)	162 (31.0)	360 (69.0)	
Age		30.81 (4.39)			
	18-25	53 (10.2)	18 (11.1)	35 (9.7)	.689
	26-30	203 (38.9)	65 (40.1)	138 (38.3)	
	31-40	257 (49.2)	75 (46.3)	182 (50.6)	
	>40	9 (1.7)	4 (2.5)	5 (1.4)	
Civil Status					
	Single	3 (0.6)	1 (0.6)	2 (0.6)	.671
	Married	219 (42.0)	69 (42.6)	150 (41.7)	
	Cohabitating	287 (55.0)	87 (53.7)	200 (55.6)	
	in a relationship	12 (2.3)	4 (2.5)	8 (2.2)	
	Divorced	1 (0.2)	1 (0.6)	0 (0)	
Working Hours					
	<40 hours per week	177 (33.9)	59 (36.4)	118 (32.8)	.170
	40 hours per week	301 (57.7)	85 (52.5)	216 (60.0)	
	> 40 hours per week	44 (8.4)	18 (11.1)	26 (7.2)	
Monthly Family Income					
	< 40000 SEK	177 (34.6)	44 (28.2)	133 (37.4)	**.029***
	40000 SEK	212 (41.4)	78 (50.0)	134 (37.6)	
	> 40000 SEK	123 (24.0)	34 (21.8)	89 (25.0)	
Educational Level					
	No education	3 (0.6)	0 (0)	3 (0.8)	.806
	9-year mandatory education	10 (1.9)	4 (2.5)	6 (1.7)	
	High school	108 (20.7)	33 (20.4)	75 (20.8)	
	Professional education	84 (16.1)	30 (18.5)	54 (15.0)	
	Bachelor	167 (32.0)	48 (29.6)	119 (33.1)	
	Masters	140 (26.8)	44 (27.2)	96 (26.7)	
	Doctoral	10 (1.9)	3 (1.9)	7 (1.9)	
Overall Mental Health Status (1-10)		4.84 (1.90)			
	Healthy	379 (72.6)	102 (63.0)	277 (76.9)	**.001****
	Worsened Mental Health (≥ 6)	143 (27.4)	60 (37.0)	83 (23.1)	
Stressfull event Exposure					

Pregnant	470 (90.0)	142 (87.7)	328 (91.1)	.222
Giving Birth	58 (11.1)	16 (9.9)	42 (11.7)	.547
Marriage	37 (7.1)	12 (7.4)	25 (6.9)	.849
Divorce	0 (0)	0 (0)	0 (0)	N/A
Death in families	58 (11.1)	22 (13.6)	36 (10.0)	.229
Changing Career	76 (14.6)	21 (13.0)	55 (15.3)	.488
Exams	30 (5.8)	10 (6.2)	20 (5.6)	.779
Unemployment	41(7.9)	16 (9.9)	25 (6.9)	.249
Others	153 (29.3)	38 (23.5)	115 (31.9)	**.049***

Mental Health Status of the Pregnant Mothers and Severity Categories

The overall prevalence of probable depression for pregnant women during the pandemic (EPDS ≥ 13) was 42.5% (n=222). One fourth (n=132, 25.3%) of Swedish pregnant women participating in the study displayed moderate to severe generalized anxiety symptoms (GAD-7 ≥ 10). 23.4% (n=122) of the participants had moderate to severe concern for PTSD (IES-R ≥ 33).

Women whose families had sick members with any illness in the past 12 months reported experiencing more depression, anxiety and acute stress reactions (probable depression: 93(57.4%) vs 129 (35.8%), *p*<.001; moderate to severe anxiety: 58 (35.8%) vs 74 (20.5%), *p*<.001; moderate to severe concern for probable PTSD: 47 (29.4%) vs 75 (21.1%), *p*<.001) (See **Table 2**).

