

Academy's Paper

Ilenia Mappa, Flavia Adalgisa Distefano and Giuseppe Rizzo*

Effects of coronavirus 19 pandemic on maternal anxiety during pregnancy: a prospective observational study

<https://doi.org/10.1515/jpm-2020-0182>

Received April 25, 2020; accepted May 25, 2020; published online June 29, 2020

Abstract

Objectives: Coronavirus (COVID-19) is a new respiratory disease that is spreading widely throughout the world. The aim of this study was to evaluate the psychological impact of COVID-19 pandemic on pregnant women in Italy.

Methods: We considered 200 pregnancies attending our antenatal clinic. A questionnaire was sent to each woman in the days of maximum spread of COVID-19. Sectional was finalized to acquire in 18 items maternal characteristics and to test the women's perception of infection. Section included the State–trait anxiety inventory (STAI) 40 items validated test for scoring trait anxiety (basal anxiety, STAI-T) and state anxiety (related to the ongoing pandemic, STAI-S). An abnormal value of STAI was considered when ≥ 40 .

Results: The questionnaire was completed by 178 women (89%). Fear that COVID-19 could induce fetal structural anomalies was present in 47%, fetal growth restriction in 65% and preterm birth in 51% of the women. The median value of STAI-T was 37 and in 38.2% of the study group STAI-T score ≥ 40 was evidenced. STAI-S values were significantly higher with an increase of median values of 12 points ($p \leq 0.0001$). There was a positive linear correlation between STAI-T and STAI-S (Pearson=0.59; $p \leq 0.0001$). A higher educational status was associated with increased prevalence of STAI-S ≥ 40 ($p=0.004$). Subgrouping women by the other variables considered did not show any further difference.

Conclusions: COVID-19 pandemic induces a doubling of the number of women who reached abnormal level of anxiety. These findings validate the role of the remote use of questionnaire for identifying women at higher risk of anxiety disorders allowing the activation of support procedures.

Keywords: COVID-19; maternal anxiety; pregnancy.

Introduction

The coronavirus 2019-nCoV (COVID-19) infection is a public health emergency of international concern in which a coronavirus has been identified as the cause of an outbreak of respiratory illness. It was first detected in Wuhan, China [1], spreading rapidly to other countries worldwide [2, 3]. On the 12th March 2020, the World Health Organization (WHO) announced the new Coronavirus outbreak pandemic and according to WHO official website of the World Health Organization [4] more than 2,500,000 people have been confirmed to have a COVID-19 infection globally.

Pandemics pose a challenge to psychological resilience and can lead to heightened levels of stress [5]. Anxiety is a common response to any stressful situation. Pregnant women, as well as mental and physical changes during gestation, are more likely to be at risk. Prevalence of anxiety disorder during pregnancy, in developed and developing countries, are 10 and 25%, respectively [6–7]. Anxiety symptoms during pregnancy have emerged as an independent risk factor for adverse obstetric and developmental outcomes [8]. Antenatal anxiety may be a risk factor for maternal mental health problems, such as an increased likelihood of postnatal depression [9] and impaired bonding [10], and obstetric complications, such as length of labor [11], premature delivery [12] and impaired fetal growth [13]. We therefore hypothesized that COVID-19 pandemic may have a profound impact on the level of anxiety of pregnant women that may be different according to their basal level of anxiety and pregnancy characteristics.

*Corresponding author: Giuseppe Rizzo, MD, Division of Maternal Fetal Medicine Ospedale Cristo Re, Università di Roma Tor Vergata, 00167 Rome, Italy; and Department of Obstetrics and Gynecology, The First I.M. Sechenov Moscow State Medical University, Moscow, Russia, Tel: +39 06 612451, E-mail: giuseppe.rizzo@uniroma2.it

Ilenia Mappa and Flavia Adalgisa Distefano: Division of Maternal Fetal Medicine Ospedale Cristo Re, Università di Roma Tor Vergata, Rome, Italy

The aim of the study is to evaluate the psychological impact of COVID-19 pandemic on pregnant women in the period of maximum spread of the virus and its relationship with pregnancies characteristics.

