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Research paper

Prevalence of comorbid anxiety and depressive symptomatology in the third trimester of pregnancy: Analysing its association with sociodemographic, obstetric, and mental health features

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ABSTRACT

Background: Little is known about the prevalence of comorbid anxiety and depression (CAD) during pregnancy and its risk factors. The aims of this study are to determine the prevalence of CAD in the third trimester of pregnancy and analyse its association with socio-demographic, obstetric, and mental health features.
Methods: In a sample of 934 Italian pregnant women, CAD was defined as having (1) a score of ≥ 10 on the EPDS - depression subscale and/or on the PHQ-9, and (2) a score of ≥ 40 on the State-Trait Anxiety Inventory State and/or a score of ≥ 6 on the EPDS - anxiety subscale. Logistic regression analyses were used to identify socio-demographic, obstetrics, and mental health risk factors of CAD.
Results: The prevalence of CAD was 6.8%. Age between 30 and 35 years (OR=3.01, 95% CI: 1.22–7.45) compared to younger age, current sleep disorders (OR=7.88, 95% CI: 3.83–16.23), and preconception mood disorders (OR=2.76, 95% CI: 1.31–5.84) were associated with higher odds of CAD. Conversely, the presence of no or few economic problems (OR=0.21, 95% CI: 0.07–0.65; OR=0.26, 95% CI: 0.09–0.77) and the perception of enough or more than enough practical support from friends or relatives (OR=0.32, 95% CI: 0.13–0.80; OR=0.22, 95% CI: 0.09–0.53) were associated with lower odds of developing CAD.
Limitations: The cross-sectional design; the use of self-report questionnaires.
Conclusion: CAD is relatively common among third-trimester antepartum women. The provision of economic/practical support may reduce CAD prevalence and its direct and indirect costs.

1. Introduction

Most traditional beliefs consider pregnancy a happy and joyful time for future mothers (Dunkel-Schetter, 2011). However, the reality is often very different because pregnancy increases vulnerability. Indeed, most antepartum women undergo significant changes in their anatomy and physiology (Tan et al., 2013) as well as in their daily routines, work situations, and family dynamics (Dennis et al., 2017). These women have to face several new difficulties and challenges, to which some adapt easily, whereas others struggle to adjust, thus increasing the risk of the onset or relapse of mental disorders (Kuhner, 2016; Cena et al., 2020).

Anxiety and depression are the most common peripartum mental disorders (Molgora et al., 2018; Tambelli et al., 2019; Vismara et al., 2020), with the associated symptoms ranging from mild to severe. Recent meta-analytic findings indicate that the prevalence of clinically significant antepartum anxiety and depression in the European region and in high-income nations is about 19% (Dennis et al., 2017) and 18% (Yin et al., 2020), respectively.

It should be noted that, in general, depression and anxiety are highly comorbid; there is evidence that half to two-thirds of adults with anxiety also suffer from depression (Lamers et al., 2011). Twin and family studies suggest that their comorbidity is largely explained by shared genetic risks (Middeldorp et al., 2005). Consistently, recent genome-wide association studies have showed a high genetic correlation

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(r_G: 0.75–0.80) among people with anxiety disorders, major depressive disorder, and neuroticism (Forstner et al., 2019; Nagel et al., 2018), which supports the existence of a general genetic risk factor that could explain their high rate of co-occurrence. As regards pathophysiology mechanisms, it is well-established that anxiety and depressive disorders share some risk factors, such as heightened stress responsivity (Janiri et al., 2019).

Anxiety and severe depressive symptoms also share a broad range of psychosocial risk factors, although they depend upon the age of the samples studied. For example, the most risk of having both anxiety and depression during adolescence and early adulthood is most strongly predicted by exposure to trauma in early life (e.g. a history of childhood maltreatment) (Dunn et al., 2013) and either parent suffering from a mood disorder (Levis et al., 2011). Financial hardship and family break-up, through bereavement, divorce, or separation, also increase the likelihood of comorbidity (Hyland et al., 2016).