Scores of Measurements

The total median scores (IQR) on the EPDS for depression, GAD7 for anxiety, and IES-R for acute stress reaction among women were 11.0 (7.0 – 16.0), 6.0 (3.0 – 10.0), and 16.0 (7.0 – 31.0) respectively. Similar to findings in severity categories of women, women whose families had sick members had higher scores for depression, anxiety and acute stress reaction compared with those who did not (median EPDS scores: 14.0 (8.75 – 18.0) vs 10.0 (6.0 – 14.0), p<.001; median GAD7 scores: 7.0 (4.0 – 12.25) vs 5.0 (3.0 – 9.0), p<.001; median IES-R scores: 20.0 (9.0 – 38.0) vs 15.0 (7.0 – 28.0), p=.004) (See **Table 3**).

Factors Associated with mental health status of pregnant women

Multivariate logistic regression analyses were performed to investigate factors associated with the mental health status of pregnant women during the pandemic. Having sick family members increased the odds of depression by 3 times (aOR 2.950, 95% CI 1.933 – 4.502, *p*<.001), anxiety by 2.5 times (aOR: 2.548, 95% CI 1.615 – 4.022, *p*<.001), acute stress reaction by 60% (aOR 1.604, 95% CI 1.004 – 2.560, p=.048), and perceived worsening in mental health by 2 times (aOR 1.951, 95% CI 1.405 – 3.391, p=.001). Unemployment increased the odds of depression by 2.5 times (aOR 2.499, 95% CI 1.140 – 5.477, *p*=.022) and acute stress reaction by 2.8 times (aOR 2.812, 95% CI 1.362 – 5.805, *p*=.005). Encountering an exceptional stressful life event increased the odds of depression (aOR 1.879, 1.215 – 2.908, *p*=.005), anxiety (aOR 2.299, 95% CI 1.426 – 3.708, *p*=.001), and so did the perceived worsening of mental health during the pandemic (aOR 1.951, 95% CI 1.233 – 3.090, *p*=.004). Anticipation of giving birth during the pandemic increased

the odds of acute stress reaction by 2.5 times (aOR 2.459, 95% CI 1.323 – 4.570, *p*=.004). (See **Table 4-7**).

Having a higher level of education (i.e. having a bachelor degree or above) decreased the odds of all three mental health outcomes (depression: aOR .761, 95% CI .637 - .911, *p*=.003; anxiety: aOR .821, 95% CI .676 - .997, *p*=.047; acute stress reaction: aOR .515, 95% CI .315 - .841, *p*=.008) Women in the age group of 26 to 30 or 31 to 40 were less likely to develop anxiety symptoms (aOR .464, 95% CI .229 - .942, *p*=.034; aOR .360, 95% CI .168 - .772, *p*=.009) and perceived worsening of mental health (aOR .495, 95% CI .246 - .996, *p*=.049; aOR .360, 95% CI .170 - .760, *p*=.007). Being at the age of 31 to 40 years decreased the odds of depression (aOR .458, 95% CI .216 - .972, *p*=.042). Changing career reduced the odds of acute stress reaction (aOR .446, 95% CI .202 - .986, *p*=.046). (See **Table 4-7**)

Table. 2 Self-reported mental health status and severity of depression, anxiety, and acute stress in total study cohort and subgroups

Severity Category	Total, No. (%)	Mean (SD)	Families with sick members		Families without sick members		P value
			No. (%)	Mean (SD)	No. (%)	Mean (SD)	
EPDS, depression symptoms							
Total cohort	522 (100.0)	11.63 (6.28)	162 (31.0)	13.47 (6.51)	360 (69.0)	10.81 (6.01)	
Normal	300 (57.5)		69 (42.6)		231 (64.2)		<.001
Probable Depression (scores ≥ 13)	222 (42.5)		93 (57.4)		129 (35.8)		
GAD7, Anxiety							
Total cohort	522 (100.0)	6.90 (5.28)	162 (31.0)	8.25 (5.64)	360 (69.0)	6.30 (5.00)	
Normal (0-4)	199 (38.1)		48 (29.6)		151 (41.9)		<.001
Mild (5-9)	191 (36.6)		56 (34.6)		135 (37.5)		
Moderate (10-14)	71 (13.6)		28 (17.3)		43 (11.9)		
Severe (15-21)	61 (11.7)		30 (18.5)		31 (8.6)		
IES-R, Acute Stress symptoms							
Total cohort	516 (100.0)	21.06 (17.60)	160 (31.0)	24.43 (19.27)	356 (69.0)	19.55 (16.61)	
Normal (0-23)	345 (66.9)		98 (61.3)		247 (69.4)		.051
Mild (24-32)	49 (9.5)		15 (9.4)		34 (9.6)		
Moderate to Severe concern for PTSD (33-88)	122 (23.4)		47 (29.4)		75 (21.1)		