Materials and methods

An anonymous online semi-structured questionnaire was developed using Google forms (<https://docs.google.com/forms> Google Mountain View, CA, USA). The link of the questionnaire was sent through emails, to the women that have attended from January 2020 to February 2020 the antenatal clinic of Università di Roma Tor Vergata Ospedale Cristo Re Rome Italy for ultrasonographic examination. All the women underwent a detailed ultrasound scan including assessment of fetal growth and rule out of fetal anomalies scan. The indications for the ultrasound scan were routine antenatal care (i. e., 11 + 0 – 13 + 6 weeks ultrasound scan, second trimester anatomic scan and third trimester growth assessment). Criteria of inclusions were singleton pregnancies and reassuring results from ultrasonographic examination. Criteria of exclusion were the presence of any fetal or maternal complications.

The questionnaire is structured in two sections: section A finalized to acquire in 18 items maternal characteristics and to test women's knowledge and concerns about perinatal complications; section B containing 40 items validate scale for scoring anxiety: state–trait anxiety inventory (STAI) [14] (Supplemental Material 1).

Sociodemographic data were also collected including maternal age, gestational age at the receipt of the questionnaire, pregnancy characteristics, level of education, marital and employment status.

To evaluate the maternal concern about perinatal complication induced by COVID-19 the following fears were considered: fetal structural anomalies, growth anomalies and preterm birth.

The STAI is a 40-items scale, using a 4-point Likert scale for each item. The scale can be used to measure both trait anxiety (how dispositionally anxious a person is across time and situations) and state anxiety (how anxious a person is feeling at a particular moment) as it consists of two separate sub-scales (STAI-T and STAI-S, respectively) each containing 20 items. An abnormal value of STAI was considered when ≥ 40 [15].

The questionnaire was sent to each included woman in the days of maximum spread of COVID 19 in Italy (March 9–March 10, 2020) close to the day of the total lockdown sanctioned by the Italian government (March 9, 2020). All the women provided at the time of ultrasonographic examination written informed consent to be re-contacted, if necessary, for clinical and research purposes. The study was approved by our institutional Ethics Committee.

Statistical analyses

Descriptive statistics were calculated for the variables considered, and data are expressed as n and % for categorical variables and median and interquartile range (IQR) for continuous variables. Chi-square (χ^2) or Fisher exact tests were used to compare group differences of categorical variables and Wilcoxon signed rank or Mann–Whitney U test for continuous variables. Pearson correlation analysis was used to calculate the univariate associations variables. All hypotheses were tested at a significance level of 0.05. Statistical analysis was performed using SPSS Statistic 21.0 (IBM SPSS Statistics, New York, USA).

Results

The questionnaire was returned completely filled by 178 women (89%) within 48 h from the shipment and these women were considered for the study. Their general characteristics are reported in Table 1.

Median maternal age was 33 years (IQR 30–36 years) and most respondents were Caucasian (98.9%) and born in Italy (94.5%). The majority of respondents were employed (84.3%) and had a higher educational level (i. e., University or diploma) (87.7%).

The median gestational age at the receipt of the questionnaire was 18 weeks (IQR 15–23) and women were in the first, second and third trimester in the 17, 61 and 22% of the cases, respectively.

About the sources of information on COVID-19 64% of participants were self-documented by newspaper and television, 29% by Internet and social and only 7% by family doctors and emergency dedicated telephone numbers.

The attitude toward COVID-19 showed women's willingness to follow government guidelines on quarantine and social distancing in 93% of the cases and fear to go to the hospital in the 75%.

About maternal concerns of the effect of infection: 37% were concerned not having enough information about the

Table 1: General characteristics of the study population.

