

Maternal Anxiety and Its Associated Factors During the First and Second Wave of COVID-19 Pandemic in Serbia: A Cross-Sectional Study

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Aim: The COVID 19-pandemic affects people differently, while pregnant women are among the most sensitive populations. The data about maternal mental health during the COVID-19 outbreak are in some ways consistent but also country-specific.

Purpose: The study aims to explore the impact of the COVID-19 pandemic on pregnant women's anxiety and identify its associated factors.

Patients and Methods: This cross-sectional study included a sample of 358 pregnant women during the first and second waves of the pandemic in Serbia. An anonymous survey included basic demographic questions, pregnancy-related background questions, the question of self-reported COVID-19-related fear, State-Trait Anxiety Inventory (STAI), and Multidimensional Scale of Perceived Social Support (MSPSS).

Results: The study revealed no pregnant women with low anxiety levels measured by STAI-T and STAI-S, while the STAI-S and STAI-T scores indicated high anxiety in 32.4% and 42.7% of pregnant women, respectively. The obtained results pointed out the nonlinear dependence of state anxiety on observed associated factors and their complex interactions, including the data collecting period.

Conclusion: Our findings reveal that COVID-19 affects pregnant women's mental health and makes it necessary for psychological monitoring and support for pregnant women, which may be reflected in their mental health but also the development of their offspring.

Keywords: maternal mental health, pregnancy, first and second wave of coronavirus, anxiety, social support, COVID-19 related fear

Introduction

In early December 2019, a new strain of coronavirus appeared in the city of Wuhan (China), after which it rapidly spread across the globe.¹ The first COVID-19 case in Serbia was confirmed on March 6, 2020, and a state of emergency was declared on March 15.² The high danger to humanity posed by the new global pandemic has led to the introduction of numerous restrictions and measures by the countries' governments worldwide. Although these measures were implemented to protect the entire population from coronavirus, they also led to adverse effects, especially at the level of mental health, which must not be ignored. To be more precise, the global pandemic has led to adverse health impacts,^{3,4} including the anxiety and fear of citizens.⁵

Anxiety and fear are basic human emotions throughout life.⁶ Anxiety is a normal response described as a state with a positive and motivating influence on adaptive behavior and coping.⁷ On the other hand, the expressed anxiety level, which is variable in each individual, may lead to persistent, uncontrollable, excessive, and inappropriate anxiety

reactions, even after the withdrawal of the stimulus.⁸ Fear is a normal reaction to a real or imagined threat and is considered an integral and adaptive aspect of development.⁹ Like anxiety, when these often adaptive states become characteristic of an individual or like traits, the resulting phenomena can become physically and psychologically destructive.¹⁰ As a result, anxiety affects physiological arousal and cognitive functions,¹¹ with manifestation in two entities: state anxiety as a current and transient emotional state and trait anxiety as a permanent personality trait.¹²

Social support is the perception that others (such as family members, friends, and significant others) care about you and that you can turn to them with confidence in everyday situations or certain moments of crisis.¹³ The research points to social support as a protective mechanism that may relieve stress and mitigate the adverse mental health issues.¹⁴

The data about the mental health of pregnant women during the COVID-19 outbreak are in some ways consistent but also country-specific. So far, there are already some papers with clinical findings on the impact of COVID-19 on pregnancy^{15–17} and psychological findings related to the mental health of pregnant women.^{3,18–20}

Mutations of the COVID-19 virus (Delta variant in the second pandemic wave) brought additional complications resulting in a severe course of the disease and increased rates of adverse obstetric outcomes in pregnant women,²¹ which can additionally be reflected in psychological consequences. On the other hand, vaccination which represents a significant prevention of the severe course of the disease, which may alleviate adverse physical and psychological health outcomes in pregnant women,²² may represent a significant factor influencing maternal anxiety, but it was not analyzed in the study since it was not administered in the observed data collecting periods in Serbia.

Furthermore, due to worries about fetal development, pregnant women tend to show different levels of psychological problems, among which pregnancy-related anxiety is one of the most common.²³ On the other hand, pregnancy is a risk factor for COVID-19.²⁴ More precisely, various measures conducted to protect the population from COVID-19 disease also affect pregnant women's psychological state and represent a source of anxiety. Furthermore, specific anxiety-related distress responses during viral outbreaks and the COVID-19 pandemic have been observed.²⁵

Numerous studies pointed out the higher anxiety levels in pregnant women during the COVID-19 pandemic.^{20,24,26–31} The most recent literature has shown that the prevalence of anxiety in pregnancy during COVID-19 ranges from 30.5% to 42%.^{31–33} On the other hand, there are countries in which the COVID-19 pandemic did not increase anxiety levels (The Netherlands)³⁴ or have a lower prevalence of anxiety among pregnant women (Belgium) (moderate anxiety in 8.4% of pregnant women; severe anxiety in 5.2% of pregnant women).³⁵ Such data confirm that findings related to the anxiety levels in pregnant women during the COVID-19 outbreak are not entirely consistent but rather country-specific. Possible explanations for this are, on the one hand, different measures implemented during the COVID-19 pandemic in each country (quarantine, complete or partial lockdown, overstretching of the healthcare system, emphasized hygiene measures, physical distancing, closure of companies and educational institutions, and others). On the other hand, these specificities may originate from the research methodology or sample characteristics. Furthermore, the cultural specificities of the country and its population may also lead to country-specific data.

To the best of our knowledge, no studies examine the STAI-S during the first and second pandemic waves, and limited studies have assessed mental health during the COVID-19 pandemic in Serbia,^{36,37} especially anxiety in pregnant women. Therefore, the present study was conducted to address this gap.

In the current study, we assessed the impact of the COVID-19 pandemic on pregnant women's anxiety during the first and second waves of COVID-19 in Serbia. Since STAI-S examines the current state of anxiety (state anxiety), and STAI-T examines trait anxiety, we aimed to assess to what extent the data collecting period affects the maternal state anxiety. We also aimed to identify how COVID-19-related fear, social support, or certain pregnant women's demographic characteristics are associated with pregnant women's anxiety during the COVID-19 pandemic in Serbia.