Aberration: EPDS, 10-item Edinburgh Postnatal Depression Scale; GAD-7, 7-item Generalized Anxiety Disorder; IES-R, 22-item Impact of Event Scale–Revised

Table. 3 Scores of Mental health Measurements in Total Cohort and Subgroups

Scale	Total score, Median	IQR	Families with sick members		Families without sick members		*P* value
			Total score, Median	IQR	Total score, Median	IQR	
EPDS, Depression Symptoms	11.0	7.0 – 16.0	14.0	8.75 – 18.0	10.0	6.0 – 14.0	<.001
GAD7, Anxiety Symptoms	6.0	3.0 – 10.0	7.0	4.0 – 12.25	5.0	3.0 – 9.0	<.001
IES-R, Acute Stress Reaction	16.0	7.0 – 31.0	20.0	9.0 – 38.0	15.0	7.0 – 28.0	.008

Aberration: EPDS, 10-item Edinburgh Postnatal Depression Scale; GAD-7, 7-item Generalized Anxiety Disorder; IES-R, 22-item Impact of Event Scale–Revised; IQR, Interquartile Range

Table. 4 Factors associated with depressive symptoms (EPDS ≥ 13) among pregnant women

	cOR	95% CI	*p*	aOR	95% CI	*p*
Age						
18-25	Ref	Ref		Ref	Ref	
26-30	.394	.209 - .741	**.004****	.514	.251 – 1.052	.069
31-40	.307	.165 - .571	**<.001****	.458	.216 - .972	**.042***
>40	.257	.057 – 1.150	.076	.313	.060 – 1.645	.170
Working Hours						
<40 hours per week	Ref	Ref		Ref	Ref	
40 hours per week	.663	.456 - .966	**.032***	.873	.566 – 1.347	.539
>40 hours per week	.882	.455 – 1.710	.710	1.069	.508 – 2.250	.860
Monthly Family Income						
<40000 SEK	Ref	Ref		Ref	Ref	
40000 SEK	1.266	.847 – 1.894	.250	.765	.474 – 1.235	.273
>40000 SEK	.748	.465 – 1.204	.232	.881	.524 – 1.482	.634
Educational Level						
Bachelor or above	.441	.308 - .632	**<.001****	.761	.637 - .911	**.003****
Family Health Status						
With sick family members	2.414	1.653 – 3.525	**<.001****	2.950	1.933 – 4.502	**<.001****
Pregnancy						
Yes	1.321	.730 – 2.390	.358	1.685	.870 – 3.265	.122
Giving Birth						
Yes	1.518	.878 – 2.623	.135	1.760	.961 – 3.222	.067
Marriage						
Yes	1.305	.668 – 2.549	.436	1.230	.583 – 2.592	.587
Death in families						
Yes	1.299	.752 – 2.245	.349	1.301	.714 – 2.371	.389
Changing Career						
Yes	.663	.399 – 1.104	.114	.769	.432 – 1.371	.374
Exams						
Yes	.660	.303 – 1.440	.297	.860	.356 – 2.079	.738
Unemployment						
Yes	3.606	1.796 – 7.240	**<.001****	2.499	1.140 – 5.477	**.022***
Others						
Yes	1.508	1.032 – 2.203	**.034***	1.879	1.215 – 2.908	**.005****