	Median or n	IQR or %
Maternal age, years	33	30–36
Ethnicity		
Caucasian	176	98.9
Others	2	1.1%
Parity		
Nulliparous	101	56.8%
Parous	77	43.2%
Gestational age at the time of questionnaire receipt, weeks	18	15–23
Education		
University degree	71	39.9%
Diploma	85	47.8%
Secondary school or less	22	12.3%
Mode of conception		
Spontaneous	166	93.2%
Assisted reproductive technique	12	6.8%
Marital status		
Married or living with partner	176	98.8%
Single	2	1.2%
Employment status		
Employed full time	139	78.1%
Employed part time	11	6.2%
Not employed	28	15.7%

Data are expressed as mean and interquartile range or number and %.

effects of COVID-19 in pregnancy, 41% not being able to carry out regular antenatal care and 22% that they had come into contact with the virus.

A fear that COVID-19 could induce fetal structural anomalies was present in 83 women (46.6% 95% confidence interval [CI] 39.4–53.9), fetal growth restriction in 116 (65.2% 95% CI 57.9–71.7) and preterm birth in 91 (51.1%; 95th CI 43.8–58.3) of women (Figure 1).

The median trait anxiety score (STAI-T) was 37 (IQR 20–43) and 68 women (38.2% 95% CI 31.3–45.5) showed a STAI-T score ≥ 40 . The psychological impact of COVID-19 outbreak, measured using the S scale, revealed increased values of STAI-S scale (median 49 IQR 40–56) with a significant increase of 12 points in median values when compared to T scale (Wilcoxon signed rank test=363; $p \leq 0.0001$) (Figure 2). As a consequence, there is significant

higher prevalence (77.0% 95% CI 70.1–82.5) of women that overcome the cut-off score of 40 for state of anxiety when STAI-S was applied ($\chi^2=53.8$, $p \leq 0.0001$).

There was a positive linear correlation between STAI-T and S anxiety scores (Pearson $r = 0.59$; $p < 0.0001$).

A higher educational status was associated with a significant increase in the prevalence of STAI-S values ≥ 40 ($p = 0.004$) but not of STAI-T values ($p = 0.158$) (Table 2). No significant differences in maternal age, gestational age, parity and employment status were evidenced between women with normal (< 40) or abnormal (≥ 40) STAI-T and S scores (Table 2).

Discussion

Main findings

Our data demonstrate how the outbreak of COVID 19 and the subsequent national lockdown induced a significant increase in maternal anxiety as expressed by the doubling of STAI scores found when trait and state scales were compared. We also showed that increase in STAI state levels are related to the pre-existing anxiety level measured by STAI trait level. This increase is also related to maternal educational to status, being more evident in women university degree or diploma than in those with lower education level. We also evidenced that only 7% of the participants received information from health care providers and their understanding of COVID-19 are acquired mainly by journal, television and web consultations. There is a high prevalence of fear of abnormal perinatal outcome since more than one-half of the participants are worried that COVID-19 may induce a fetal structural anomaly, fetal growth restriction or a preterm delivery despite a reassuring ultrasound examination received in the previous 2 months.

Comparison with other studies

Recent studies from China have reported an increase in the general population of anxiety score of 28% [16] which is lower than those found in this study but confirm previous data during previous pandemic (H1N1 pandemic 10–30%) [17]. These discrepancies can be easily explained by the different emotional condition during pregnancy with respect of the general population.

To date, knowledge on the emotional experiences of women during pregnancy is limited and difficult to assess. The STAI has previously been employed as an assessment

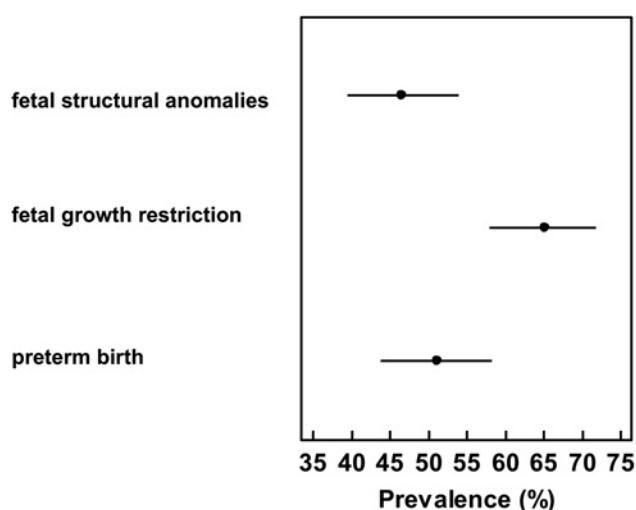


Figure 1: Forest plot showing the prevalence (%) and 95th confidence interval of maternal fear for perinatal complications.