Materials and Methods

Study Design and Participants

The cross-sectional study of pregnant women's anxiety was conducted during the first and second waves of the COVID-19 pandemic in Serbia to determine the impact of COVID-19 on maternal anxiety and identify its associated factors. The study sample was women in the third trimester of pregnancy, who were included consecutively in the order in which they

came for a regular examination during pregnancy. Participating pregnant women were recruited from the state-funded Clinic for Gynecology and Obstetrics “Narodni Front” in the Serbian capital, Belgrade. The number of births in this clinic is around 7000 per year, with pregnant women coming from all over Serbia. All pregnant women were asked to complete an anonymous self-administered questionnaire voluntarily in a pleasant atmosphere in the waiting room during a time-optimal for them. Before administering a questionnaire, participants were informed about the research’s goal: to examine the influence of COVID-19 on a woman’s mental health, which may be reflected in the child’s development. The questionnaire contained questions about socio-demographics, pregnancy-related background, perceived COVID-19 related fear, the presence of current or recent COVID-19 disease in the family and close relatives, maternal anxiety, perceived social support, maternal mental health, and personal contact information related to an e-mail address and/or mobile phone. It is emphasized that personal contact information should be written if the pregnant woman agrees to provide data on her child’s development later in the longitudinal research. All participants signed their written informed consent to participate in this study, and confidentiality of the responses was assured.

The study sample included the data collected during the first pandemic wave (from April to June 2020) and the second pandemic wave (from early June to October 2020) in Serbia. It was recruited from a larger sample collected between April 2020 and December 2020. Namely, 900 questionnaires were distributed between April 2020 and December 2020; 209 were not completed, and 187 were partially completed. After defining the inclusion and exclusion criteria, the final sample included 358 pregnant women (39.8%). The inclusion criteria for the study were: normal singleton pregnancy without complications of any kind; singleton pregnancies with the presence of hypertension, diabetes, or preterm delivery symptoms; spontaneous conception, delivering a phenotypically normal live birth. The exclusion criteria for the study were: failure to meet the inclusion criteria, infertility treatment; hospitalization; history of preeclampsia, eclampsia, autoimmune diseases, cancer, or any general chronic illnesses except hypertension or diabetes; psychiatric illnesses verified and/or treated before pregnancy; use of tranquilizers or sedatives, tobacco, alcoholic beverages, or any other type of psychoactive substances; non-acceptance of participation in the study. The exclusion criteria were in relation to the primary goal of the research, for which it was significant to reduce factors that can influence pregnant women’s anxiety, and are not related to the COVID-19 pandemic. Regarding sociodemographic characteristics, it is essential to point out a significant disproportion between participants with average, low, and high household income, concerning the small presentation of women with low or high household income. It resulted in average household income being one of the inclusion criteria.

Measures

Two scales were administered to the participants: the Spielberger State-Trait Anxiety Inventory (STAI)¹² and the MSPSS.³⁸

- Pregnant women’s anxiety was measured with the Spielberger State-Trait Anxiety Inventory (STAI), a widely used measure of general anxiety.¹² The questionnaire form Y was used in our study.³⁹ It represents a self-report measure of anxiety and has two scales: The STAI-S scale consists of 20 statements and measures transient anxiety states, ie subjective, consciously perceived feelings of anxiety, tension and concerns that change their intensity over time (state anxiety). It can be used to determine the actual anxiety intensity levels induced by stressful procedures.⁴⁰ The STAI-T scale consists of 20 statements and measures relatively stable individual differences in propensity for anxiety (trait anxiety). It evaluates relatively stable aspects of “anxiety proneness”, including general states of calmness, confidence, and security.⁴¹ State and trait anxiety are evaluated on a 4-point Likert scale, from “almost never”, “sometimes”, “often” and “almost always” for the trait anxiety, and from “not at all”, “somewhat”, “moderately so”, and “very much so” for the state anxiety. The total score for each scale ranges between 20 and 80, with higher scores indicating greater anxiety levels. STAI scores are classified as “no or low anxiety” (20–30), “moderate anxiety” (31–44), and “high anxiety” (45–80). Despite this categorization, many authors use two-level cut-off points to define the low or medium/high state of state and trait anxiety.^{26,42,43} Three-level cut-off points which define low, intermediate or high state and trait anxiety levels were used in our study for reasons described in the literature.^{44,45}

- Multidimensional Scale of Perceived Social Support (MSPSS) is an instrument which measures perceived support from three sources: family members, friends, and significant others.³⁸ Pregnant women's perception of social support was measured with the Serbian version of the MSPSS.⁴⁶ This instrument has strong psychometric properties in the population of pregnant women.⁴⁷ It consists of 12 items which are scored on a 7-point Likert scale ranging from "very strongly disagree" (1) to "very strongly agree" (7). The MSPSS scores range from 12 to 84. Higher total scores indicate high levels of perceived social support.
- COVID-19-related fear was assessed using a single item question, "Do you feel a fear of COVID-19 viral infection?" Participants select one of three responses: 1 - "I do not feel a fear of COVID-19 viral infection"; 2 - "Sometimes, not all the time, I feel a fear of COVID-19 viral infection"; 3 - "I do feel a fear of COVID-19 viral infection".

Statistical Analysis

Descriptive statistics were used to determine central tendencies and distributions of variables. To determine the existence of relationships between variables, we conducted a bivariate correlation analysis. One-Way ANOVA was used to compare means between variables of interest. Before any statistical test, appropriate assumptions were checked.

For STAI-S, STAI-T and MSPSS, we defined the new variables STAI-S level, STAI-T level and MSPSS level, dividing the main variables into three groups. For STAI-S and STAI-T levels, range limits are: if STAI-S/STAI-T is ≤ 30 , Level is Low (1), if STAI-S/STAI-T is between 31 and 44, Level is Intermediate (2), and for values ≥ 45 Level is High (3). For MSPSS, level range limits are Low (1) ≤ 35 ; Medium (2) between 36 and 60; High (3) ≥ 61 .