*p <.05, **p <.01

Table. 5 Factors associated with anxiety symptoms (GAD7 ≥ 10) among pregnant women

	cOR	95% CI	p	aOR	95% CI	p
Age						
18-25	Ref	Ref		Ref	Ref	
26-30	.427	.229 - .798	**.008****	.464	.229 - .942	**.034***
31-40	.321	.173 - .597	**<.001****	.360	.168 - .772	**.009****
>40	.151	.018 – 1.294	.085	.184	.019 – 1.753	.141
Working Hours						
<40 hours per week	Ref	Ref		Ref	Ref	
40 hours per week	.895	.584 – 1.373	.613	1.042	.637 – 1.705	.869
>40 hours per week	1.329	.648 – 2.724	.437	1.348	.595 – 3.052	.474
Monthly Family Income						
<40000 SEK	Ref	Ref		Ref	Ref	
40000 SEK	1.459	.911 – 2.336	.116	.887	.509 – 1.545	.671
>40000 SEK	1.387	.809 – 2.378	.234	1.635	.915 – 2.922	.097
Educational Level						
Bachelor or above	.554	.372 - .825	**.004****	.821	.676 - .997	**.047***
Family Health Status						
With sick family members	2.155	1.430 – 3.249	**<.001****	2.548	1.615 – 4.022	**.000****
Pregnancy						
Yes	1.292	.644 – 2.594	.471	1.672	.788 – 3.549	.180
Giving Birth						
Yes	1.382	.762 – 2.505	.287	1.731	.895 – 3.347	.103
Marriage						
Yes	1.273	.611 – 2.653	.520	1.166	.524 – 2.593	.707
Death in families						
Yes	1.258	.688 – 2.301	.455	1.220	.643 – 2.313	.543
Changing Career						
Yes	1.065	.612 – 1.853	.823	1.319	.713 – 2.440	.378
Exams						
Yes	.726	.290 – 1.817	.494	1.117	.412 – 3.028	.828
Unemployment						
Yes	2.254	1.170 – 4.343	**.015***	1.601	.757 – 3.389	.218
Others						
Yes	1.699	1.119 – 2.580	**.013***	2.299	1.426 – 3.708	**.001****

***p <.05, **p<.01**

Table. 6 Factors associated with acute stress reaction (IES-R ≥ 33) among pregnant women

	cOR	95% CI	*p*	aOR	95% CI	*p*
Age						
18-25	Ref	Ref		Ref	Ref	
26-30	.488	.258 - .923	**.027***	.733	.358 – 1.500	.395
31-40	.368	.195 - .692	**.002****	.644	.301 – 1.380	.258
>40	.762	.172 – 3.385	.721	1.094	.212 – 5.642	.914
Working Hours						
<40 hours per week	Ref	Ref		Ref	Ref	
40 hours per week	.798	.517 – 1.231	.307	1.146	.699 – 1.879	.589
>40 hours per week	.850	.388 – 1.860	.684	1.091	.451 – 2.640	.847
Monthly Family Income						
<40000 SEK	Ref	Ref		Ref	Ref	
40000 SEK	1.362	.858 – 2.162	.189	.897	.523 – 1.539	.693
>40000 SEK	.663	.366 – 1.203	.177	.748	.396 – 1.412	.370
Educational Level						
Bachelor or above	.419	.277 - .633	**<.001****	.515	.315 - .841	**.008****
Family Health Status						
With sick family members	1.558	1.019 – 2.384	**.041***	1.604	1.004 – 2.560	**.048***
Pregnancy						
Yes	1.036	.525 – 2.044	.919	1.091	.522 – 2.283	.816
Giving Birth						
Yes	2.383	1.346 – 4.219	**.003****	2.459	1.323 – 4.570	**.004****
Marriage						
Yes	1.041	.477 – 2.271	.919	.954	.407 – 2.237	.914
Death in families						
Yes	.825	.422 – 1.614	.575	.870	.426 – 1.773	.701
Changing Career						
Yes	.396	.191 - .820	**.013***	.446	.202 - .986	**.046***
Exams						
Yes	.480	.164 – 1.403	.180	.809	.259 – 2.529	.715
Unemployment						
Yes	3.483	1.817 – 6.674	**<.001****	2.812	1.362 – 5.805	**.005****
Others						
Yes	1.259	.813 – 1.950	.301	1.335	.821 – 2.171	.244