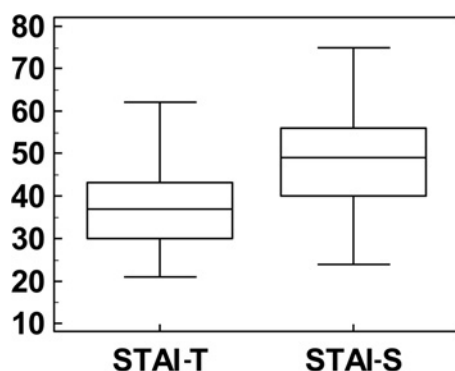


Figure 2: Box plot showing state-trait anxiety inventory (STAI-T) and STAI-S scales.

Horizontal lines within boxes, boxes and whiskers represent median, interquartile range and range, respectively.

Table 2: Characteristics of the women studied grouped according to STAI-T and STAI-S values.

	STAI-T<40 n=110	STAI-T≥40 n=68	p	STAI-S<40 n=41	STAI-S≥40 n=137	p
Maternal age, years	33 (30–36)	33.5 (30–37.5)	0.381	33 (30–35)	33 (30–36)	0.897
Gestational age at questionnaire	18 (15–24)	18 (14–23)	0.96	19 (16–23)	18 (14–23)	0.581
Mode of conception						0.150
Spontaneous	102 (96.7%)	64 (94.1%)	0.999	36 (87.8%)	130 (94.9)	
Assisted reproductive technique	8 (7.3%)	4 (5.9%)		5 (12.2%)	7 (5.1%)	
Parity			0.999			0.210
Nulliparous	62 (56.4%)	39 (57.3%)		27 (65.8%)	74 (54.0%)	
Parous	48 (43.6%)	29 (42.7%)		14 (34.2%)	63 (46.0%)	
Educational status			0.158			0.004
Secondary school or less	17 (15.5%)	5 (7.6%)		11 (26.8%)	11 (8.0%)	
University degree or diploma	93 (84.5%)	63 (92.4%)		30 (73.2%)	126 (92.0%)	
Employment status			0.999			0.808
Employed	93 (84.5%)	57 (83.8%)		34 (82.9%)	116 (84.7%)	
Not employed	17 (15.5%)	11 (16.2%)		7 (17.1%)	21 (15.3%)	

Data are expressed as mean and interquartile range or number and %.

tool in pregnancy and has been used in several studies to measure the impact of psychological treatments delivered to pregnant women [18]. Compared to non-pregnant populations, previous studies reported that the lowest baseline mean STAI-S score in pregnancy was 35.6 close to the score 40 considered indicative of anxiety [19] and interpreted this result in two ways: pregnancy itself can rise anxiety levels and this confirm that pregnant women should be considered a group at risk; probably some questions on the scale in reference to physical/somatic symptoms can lose their face validity when asked in pregnancy and therefore someone who is relatively anxiety-free can potentially obtain a raised STAI [20, 21]. The median STAI-S score of 49 found in this study is significantly higher than that previously reported [17] emphasize the effect of COVID-19 pandemic on mental health.

There are still conflicting data on the influence of gestational age on anxiety levels in pregnancy. Schubert et al. [22] found that STAI scores remained stable throughout pregnancy while Da Costa et al. [23] described higher scores during first and third trimester. We are unable to evidence any significant effect of gestational age on the anxiety levels, thus not supporting a role of this variable.

Concern and stress in pregnancy are also associated with side effects such as preeclampsia, depression, increased nausea and vomiting during pregnancy, pre-term labor, low birth weight, and low Apgar score [24] and previous research reported that during the COVID-19 pandemic women are much more vulnerable to stress [25]. The experimental design of our study did not allow us to evaluate these findings, but future studies will be required to clarify these issues.