There is some evidence that anxiety and depression are also highly comorbid during the antepartum period (Verreault et al., 2014) and likely share most of the well-established psychosocial risk factors of depression or anxiety alone. The most relevant factors associated with the risk of depression or anxiety are: absent partner or lack of social support; history of abuse or domestic violence; personal history of mental illness; adverse life events and high perceived stress and negative cognitive style/low self-esteem and self-efficacy and problematic/dissatisfied relationship with partner (Biaggi et al., 2016). Although it was suggested that about one expectant woman in ten has comorbid anxiety symptoms and mild-to-severe depressive symptoms (Falah--Hassani et al., 2017), such comorbidity remains an under-investigated area of research and often an under-recognized clinical condition (Fedock and Alvarez, 2018; Goodman and Tyer-Viola, 2010).

Nevertheless, the evaluation of comorbid anxiety and depression (CAD) during pregnancy and its associated factors is crucial for developing effective risk assessment strategies as well as prevention and intervention programs. This is important for two main reasons. First, antepartum anxiety and depression have different and cumulative adverse effects on both maternal and fetal outcomes (O'Donnell et al., 2014; Grigoriadis et al., 2018; Ierardi et al., 2018; Spry et al., 2020; Wallwiener et al., 2019). Moreover, there is evidence that untreated antepartum CAD increases the risk of negative outcomes on neonates and children such as prematurity (Field et al., 2010) and low birth weight (Accortt et al., 2015), birth asphyxia and coronary heart disease (Shahhosseini et al., 2015), delayed initiation of breastfeeding, poor infant cognitive development (Ibanez et al., 2015) and mental health problem in late childhood (Capron et al., 2015). The second reason, strictly connected to the first, is that individuals with CAD have more severe symptoms, longer illness episodes, worse psychosocial impairment, and poorer response to medication treatment than individuals with only one of these disorders (Pollack, 2005).

The aim of this study was to determine the prevalence of CAD symptoms in a large sample of Italian women in their third trimester of pregnancy, and analysing the association between CAD and sociodemographic, obstetric, and mental health features.

2. Methods

2.1. Recruitment

This study is part of a larger study promoted by the Observatory of Perinatal Clinical Psychology (https://www.unibs.it/it/node/988), Department of Clinical and Experimental Sciences University of *Brescia,* in Italy, in mutual agreement of scientific collaboration with Italian National *Institute of Health*. This larger study merges a cross-sectional study and a pre–post intervention cohort study (Cena et al., 2020) with two objectives: (1) to evaluate the prevalence of both maternal antepartum and postpartum depression and anxiety symptoms in a sample of women (cross-sectional study component) and (2) to evaluate the effectiveness of a psychological intervention in improving both antepartum and postpartum depression and anxiety (pre-post intervention cohort study component). Ethical approval of the study was obtained from the ethics committee of the Health Care Centre of Bologna (registration number 77808, dated 6/27/2017), and was conducted in accordance with the World Medical Association (WMA) Declaration of Helsinki.

The present study came from the data collected in the cross-sectional study, which included both antepartum and postpartum women. As part of that study, the present study only focused on antepartum Italian women.

In each of the eleven Italian peripartum health care centres, facilities involved and coordinated by the Observatory of Perinatal Clinical Psychology, the recruitment took place among all the antepartum women attending one of their scheduled appointments, during an approximately 2-year period (2017–2019). The study was presented to these women by psychologists, midwives, or gynaecologists. All the women approached were provided with a pamphlet, developed as part of the study, in which the purpose, aims and methodology of the study were explained. Women who said they wanted to participate in the study and definitively agreed, signed an informed consent form.

A total of 1378 antepartum women were asked to join in the study. Of these, 1282 were of Italian nationality and 96 were of non-Italian nationality.

As previously mentioned, the present study only focused on the women who were of Italian nationality ($N = 1282$). Among them, only women in their third trimester of pregnancy were considered in the analyses (959 out of 1082 women in all the trimesters who were eligible and accepted to participate; 89%). This was done because they accounted for the majority of antepartum Italian respondents (Fig. 1) and also because in this way we obtained a homogeneous sample which annulled potential confounding in the event that different trimesters had different impacts on symptoms (Dennis et al., 2017; Okagbue et al., 2019).