***p >.05, **p>.01**

Table. 7 Factors associated with worsen mental health (Global rating scale ≥6) among pregnant women

	cOR	95% CI	p	aOR	95% CI	p
Age						
18-25	Ref	Ref		Ref	Ref	
26-30	.437	.235 - .813	**.009****	.495	.246 - .996	**.049***
31-40	.319	.173 - .590	**<.001****	.360	.170 - .760	**.007****
>40	.896	.216 – 3.711	.880	.980	.207 – 4.641	.980
Working Hours						
<40 hours per week	Ref	Ref		Ref	Ref	
40 hours per week	.610	.404 - .922	**.019***	.701	.440 – 1.117	.135
>40 hours per week	1.172	.588 – 2.337	.651	1.294	.602 – 2.780	.509
Monthly Family Income						
<40000 SEK	Ref	Ref		Ref	Ref	
40000 SEK	1.162	.747 – 1.809	.506	.785	.465 – 1.325	.364
>40000 SEK	.792	.463 – 1.354	.394	.940	.530 – 1.668	.832
Educational Level						
Bachelor or above	.555	.376 - .819	**.003****	.754	.470 – 1.210	.242
Family Health Status						
With sick family members	1.963	1.313 – 2.935	**.001****	2.183	1.405 – 3.391	**.001****
Pregnancy						
Yes	1.027	.539 – 1.958	.936	1.149	.572 – 2.310	.696
Giving Birth						
Yes	1.220	.675 – 2.208	.510	1.361	.716 – 2.587	.347
Marriage						
Yes	1.902	.957 – 3.779	.067	1.860	.893 – 3.873	.097
Death in families						
Yes	1.459	.817 – 2.604	.201	1.503	.811 – 2.787	.196
Changing Career						
Yes	.670	.372 – 1.207	.182	.800	.420 – 1.525	.498
Exams						
Yes	.648	.259 – 1.169	.353	.831	.307 – 2.251	.716
Unemployment						
Yes	1.784	.923 – 3.450	.085	1.134	.536 – 2.397	.743
Others						
Yes	1.643	1.091 – 2.473	**.017***	1.951	1.233 – 3.090	**.004****

*p >.05, **p>.01*

Discussion

Women's healthcare is often adversely affected by humanitarian disasters (Yerger et al., 2020). Our findings highlight the importance of planning robust maternity services in any emergency response, in line with the findings of a recent review on the impact of the COVID-19 pandemic on pregnant women (Chmielewska et al., 2021). Pregnant women in Sweden appeared to have suffered more than prior to the pandemic, based on our finding of substantially increased prevalence of perinatal depression, anxiety, and acute stress reaction. Similar to the present study, one of the first studies conducted under the COVID-19 pandemic in China has shown that pregnant women had significantly higher rates of depressive symptoms (26.0% vs 29.6%, P=0.02) than women assessed before the pandemic was declared (Wu et al., 2020)

In our study, the prevalence of depressive symptoms among pregnant women in Sweden was exceptionally high, both in comparison with pre-pandemic prevalence studies from Sweden (Silverman et al., 2017), neighboring Scandinavian countries (Silverman et al., 2017), as well as internationally (Cameron et al., 2020; Torales et al., 2020). This result stands in contrast to the expectations that in an open, non-confined society, such as Sweden, pregnant women would have better mental well-being compared to societies with prolonged isolation during the pandemic.