Strengths and limitations

To the best of our knowledge, this is the first study reporting on the psychological effects of COVID-19 in a pregnant woman. Prospective design, selection of women who have received reassurance by a normal ultrasound examination and timing of questionnaire deliver close to the maximum spread of COVID-19 represent the main strengths of this study.

The major limitations of the study are that it was conducted at a single center which may limit its generalizability. Furthermore, the population included was almost Caucasian women and the performance of our findings may differ in other ethnic groups. Moreover, the experimental design did not allow to evaluate whether the rise of anxiety was related also to sudden onset of pregnancy complications. However, this hypothesis seems unlikely on the basis of our entry criteria that excluded any pregnancy with maternal and/or fetal complications.

Finally, although the STAI score allow to evaluate the trait anxiety, it should be acknowledged the absence of previous data on the state of anxiety in the same women before the start of pandemic may not completely reflect the actual effect of COVID-19 outbreak.

Implications for clinical practice

In mothers infected with COVID-19 infections, the outcome so far reported has been generally good [26, 27]. Similarly, it is still unclear the occurrence and a prevalence of a vertical transmission to the fetus and no detrimental effects on the

fetus have been so far reported [28, 29]. These findings underly the importance of provide these information to the pregnant women, despite caution is necessary due to the paucity of data available. Indeed, in our population how only the 7% of women were counseled by professional care providers and this may well explain the induced anxiety toward an adverse perinatal outcome. Moreover, the use of remote questionnaire allows an identification of women that may benefit for the professional help from mental health experts to deal with emotional issues and other psychological issues during this pandemic.

Conclusions

Our data suggest that pregnant women have a greater psychological impact as well as higher anxiety in COVID-19 outbreak. Identify high-risk women can be important to suggest early psychological interventions and prevent some pregnancy stress-related complications.

Research funding: None declared.

Author contributions: All authors have accepted responsibility for the entire content of this manuscript and approved its submission.

Competing interests: Authors state no conflict of interest.

Ethical approval: The study was approved by our institutional Ethics Committee.