To investigate the effects of individual factors on the variables of interest and interactions between factors, we conducted Univariate General Linear Model (GLM) Analysis. Before hypothesis testing, a priori contrasts were applied and, depending on the results Post hoc test was applied. Before conducting a Univariate General Linear Model analysis, we checked the assumption of the equality of variances. Levene's Test of Equality of Error Variances having STAI-S as a dependent variable; Education, Data collecting period (first and second pandemic wave), Number of children, Pregnancy health condition, COVID-19 related fear, Employment and COVID-19 disease in the family, as independent variables, and STAI-T, MSPSS and Maternal age as covariates revealed that the assumption of equality is violated ($F_{STAI-S}(124, 234) = 1.597, p=0.001$). To overcome this problem, we log-transformed (logarithm with base 10) STAI-S, STAI-T, MSPSS, and age and obtained new variables logSTAI-S, logSTAI-T, logMSPSS, and logage, respectively. For the Univariate GLM analysis, we used type IV sum of squares because it is appropriate for unbalanced sample with missing events.

Univariate analysis with all independent variables (Education, Data collecting period, Number of children, Pregnancy health condition, COVID-19 related fear, Employment and COVID-19 disease in the family) and covariates logSTAI-S, logMSPSS, and logage revealed that there is no statistically significant impact of Number of children nor as the main effect nor through interactions. The model was reduced by taking the following independent variables: Education, Data collecting period, COVID-19 related fear, Employment, Pregnancy health condition, and COVID-19 disease in the family.

Levene's Test of Equality of Error Variances revealed that the assumption of equality is not violated ($F_{logSTAI-S}(74, 283) = 1.250, p=0.102$).

Statistical Package for the Social Sciences version 22.0 was used.

Results

Sample Characteristics

The research sample comprised 358 pregnant women with a mean age of 30.80 (SD = 6.06). One-third of the participants ($n=117, 32.7\%$) were examined in the first data collecting period, and two-thirds ($n=248, 67.3\%$) in the second data collecting period. None of the participants had a low level of anxiety. More than half of the participants ($n=205, 57.3\%$) had an intermediate level of trait anxiety, while 42.7% ($n=153$) had a high level of trait anxiety. Regarding state anxiety, two-thirds of participants ($n=242, 67.6\%$) had an intermediate level, while 32.4% ($n=116$) had a high level of state anxiety. Almost all participants ($n=344, 96.1\%$) reported high perceived social support. Baseline sample characteristics are shown in Table 1.

Table 1 Sample Characteristics (N=358)

Sample Characteristics	Pregnant Women (N=358)	
	Number	Percentage%
Years of school education		
<12 years	176	(49.2)
12 or more years	182	(50.8)
Data collecting period		
First wave of the COVID-19 pandemic In Serbia (April and May 2020)	117	(32.7)
Second wave of the COVID-19 pandemic In Serbia (June – October 2020)	241	(67.3)
Employment status		
Employed	237	(66.2)
Unemployed	121	(33.8)
Number of children		
One child	172	(48)
Two or more children	186	(52)
Pregnancy health condition^a		
No complications in pregnancy	190	(53.1)
Complications in pregnancy	168	(46.9)
COVID-19 disease in family		
No COVID-19 disease in family	206	(57.5)
COVID-19 disease in family	152	(42.5)
COVID-19-related fear		
Having no COVID-19 related fear	138	(38.5)
Sometimes have a COVID-19 related fear	113	(31.6)
Having a COVID-19 related fear	107	(29.9)
STAI-S		
Low anxiety level	0	(0)
Intermediate anxiety level	242	(67.6)
High anxiety level	116	(32.4)
STAI-T		
Low anxiety level	0	(0)
Intermediate anxiety level	205	(57.3)
High anxiety level	153	(42.7)
MSPSS		
Low perceived support	0	(0)
Medium perceived support	14	(3.9)
High perceived support	344	(96.1)

Note: ^aPregnancy health condition related to presence of hypertension, diabetes, or preterm delivery symptoms.

Abbreviations: STAI-S, state anxiety; STAI-T, trait anxiety; MSPSS, perceived social support.

Descriptive statistics on maternal age, state and trait anxiety, and perceived social support are shown in Table 2. No participants had scores corresponding to low anxiety levels either on the STAI-S or STAI-T scale.

Mean values for maternal age, STAI-S, STAI-T, and MSPSS related to fear of COVID-19 (Table 3) show minor differences between the groups for the observed variables. One-way ANOVA revealed no statistically significant difference comparing maternal age related to the subjective attitude towards COVID-19 related fear, $F(2,355)=1.547$, $p=0.214$.

Mean values for maternal age, STAI-T, and MSPSS related to the data collecting period show minor differences between the groups for the observed variables. One-way ANOVA revealed no statistically significant difference comparing maternal age related to the first and second pandemic waves $F(1,356)=1.381$, $p=0.241$, STAI-T $F(1,356)=2.483$, $p=0.116$, and there is no statistically significant difference comparing MSPSS of pregnant women related to data collecting period $F(1,356)=.077$, $p=0.781$ (Table 4).

Table 2 Descriptive Statistics on Maternal Age, State and Trait Anxiety, and Perceived Social Support

Variable	Min.	Max.	Mean	SE	SD
Maternal age	18.00	45.00	30.80	0.32	6.06
STAI-S	31.00	66.00	41.62	0.35	6.60
STAI-T	32.00	68.00	43.67	0.30	5.75
MSPSS	42.00	85.00	76.87	0.38	7.17

Abbreviations: STAI-S, state anxiety; STAI-T, trait anxiety; MSPSS, perceived social support.

Table 3 Descriptive Statistics for Maternal Age, STAI-S, STAI-T and MSPSS Related to COVID-19 Related Fear

	COVID-19 Related Fear	N	Mean	SD	SE
MaternalAge	No	138	30.18	6.15	0.52
	Sometimes	113	31.53	6.06	0.57
	Yes	107	30.81	5.91	0.57
STAI-S	No	138	43.42	6.54	0.56
	Sometimes	113	40.52	5.93	0.56
	Yes	107	40.46	6.90	0.66
STAI-T	No	138	42.60	5.20	0.44
	Sometimes	113	43.84	4.44	0.42
	Yes	107	44.90	7.27	0.70
MSPSS	No	138	76.44	7.23	0.62
	Sometimes	113	76.80	7.15	0.67
	Yes	107	77.50	7.16	0.69

Abbreviations: STAI-S, state anxiety; STAI-T, trait anxiety; MSPSS, perceived social support.