The inclination of "adopting social distancing measures" is often thought to be positively associated with worsened mental health during the pandemic. However, it has proven not to be the case in a study in New York City (Silverman et al., 2020). Silverman et al. found that in women with low socioeconomic status, who are most vulnerable for prenatal mood disruption, the social restrictions reduced their mental health problems. A decrease in symptomatology was also found in a recent Gallup Panel 2021 (Gallup, 2021) reporting a decrease in worry after restrictions were put in place, compared to earlier in the pandemic. Therefore, loose social restrictions leading to worries for disease transmission could be a potential explanation of why the Swedish pregnant reported an exceptionally high? prevalence of mental health problems.

The prevalence of depression (EPDS scores of ≥ 13) among Swedish women in pregnancy during the pandemic was high at 42.5%. Compared to the mean EPDS score acquired in a Swedish study 12% (mean: 5.0, n=110) before the pandemic (Massoudi et al., 2016), we found it to be doubled during the pandemic at 11.63 (n=522). Similarly, the pre-pandemic prevalence of anxiety symptoms in pregnant women residing in Sweden (HADS-A scores ≥8 during early pregnancy) was 15.6% (Rubertsson et al., 2014), while during the pandemic the point prevalence (GAD7 scores ≥ 10) has increased to 25.3%. However, this needs to be interpreted with caution as the women participating in our study were at variable stages in their pregnancy.

With regards to acute stress reaction, the estimated lifetime prevalence of acute stress and in severe conditions of probable PTSD among women in Sweden is 7.4% (Frans et al., 2005) using diagnostic procedures and the PTSD Checklist (PCL), a series of posttraumatic stress scales to assess acute stress and PTSD developed by Persson (Persson et al., 2020). Current PTSD, based

on diagnostic criteria and severity, was reported by 4.1 percent (95% CI 2.8-5.8) of the pregnant women(Persson et al., 2020) .

Perrson et al found in their study conducted in 2017-2018, that a majority of pregnant women with PTSD experienced violence, and expressed a fear of childbirth (Persson et al., 2020). Both domestic violence and fear of childbirth have increased globally, as a consequence of the COVID-19 pandemic (Berthelot et al., 2020). Although we did not inquire about domestic violence in our survey, these results are important to consider, in relation to the present study. In our study, the prevalence of moderate to severe concern for probable PTSD among the Swedish pregnant women during the pandemic was 23.4%. The rise in acute stress reaction and PTSD symptoms has also been shown in previous research during the SARS and MERS outbreaks (Lee et al., 2007; Lee et al., 2019; Lee et al., 2018; Mak et al., 2010; Park et al., 2020). Similar results occurred after the 9/11 terrorist attack (Rousseau et al., 2015) and the Holocaust (Bowers & Yehuda, 2016; Yehuda et al., 2005; Yehuda et al., 1998). The clinically concerning acute stress in pregnant women may impact their fetuses (Doyle et al., 2015). Chronic stress may cause an epigenetic change in the placenta, facilitating cortisol to pass through easier, which can result in the fetus brain maturing faster, and upon birth being hypervigilant (Monk, 2016; Monk et al., 2016; O'Connor et al., 2016). Beside the potential impact on the fetus, there is a risk of increase in number of women experiencing fear of labor and childbirth, which is important for healthcare professionals to be aware of to avoid unnecessary operative deliveries and associated complications.

When we compared participants, who were from families that had sick members and those who were not, we found that poor family health status had increased the odds of having perinatal mental health issues. Unemployment and exceptionally stressful encounters were also associated with an increasing likelihood of exhibiting probable perinatal mental disorders during the COVID-19 pandemic. This is not surprising as lower socio-economic status is known to be associated with higher risk of perinatal mental health problems. Rectifying long-standing health inequalities in the societies is equally important while making swift responses to the impact of the pandemic.

In our study, women in the age groups of 26 to 30 and 31 to 40 years showed significantly lower levels of anxiety. It could be related to the fact that in these age groups, most mothers have stable families, economic stability, and good social networks.