References

- Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med* 2020;382:1199–207.
- Lancet. COVID-19: too little, too late? *Lancet* 2020;395:755.
- Day M. Covid-19: surge in cases in Italy and South Korea makes pandemic look more likely. *BMJ* 2020;368:m751. <https://doi.org/10.1136/bmj.m751>.
- World Health Organization. Geneva: coronavirus disease (COVID-2019) situation reports [Internet]. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports> [Accessed 24 Apr 2020].
- Crouse Quinn S. Crisis and emergency risk communication in a pandemic: a model for building capacity and resilience of minority communities. *Health Promot Pract* 2008;9(4 Suppl):18S–25S.
- Gover V. Maternal depression, anxiety and stress during pregnancy and child outcome; what needs to be done. *Best Pract Res Clin Obstet Gynaecol* 2014;28:25–35.
- Martini J, Petzoldt J, Einsle F, Beesdo-Baum K, Höfler M, Wittchen HU. Risk factors and course patterns of anxiety and depressive disorders during pregnancy and after delivery: a prospective-longitudinal study. *J Affect Disord* 2015;175:385–95.
- Ding XX, Wu YL, Xu SJ, Zhu RP, Jia XM, Zhang SF, et al. Maternal anxiety during pregnancy and adverse birth outcomes: a systematic review and meta-analysis of prospective cohort studies. *J Affect Disord* 2014;159:103–10.
- Coelho, HF, Murray L, Royal-Lawson M, Cooper PJ. Antenatal anxiety disorder as a predictor of postnatal depression: a longitudinal study. *J Affect Disord* 2011;129:348–53.
- Lindgren K. Relationships among maternal-fetal attachment, prenatal depression, and health practices in pregnancy. *Res Nurs Health* 2001;24:203–17.
- Lederman RP, Lederman E, Work BA, McCann DS. The relationship of maternal anxiety, plasma, catecholamines, and plasma cortisol to progress in labor. *Am J Obstet Gynecol* 1978;132:495–500.
- Shahhosseini Z, Abedian K, Azimi H. Role of anxiety during pregnancy in preterm delivery. *Zanjan Univ Med Sci J* 2008;16: 85–92.
- Brunton PJ. Effects of maternal exposure to social stress during pregnancy: consequences for mother and offspring. *Reproduction* 2013;146:175–89.
- Gunning M, Dennison F, Stockley C, Ho S, Sandhu H, Reynolds R. Assessing maternal anxiety in pregnancy with the state-trait anxiety inventory (STAI): issues of validity, location, and participation. *J Reproductive Infant Psychol* 2010;28:266–73.
- Spielberger CD, Gorsuch, RI, Lushene RE. STAI manual for the state–trait anxiety inventory. In Spielberger CD, editor, *State–Trait anxiety inventory for adults. Sampler set, manual set, scoring key*. Palo Alto CA: Consulting Psychologists Press; 1983.
- Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS, et al. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int J Environ Res Public Health* 2020;17:1729.
- Rubin GJ, Potts HWW, Michie S. The impact of communications about swine flu (influenza A H1N1v) on public responses to the outbreak: results from 36 national telephone surveys in the UK. *Health Technol Assess* 2010;14:183–266.
- Newham JJ, Westwood M, Aplin JD, Wittkowski A. State-trait anxiety inventory (STAI) scores during pregnancy following intervention with complementary therapies. *J Affect Disord* 2012; 142:22–30.
- Grant KA, McMahon C, Austin, MP. Maternal anxiety during the transition to parenthood: a prospective study. *J Affect Disord* 2008;108:101–11.
- Faisal-Cury A, Menezes PR. Prevalence of anxiety and depression during pregnancy in a private setting sample. *Arch Women's Ment Health* 2007;10:25–32.
- Salamero M, Marcos T, Gutierrez F, Rebull, B. Factorial study of the BDI in pregnant women. *Psychol Med* 1994;24:1031–5.
- Schubert KO, Air T, Clark SR, Grzeskowiak LE, Miller E, Dekker GA, et al. Trajectories of anxiety and health related quality of life during pregnancy. *PLoS ONE* 2017;12:e0181149.
- Da Costa D, Larouche J, Dritsa M, Brender W. Variations in stress levels over the course of pregnancy: factors associated with elevated hassles, state anxiety and pregnancy-specific stress. *J Psychosom Res* 1999;4:609–21.
- Dowse E, Chan S, Ebert L, Wynne O, Thomas S, Jones D, et al. Impact of perinatal depression and anxiety on birth outcomes: a retrospective data analysis. *Matern Child Health J*. 2020. <https://doi.org/10.1007/s10995-020-02906-6>.

25. Qiu J, Shen B, Zhao M, Wang Z, Xie B, Xu Y. A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *Gen Psychiatr* 2020;33:e100213.
 26. Di Mascio D, Khalil A, Saccone G, Rizzo G, Buca D, Liberati M, et al. Outcome of coronavirus spectrum infections (SARS, MERS, COVID 1–19) during pregnancy: a systematic review and meta-analysis. *Am J Obstet Gynecol MFM*. 2020. <https://doi.org/10.1016/j.ajogmf.2020.100107>.
 27. Della Gatta AN, Rizzo R, Pili G, Simonazzi G. COVID19 during pregnancy: a systematic review of reported cases. *Am J Obstet Gynecol* 2020. <https://doi.org/10.1016/j.ajog.2020.04.013>.
 28. Yan J, Guo J, Fan C, Juan J, Yu X, Li J, et al. Coronavirus disease 2019 (COVID-19) in pregnant women: a report based on 116 cases. *Am J Obstet Gynecol* 2020. <https://doi.org/10.1016/j.ajog.2020.04.014>.
 29. Amouroux A, Attie-Bitach T, Martinovic J, Leruez- Ville M, Ville Y. Evidence for and against vertical transmission for SARS-CoV-2 (COVID-19). *Am J Obstet Gynecol* 2020. <https://doi.org/10.1016/j.ajog.2020.04.039>.
-
- Supplementary Material:** The online version of this article offers supplementary material (<https://doi.org/10.1515/jpm-2020-0182>).