Table 4 Descriptive Statistics for Maternal Age, STAI-T and MSPSS Related to Data Collecting Period

	Data Collecting Period	N	Mean	SD	SE	One-Way ANOVA
MaternalAge	First wave	117	30.26	5.71	0.53	F(1356)=1.381, p=0.241
	Second wave	241	31.06	6.22	0.40	
STAI-T	First wave	138	44.36	5.02	0.44	F(1356)=2.483, p=0.116
	Second wave	107	43.34	6.05	0.70	
MSPSS	First wave	138	77.03	7.24	0.67	F(1356)=0.077, p=0.781.
	Second wave	107	76.80	7.15	0.46	

Abbreviations: STAI-T, trait anxiety; MSPSS, perceived social support.

Correlation of Maternal Age, STAI-S, STAI-T, and MSPSS Scores in the First and Second Data Collecting Period

Table 5 shows the correlation between maternal age, STAI-S, STAI-T, and MSPSS scores in the first and second data collecting period. Bivariate correlation analysis revealed a statistically significant low correlation between particular parameters, some positive and some negative.

In the first data collecting period low negative statistically significant correlation is found between the Maternal age and STAI-S [$r(117) = -0.195$, $p = 0.035$] and Maternal age and MSPSS [$r(117) = -0.229$, $p = 0.013$].

In the second data collecting period low positive statistically significant correlation is found between STAI-S and STAI-T [$r(241) = 0.274$, $p < 0.001$] and STAI-S and MSPSS [$r(241) = 0.163$, $p = 0.011$]. Also, there is a low negative statistically significant correlation between the STAI-T and MSPSS [$r(241) = -0.148$, $p = 0.022$].

Table 5 Correlation Between Maternal Age, STAI-S, STAI-T and MSPSS in the First and Second Data Collecting Period

		First Data Collecting Period				Second Data Collecting Period			
		Maternal Age	STAI-S	STAI-T	MSPSS	Maternal Age	STAI-S	STAI-T	MSPSS
Maternal Age	Pearson Correlation Sig. (2-tailed)	1	-0.172 0.064	-0.195* 0.035	-0.229* 0.013	1	-0.094 0.145	0.054 0.408	-0.031 0.628
STAI-S	Pearson Correlation Sig. (2-tailed)	-0.172 0.064	1	0.132 0.156	0.124 0.183	-0.094 0.145	1	0.274** 0.000	0.163* 0.011
STAI-T	Pearson Correlation Sig. (2-tailed)	-0.195* 0.035	0.132 0.156	1	-0.068 0.465	0.054 0.408	0.274** 0.000	1	-0.148* 0.022
MSPSS	Pearson Correlation Sig. (2-tailed)	-0.229* 0.013	0.124 0.183	-0.068 0.465	1	-0.031 0.628	0.163* 0.011	-0.148* 0.022	1

Note: Significant correlations are marked in grey.

Abbreviations: STAI-S, state anxiety; STAI-T, trait anxiety; MSPSS, perceived social support; Sig., statistical significance.

Univariate Analysis

Univariate GLM analysis for dependent variable logSTAI-S achievement revealed that the full linear model (Table 6) could explain 43.5% of variability $F(77,280)=2.80$, $p<0.001$, $\eta^2=0.435$ and Observed Power=1. LogSTAI-S and LogMSPSS as the main effects have a statistically significant impact on the model. There is no statistically significant main effect of independent variables, but their effect is present through two and three way interactions (Table 6). Table 6 shows Tests of Between-Subjects Effects containing only statistically significant elements, including statistical significance, Partial Eta Square and Observed power. The literature is ambiguous on the validity of using the Observed Power in interpreting the obtained results. Having that in mind, the paper also presents those statistically significant interactions whose Observed Power is <0.8 .^{48–50}

There are five two-way interactions and three three-way interactions. Education* COVID-19 disease in the family is only two-way interaction which is not an element of three-way interactions. COVID-19 related fear is the most frequently appearing independent variable in interactions (five times), followed by Data collecting period (four times).

Table 6 Tests of Between-Subjects Effects Containing Only Statistically Significant Elements

Source	Sig.	Partial Eta Squared	Observed Power
Corrected Model	0.000	0.435	1.000
Intercept	0.016	0.021	0.679
logSTAI-T	0.000	0.120	1.000
logMSPSS	0.000	0.063	0.991
Education * Data collecting period	0.019	0.019	0.652
Education * COVID-19 disease in the family	0.032	0.016	0.574
Data collecting period* COVID-19 related fear	0.001	0.046	0.917
COVID-19 related fear* Employment	0.021	0.027	0.705
COVID-19 disease in the family* Pregnancy health condition	0.047	0.014	0.513
Education* Data collecting period * COVID-19 related fear	0.010	0.032	0.785
Data collecting period* COVID-19 related fear* Employment	0.000	0.068	0.986
COVID-19 disease in the family* COVID-19 related fear* Pregnancy health condition	0.041	0.023	0.614

Notes: Data collecting period is related to the first and second COVID-19 pandemic wave. Pregnancy health condition is related to presence of complications in the pregnancy (hypertension, diabetes, or preterm delivery symptoms). Unrelated interactions are marked in gray.

Abbreviations: Sig., statistical significance; logSTAI-T, the logarithm of trait anxiety; logMSPSS, the logarithm of perceived social support.

A closer look at the interaction terms (Table 6) revealed that we could analyse the following interactions independently: Education * COVID-19 disease in the family; Education * Data collecting period * COVID-19 related fear; Employment * Data collecting period * COVID-19 related fear; COVID-19 disease in the family * Pregnancy health condition * COVID-19 related fear. The most significant contribution to the model has the interaction term Employment * Data collecting period * COVID-19 related fear (Partial eta squared=0.068).

Figures 1 and 2 show the plots of estimated marginal means of dependent variable logSTAI-S for two three-way statistically significant interactions (Education * Data collecting period * COVID-19 related fear; Employment * Data collecting period * COVID-19 related fear, respectively) are presented as examples.