3. Inclusion and exclusion criteria

Inclusion criteria for participation in the antepartum cross sectional study were being above 18 years of age, being antepartum, and being able to speak and read Italian. The exclusion criteria were having psychotic symptoms or issues with substance abuse.

4. Assessment

4.1. Preliminary clinical interview

Women who agreed to participate in the study were asked to undergo a preliminary clinical interview led by a clinical psychologist trained in peripartum clinical assessment. The interview was not a diagnostic interview but a semi-structured interview to elicit information on current and past maternal experience with psychiatric conditions and use of psychotropic drugs. Psychiatric conditions included symptoms of anxiety, depression, psychotic symptoms (i.e., delusions and/or hallucinations), non-suicidal self-harm tendencies, suicidal ideation or substance abuse. In the case of symptoms of psychosis, self-harm tendencies or suicidal ideation or substance abuse, the women were invited to undergo further psychiatric assessment and excluded from the study. All the interviews were conducted individually in private rooms at the health care centres. The eligible women were subsequently administered self-report questionnaires for data collection on anxiety, depression, and demographic and socioeconomic characteristics.

4.2. Evaluation instruments

4.2.1. Demographic and socioeconomic characteristics

Information about maternal demographic and socioeconomic

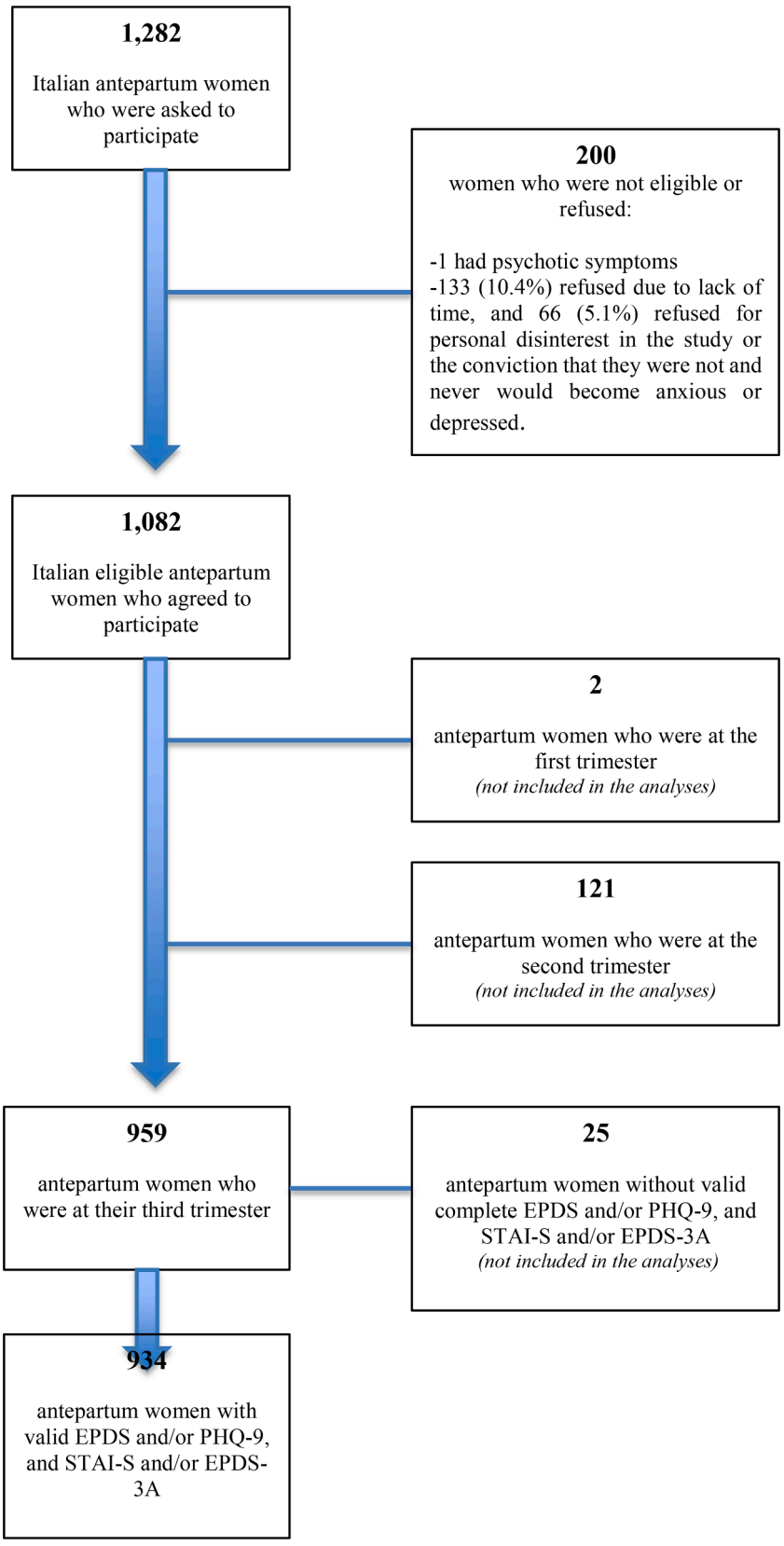

Fig. 1. Flowchart of participants in the study sample.

characteristics was collected through the Psychosocial and Clinical Assessment Form (Palumbo et al., 2017). The socio-demographic characteristics include: age (18–29 years, 30–35 years, > 35 years); marital status (married or cohabitating, single), educational level (elementary, college or trade school, university degree); working status (homemaker or unemployed, employee on temporary or permanent contract); economic status (some or many problems, a few problems without specific difficulties, average to high status); practical support from their partner (not enough, enough, more than enough support); emotional support from their partner (not enough, enough, more than enough support); practical support from friends and/or relatives (not enough, enough, more than enough support); emotional support from friends and/or relatives (not enough, enough, more than enough support).