Strengths and limitations
Our study is one of the first in Sweden to evaluate mental health of pregnant women during COVID-19 pandemic. Data collection took place form May 2020 to May 2021, initiating the data collection during the peak of the pandemic in Sweden. However, it is not without limitations. Convenient sampling method limits the generalization of our findings, and the cross-sectional design did not allow to study the trends over a longer time and differences in mental health status of pregnant women during different stages of gestation. The study population of 522 pregnant women, potentially reduces the generalizability of the results to the general population of Swedish pregnant women. Potential for misinterpretation of questions by participants cannot be excluded

as the survey was self-administered online. Prevalence of anxiety, depression, and stress in pregnant women were found to be very high, and future studies with larger sample size are needed to evaluate the prevalence of perinatal mental health disorders due to the COVID-19 pandemic in Sweden.

The consequences on global mental health due to COVID-19 will be significant and cause long-term impact on the global burden of disease. Mental health problems cannot not be overlooked in this regard. It is important to understand now what women need to cope with and navigate their pregnancies during this pandemic. It is important that women receive reliable information and professional from their healthcare providers rather than getting conflicting advice in the social media as a primary source of information.

The high prevalence of perinatal mental health problems found in this study suggests the need for a systematic approach to screening pregnant women and providing professional support to those at high risk. Providing psychological first aid and counselling are essential during a pandemic. It helps in reducing the psychological distress and promoting adaptive coping strategies to deal with the situation short and long term (Humer et al., 2021; Moreno et al., 2020). Web-based psychosocial support can be an invaluable resource to bridge the treatment gap of perinatal mental health problems (Schwank et al., 2020), which has clearly increased during the global pandemic. Results from pre-pandemic research on the effect of internet-based support for perinatal mental health care services in Sweden, have shown significantly lower levels of depressive symptoms post treatment. Pregnancy adapted internet based psychosocial support for antenatal depression is therefore feasible, acceptable and efficacious (Forsell et al., 2017).

Conclusion

Depression and anxiety were highly prevalent among pregnant women in Sweden during the COVID-19 pandemic indicating a need for professional mental health support for this vulnerable group of population. Unemployment was an associated risk factor whereas younger age and higher educational level were protective suggesting an important role of socio-economic factors in modulating the impact of COVID-19 pandemic on perinatal mental health.

Abberations
aOR: Adjusted Odds Ratio
CI: Confidence Interval
cOR: Crude Odds Ratio
COVID-19: Coronavirus Disease 2019
EPDS: Edinburgh Postnatal Depression Scale
GAD7: Generalized Anxiety Disorder 7
HADS-A: Hospital Anxiety and Depression Scale – Anxiety

IES-R: Impact of Event Scale -Revised
IQR: Interquartile Range
MERS: Middle East respiratory syndrome
PTSD: Post-traumatic stress disorder
SARS: Severe acute respiratory syndrome
SEK: Swedish Krona
Please check author instructions, I think reference list should go before the Declarations.

Declarations

Ethical approval

Informed consent was obtained from all the participants and their guardian for illiterate participants. All methods were performed in accordance with the relevant guidelines and regulations of the Helsinki Declaration. The study was approved by the Swedish Ethical Review Authority, Etikprövnings Myndigheten (ref: Dnr Ö 21-2020/3.1; date of approval: 2020.05.18). Each participant consented to the study before participating in the survey.

Consent for publication

Not applicable

Availability of data and materials

The dataset generated and analyzed in the current study is not publicly available. However, anonymized data can be made available from the corresponding author on reasonable request.

Competing interests

Authors have no competing interest to declare in relation to this article.

Funding

Author contributions

Conception and design of study: All coauthors H.-F.C., S.E.S., E.A., H.-Y.H, G.A. contributed, discussed, agreed, and wrote the research protocol.
Acquisition of data: H.-F.C., S.E.S., E.A.

Analysis and/or interpretation of data: All the coauthors contributed H.-F.C.., S.E.S., E.A., H.-Y.H, G.A.

Drafting the manuscript: H.-F.C. and S.E.S.

Revising the manuscript critically for important intellectual content: All coauthors contributed H.-F.C., S.E.S., E.A., H.-Y.H, G.A.

Approval of the version of the manuscript to be published H.-F.C., S.E.S., E.A., H.-Y.H, G.A.

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