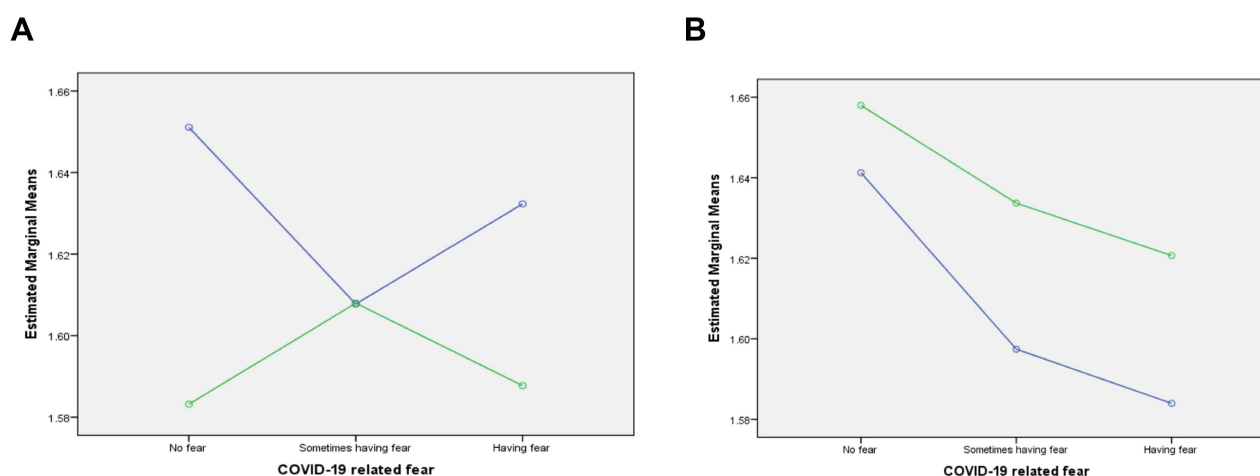


Figure 1 Marginal means of LogSTAI-S estimated by Univariate General Linear Model for interaction term Education * Data collecting period * COVID-19 related fear.

Notes: — Education ≤ 12 years; — Education > 12 years. (A) Interaction between Education and COVID-19 related fear at first data collection point; (B) Interaction between Education and COVID-19 related fear at second data collecting point. Covariates appearing in the model are evaluated at the following values: logSTAI-T = 1.6353, logMSPSS = 1.8841, logAGE = 1.4786.

Abbreviations: logSTAI-S, the logarithm of state anxiety; logSTAT-T, the logarithm of trait anxiety; logMSPSS, the logarithm of perceived social support; logAGE, the logarithm of maternal age.

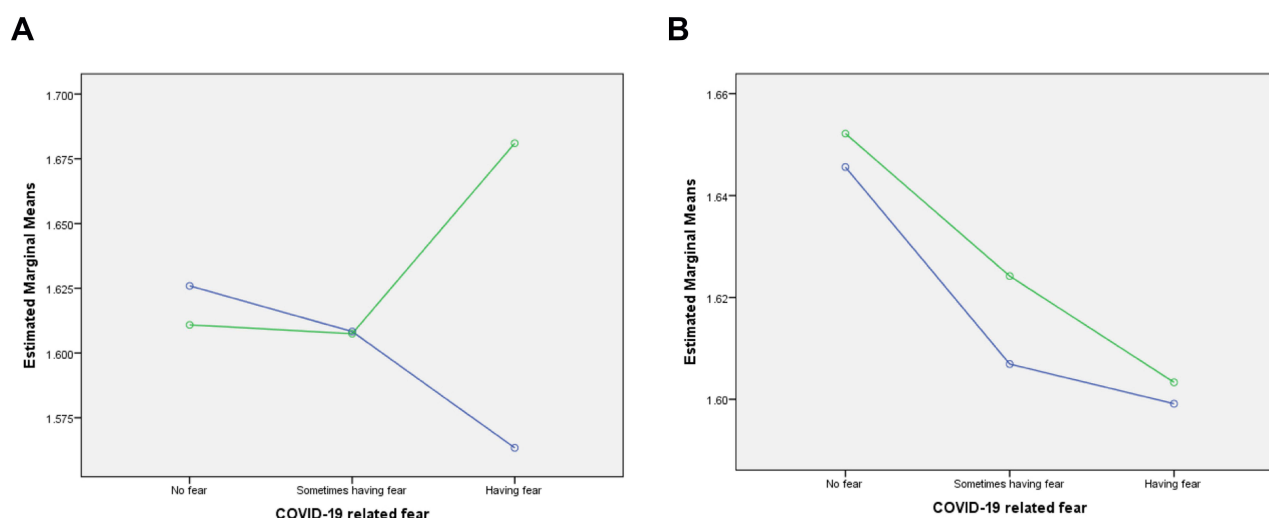


Figure 2 Marginal means of LogSTAI-S estimated by Univariate General Linear Model for interaction term Employment * Data collecting period * COVID-19 related fear.

Notes: — Employed; — Non employed. (A) Interaction between Employment and COVID-19 related fear at first data collection point; (B) Interaction between Employment and COVID-19 related fear at second data collection point. Covariates appearing in the model are evaluated at the following values: logSTAI-T = 1.6353, logMSPSS = 1.8841, logAGE = 1.4786.

Abbreviations: logSTAI-S, the logarithm of state anxiety; logSTAT-T, the logarithm of trait anxiety; logMSPSS, the logarithm of perceived social support; logAGE, the logarithm of maternal age.

New grouping variables were composed for each interaction term (Table 7) to determine if there was a statistically significant difference between the mean values of groups within interaction terms. One-way ANOVA for new grouping variables was conducted.

One-way ANOVA revealed no statistically significant difference between groups of interaction term Education * COVID-19 disease in the family ($F(3354)=.821$, $p=0.483$).

Table 7 Explanation of New Grouping Variables of Interaction Terms Used in One-Way ANOVA Statistical Test

(A) Explanation of Grouping Variable Values for Interaction Term Education* COVID-19 Disease in the Family.			
Education	COVID-19 Disease in the Family		Grouping Value
<12 years	No	1	
	Yes	2	
12 or more years	No	3	
	Yes	4	
(B) Explanation of Grouping Variable Values for Interaction Term Education* Data Collecting Period* COVID-19 Related Fear.			
Education	Data Collecting Period	COVID-19 Related Fear	Grouping Value
<12 years	First pandemic wave	No	1
		Sometimes	2
		Yes	3
	Second pandemic wave	No	4
		Sometimes	5
		Yes	6
12 or more years	First pandemic wave	No	7
		Sometimes	8
		Yes	9
	Second pandemic wave	No	10
		Sometimes	11
		Yes	12
(C) Explanation of Grouping Variable Values for Interaction Term Employment* Data Collecting Period* COVID-19 Related Fear.			
Data Collecting Period	Employment	COVID-19 Related Fear	Grouping Value
First pandemic wave	Unemployed	No	1
		Sometimes	2
		Yes	3
	Employed	No	4
		Sometimes	5
		Yes	6
Second pandemic wave	Unemployed	No	7
		Sometimes	8
		Yes	9
	Employed	No	10
		Sometimes	11
		Yes	12

(Continued)

Table 7 (Continued).

(D) Explanation of Grouping Variable Values for Interaction Term COVID-19 Disease in the Family* Pregnancy Health Condition* COVID-19 Related Fear.			
COVID- 19 Disease in Family	Pregnancy Health Condition	COVID-19 Related Fear	Grouping Value
No	No	No	1
		Sometimes	2
		Yes	3
	Yes	No	4
		Sometimes	5
		Yes	6
Yes	No	No	7
		Sometimes	8
		Yes	9
	Yes	No	10
		Sometimes	11
		Yes	12

Notes: (A) Education* COVID-19 disease in the family; (B) Education* Data collecting period* COVID-19 related fear; (C) Employment* Data collecting period* COVID-19 related fear; (D) COVID-19 disease in the family* Pregnancy health condition* COVID-19 related fear.

For interaction term Education * Data collecting period * COVID-19 related fear, we obtained a statistically significant difference between groups $F(11,346)=5.592$, $p<0.001$. (Levene's Test of Equality of Error Variances revealed that the assumption of equality is not violated $F(11,346)=1.360$, $p=0.190$). It turns out that group 3 had the highest (mean value=1.669), and group 2 had the lowest level (mean value 1.535) of logSTAI-S. Post Hoc test with Tukey-Kramer correction revealed a statistically significant difference between group 2 and all other groups except group 5 (mean value 1.586) and group 8 (mean value 1.588). There is also a statistically significant difference between group 8 and groups 1, 3, 4 and 9 and between groups 5 and 9. An explanation of membership to the variable group is given in [Table 7B](#).

For interaction term Data collecting period * Employment * COVID-19 related fear, we obtained a statistically significant difference between groups $F(11,346)=5.009$, $p<0.001$. (Levene's Test of Equality of Error Variances revealed that the assumption of equality is not violated $F(11,346)=1.110$, $p=0.352$). It turns out that group 4 had the highest (mean value=1.672), and group 5 had the lowest level (mean value 1.548) of logSTAI-S. Post Hoc test with Tukey-Kramer correction revealed a statistically significant difference between group 2 and groups 3, 4 and 7 and group 3 and groups 2, 5, 8 and 9. Furthermore, there is a statistically significant difference between group 5 and groups 1, 3, 4, 7, 10 and 12. An explanation of membership to the variable group is given in [Table 7C](#).

For interaction term COVID-19 disease in the family * Pregnancy health condition * COVID-19 related fear, we obtained a statistically significant difference between groups $F(11,346)=3.570$, $p<0.001$. (Levene's Test of Equality of Error Variances revealed that the assumption of equality is not violated $F(11,346)=1.396$, $p=0.172$). It turns out that group 6 had the highest (mean value=1.646), and group 11 had the lowest level (mean value 1.578) of logSTAI-S. Post Hoc test with Tukey-Kramer correction revealed a statistically significant difference between group 2 and groups 1, 4 and 6 and group 6 and groups 2, 5 and 11. An explanation of membership to the variable group is given in [Table 7D](#).

Discussion

The impact of the novel coronavirus, SARS-CoV-2, and Coronavirus Disease-2019 (COVID-19) on physiological, psychological, social, and economic status has been investigated in research on different clinical and typical human populations and from various aspects.^{51–55} Considering the population of pregnant women, research in the past two years revealed that they might be affected by various aspects of the COVID-19 pandemic, causing negative implications on

their mental health, especially anxiety and depression.^{3,18,20,56} More precisely, pregnant women represent a very vulnerable group in the conditions of the COVID-19 pandemic.⁵⁶

To our knowledge, limited studies have assessed maternal anxiety during the COVID-19 pandemic in Serbia.^{36,57,58} The present cross-sectional study examined the impact of the COVID-19-related fear, social support, or certain pregnant women's demographic characteristics on pregnant women's anxiety during the first and second wave of COVID-19 in Serbia.

Our main findings were as follows: Most pregnant women from the sample reported high perceived social support during both data collecting periods. No pregnant women, who were examined during the first and second pandemic wave in Serbia, had low anxiety levels measured by STAI-T and STAI-S. A slightly less than one-third of the pregnant women reported a COVID-19 related fear. The study pointed out the complex dependence of state anxiety on various factors, including the data collecting period. While in the first wave, the interaction between the parameters is expressed, in the second, it is absent, and the pattern of the parameters' influence on pregnant women's anxiety is observed.

Perceived Social Support in Pregnant Women During the First and Second Wave of COVID-19 in Serbia

Findings from our study showed that almost all participants reported a high level of perceived social support during the first and second pandemic waves in Serbia. Also, there was no statistically significant difference comparing perceived social support of pregnant women related to the data collecting period. Before and during the COVID-19 pandemic, studies pointed out that pregnant women reported a higher level of social support than the general population.^{59,60} Such studies indicated that high social support plays a protective role in anxiety during pregnancy.^{61–63} Considering the COVID-19 pandemic, this may be explained by the fact that it imposed social isolation, due to which pregnant and postpartum women received more support from their partners and were less disturbed by external stimuli compared to the pre-COVID-19 women.⁶⁴ Our study's findings showed a high level of perceived social support in pregnant women, despite their high or intermediate anxiety levels during the first and second waves of the COVID-19 pandemic. Such findings may point to social support as a key protective factor against the adverse mental health issues caused by epidemics and natural disasters,⁶⁵ especially in pregnant women.^{66,67} Accordingly, high perceived social support in Serbian pregnant women may be an essential coping re-source and a mechanism for maintaining psychological well-being under conditions of psychological burdens,⁶⁸ as the COVID-19 pandemic is.

Also, our findings align with studies that reported increased social support during the COVID-19 pandemic perceived by pregnant women.^{19,69} On the contrary, it is significant to note that studies reported decreased social support for pregnant women during the COVID-19 pandemic.^{70–72} Based on such different findings, we noticed that the data about perceived social support in pregnant women during the COVID-19 pandemic is country-specific, similar to the data about maternal anxiety during the COVID-19. These differences can be explained and discussed from several aspects. On the one hand, the severity of lockdown measures, which vary between countries, may explain some of these differences. On the other hand, the socio-cultural peculiarities of each country also could explain this. The strong family bonding and support that pregnant women receive from their families and friends are emphasized when looking at Serbia, which was also evident in some other studies.⁶⁰

Maternal Anxiety During Pregnancy During the First and Second Wave of COVID-19 in Serbia

The study revealed no pregnant women with low anxiety levels measured by STAI-T and STAI-S during the first and second pandemic waves in Serbia. Namely, the STAI-S and STAI-T scores indicated high anxiety in 32.4% and 42.7% of pregnant women, respectively. Also, there was no statistically significant difference comparing trait anxiety of pregnant women related to the first and second pandemic waves. All pregnant women were examined in the third trimester as the most sensitive period for manifesting high anxiety.⁷³ Similar to our study results, numerous studies have been published recently, indicating an increase in anxiety symptoms in pregnant women during the COVID-19 pandemic.^{20,28,60,74–76} It is noticed that the data about maternal anxiety during the COVID-19 outbreak may be country-

specific, pointing to the different prevalence of anxiety among pregnant women.⁷⁷ Generally, the most recent systematic reviews and meta-analyses have shown that the prevalence of anxiety in pregnancy during COVID-19 ranges from 26% to 57%.^{31–33} Also, it was noticed that the prevalence varies to the continent and that western countries have a higher prevalence of anxiety in pregnant women (38%) than in Asian countries (7.8%),⁷⁷ with similar findings for the general population as well.⁷⁸

The phenomenon of increased anxiety during the COVID-19 pandemic was also observed in the general population.⁷⁹ Accordingly, when analyzing the presence of elevated anxiety in the general population, Serbia has lower scores than respondents from Lebanon, Portugal, and Italy, pointing to a higher degree of resilience to psychological impacts from COVID-19 among Serbian respondents compared with those in mentioned countries.⁵ Comparing such findings with findings indicating elevated anxiety in pregnant women during the COVID-19 pandemic in Serbia,^{36,57,58} pregnant women are highlighted as a particularly vulnerable and sensitive group in the context of the COVID-19 pandemic, with higher anxiety levels compared to the general population.

In addition, the difference in anxiety levels in pregnant women during the first, second, or subsequent wave of the COVID-19 pandemic was investigated, with varying results indicating higher anxiety at the beginning of the COVID-19 pandemic and slighter decrease at the later waves and vice versa.^{76,80} We observed STAI-S because of its variability over time.⁸¹

Correlation Between Maternal Age, STAI-S, STAI-T and MSPSS in the First and Second Collecting Period

Correlation between maternal age, STAI-S, STAI-T and MSPSS differs in the first and second collecting periods. It is evident that the relationship between STAI-S, STAI-T and MSPSS is complex and differs between the first and second pandemic waves. In the first pandemic wave, there is a negative correlation between maternal age, STAI-T and MSPSS, and for STAI-S and maternal age, it is also close to statistical significance ($p=0.064$). Pre-pandemic studies reported a strong correlation between age and anxiety in the general population, pointing to younger age associated with higher anxiety levels,⁷⁹ which was confirmed during the COVID-19 pandemic.⁸² Interestingly, there is no statistically significant correlation between STAI-S and STAI-T during the first collecting period. These findings may be further explained by the role of psychological and social changes in pregnant and postpartum women due to the burden imposed by the COVID-19 pandemic.⁸³

In the second pandemic wave, the correlation between maternal age, STAI-T and MSPSS disappear, but a positive correlation between STAI-S and STAI-T, as well as STAI-S and MSPSS, and a negative correlation between STAI-T and MSPSS appear. Literature findings also indicate a weak positive correlation between STAI-S and STAI-T in pregnant women during the COVID-19 pandemic²⁶ and a negative correlation between STAI-T and MSPSS.^{60,84} The negative correlation between higher levels of perceived social support and trait anxiety levels, which is a more expected finding in general, is in line with findings pointing to an association between higher levels of perceived social support and lower psychological symptoms in pregnant women.^{29,60,84} Also, considering the relation between anxiety and perceived social support, social support may have significant effects on anxiety and may be considered a potential therapeutic target for interventions in pregnant women.⁸⁵ Social support has a direct negative influence on the anxiety level in pregnant women, which is consistent with previous studies.^{60,84} Some studies point to a small significant relationship between perceived social support and pregnant women's anxiety during the COVID-19 pandemic.⁸⁶ However, unlike the dominant studies indicating that social support was negatively linked with anxiety,⁸⁷ the COVID-19 pandemic in Serbia, with all its characteristics, clearly indicates the positive relationship between the elevated state anxiety and perceived social support, as shown in our study. It can be noticed that the positive correlation between STAI-S and MSPSS is a somewhat surprising result, for the interpretation of which there is currently no sufficient amount of information. While the positive correlation between STAI-S and STAI-T observed in Serbia pregnant women during the COVID-19 pandemic has been noticed in the literature,²⁶ and the negative correlation between trait anxiety and social support on the other side,⁶⁰ the question of the weak positive correlation between state anxiety and social support is raised. A possible explanation could be the pregnant women's prolonged period of social isolation during the second

pandemic wave. This more extended isolation period, affecting pregnant women's anxiety and family bonding relying on sociocultural peculiarities in Serbia,⁶⁰ can lead to a different relationship between STAI-S and MSPSS, causing a weak positive correlation.

COVID-19 Related Fear in Pregnant Women During the First and Second Wave of COVID-19 in Serbia

Among crucial reasons that increase anxiety in pregnant women during the pandemic is the fear of COVID-19.⁸⁸ Fear's primary function is to respond to threatening situations.⁸⁹ Fear to some extent has a defense mechanism leading people to comply with protective behaviors against COVID-19.⁹⁰ The study results pointed to slight differences between the number of pregnant women concerning the presence of COVID-19 related fear. Although the most numerous is the group of pregnant women who reported that they have no COVID-19 related fear, the percentage of all three groups of women is approximate. Such findings align with findings indicating that individuals may respond differently to the emotional distress caused by traumatic events such as the COVID-19 pandemic.⁹¹ Also, they are not entirely in line with recent research conducted not on pregnant women, which showed that the COVID-19 pandemic might cause a significant long-lasting increase in fear,^{92,93} and with research pointing to a decrease in COVID-19 fear within six weeks from the pandemic outbreak.⁹⁴

Univariate Analysis

None of the observed independent variables had a statistically significant influence on the model as the main effect, but statistically significant influences occurred through mutual two and three-way interactions. Data collection period appeared as a variable in three-way statistically significant interactions: Education * Data collecting period * COVID-19 related fear; Data collecting period * COVID-19 related fear * Employment. Observing the interactions between Education * COVID-19 related fear and COVID-19 related fear * Employment in the first and second collecting period, the different nature of these parameters' influence on STAI-S can be observed. A clear interaction between the variables can be observed in the first collecting period, while there is no interaction in the second collecting period. In the second Data collection period, a certain regularity of influence of the parameters on STAI-S can be observed. Regardless of the personal level of the COVID-19 related fear, unemployed pregnant women and pregnant women with a higher level of education were more anxious than employed pregnant women and pregnant women with a lower level of education. The obtained results could be related to the fact that with time, the amount of information about the COVID-19 pandemic and its reliability enabled the formation of a clearer picture of possible risks, the course of the disease, and its consequences for certain pregnant women groups.

Regardless of the level of education and employment, the anxiety level of pregnant women decreased as the COVID-19 related fear increased. Our data pointed to the negative trend of maternal anxiety in the second data collecting period associated with COVID-19-related fear. The relationship between fear and anxiety of COVID-19 was examined,⁸⁸ and it was pointed out that there is a positive correlation between fear and anxiety ($r=0.6$, $p=0.001$). The possible causes of the difference compared to our results are different methodologies of measuring fear, different measuring time points, and different anxiety measures. It should also be considered that there are divided opinions on whether fear and anxiety are distinct phenomena. At the same time, some authors describe fear and anxiety as undistinguishable, while others define them as distinct emotions.⁸⁹ Our result can be related to the literature findings indicating that fear and anxiety are not interchangeable constructs on the one hand and, on the other, that fear captured significant variance in performance that was not shared with anxiety.⁹⁵

The results of ONE-way ANOVA with new grouping variables of interaction terms indicated statistically significant differences between individual subgroups within the grouping variables. Subgroups of pregnant women with min and max logSTAI-S levels can be found in both collecting periods, so it cannot be concluded that the STAI-S level is higher or lower in the first than in the second collecting period. Results indicated the intricate interconnection of the observed variables in the first collecting period and the non-linearity of the observed phenomenon that was already mentioned.

Strengths and Limitations

This research was a rare opportunity to examine pregnant women's anxiety during the COVID-19 pandemic, which had never been present before. Since limited studies have assessed maternal anxiety during the COVID-19 pandemic in Serbia, the present study was conducted to address this gap, relying on the fact that the data about maternal anxiety during the COVID-19 outbreak may be country-specific. On the other hand, the psychological burdens which occurred in pregnant women during the COVID-19 pandemic in Serbia point to psychological support needed for pregnant and postpartum women. The study was based on a cross-sectional data collection, carried out during two data collecting periods (first and second pandemic wave), and obtained results pointed to data collecting periods as part of the interactions which affect state anxiety in pregnant women. Accordingly, the findings from this study suggest that future targeted research is warranted to investigate better insight into the examination of interrelationships or contributions to the observed interactions. It is also important to point out that the specific conditions of the COVID-19 pandemic imply the implementation of various measures and restrictions to suppress its spread, which differed from country to country. Such burdens may affect maternal anxiety and the readiness of the sample to participate in the study. Accordingly, it is necessary to be careful when comparing the results of different studies on this issue, especially studies of different countries. We can assume that this may be the global impact of the pandemic.

Conclusion

The study revealed no pregnant women with low anxiety levels measured by STAI-S and STAI-T during the first and second pandemic waves in Serbia. The STAI-S and STAI-T scores indicated high anxiety in 32.4% and 42.7% of pregnant women, respectively.

The study also pointed out the complex nonlinear dependence of state anxiety on various factors, including the data collecting period. During the COVID-19 pandemic, we did not observe the independent influence of individual variables on STAI-S, but we noticed their impact through mutual interactions. Such findings indicate the complexity of interactions and their impacts on STAI-S. There is a difference in the influence of certain parameters in the first and second pandemic waves. While in the first wave, the interaction between the parameters is expressed, in the second, it is absent, and the pattern of the parameters' influence on pregnant women's anxiety is observed. The obtained results suggest that timely, precise, and reliable information in the conditions of a pandemic can contribute to the formation of a clearer picture of possible risks, the course of the disease, and its consequences in certain groups of pregnant women. This would enable greater predictability of the influence of certain parameters on the anxiety of pregnant women and, thus, adequate help and support for pregnant women who, even in conditions that are not burdened by the pandemic, have a higher level of anxiety.

Abbreviations

COVID-19, Coronavirus Disease 2019 caused by SARS-CoV-2 virus; SARS-CoV-2, Severe acute respiratory syndrome coronavirus 2; STAI, State-Trait Anxiety Inventory; MSPSS, Multidimensional Scale of Perceived Social Support; STAI-S, State anxiety measure; STAI-T, Trait anxiety measure.

Ethics Approval and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of the Clinic for Gynecology and Obstetrics "Narodni Front" in Belgrade, Serbia (No 27/2020; Date: 26. March 2020). Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the patient(s) to publish this paper.

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Disclosure

The authors report no conflicts of interest in this work.

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