4.2.2. Depressive symptoms

Symptoms of maternal depression were assessed using the Italian version of both the Edinburgh Postnatal Depression Scale (EPDS) (Benvenuti et al., 1999) and the Patient Health Questionnaire-9 (PHQ-9) (Mazzotti et al., 2003). Both EPDS and PHQ-9 can be used to measure depression severity based on the DSM-5 criteria (Smith-Nielsen et al., 2018; Spitzer et al., 2014).

The EPDS is a ten-item, self-report questionnaire assessing the frequency in the previous seven days of the following depressive symptoms: anhedonia (two items), anxiety, panic attack, guilt, being overwhelmed, sadness, sleep disorders, suicidal thoughts, and tearfulness. As the EPDS contains three items measuring anxiety, only the depressive subscale (EPDS-7D; including items 1, 2, and 6–10) was used to estimate depressive symptomatology. The EPDS-7D total score was divided by seven and then multiplied by ten to create a total score tantamount to the original version (Nawa et al., 2019). A score of ≥ 10 was used to identify antepartum women with depressive symptoms, as suggested by the literature on antepartum populations (Agostini et al., 2019; Vàzquez and Mîguez, 2019) yielding a sensitivity of 72.4% and specificity of 79.3%.

The PHQ-9 is a nine-item, self-report questionnaire assessing the frequency in the previous two weeks of the following depressive symptoms: appetite disturbances, anhedonia, depressed mood, diminished concentration, fatigue, feelings of worthlessness or inappropriate guilt, insomnia or hypersomnia, psychomotor agitation or retardation, and thoughts of death. A score of $\geq$10 is recommended for the risk of antepartum depression (Marcos-Nàjera et al., 2018; Gallis et al., 2018), which has been demonstrated to yield a sensitivity and specificity of 94.7% and 88.9%, respectively.

4.2.3. Anxiety symptoms

Symptoms of maternal anxiety were assessed using the Italian version of both the State-Trait Anxiety Inventory State (STAI-S) (Spielberger, 1989) and the EPDS-anxiety subscale (EPDS-3A).

The STAI-S is a 20-item, self-report questionnaire that measures the level of anxiety in the current situation. Its construct and content validities for antepartum women have been established (Gunning et al., 2010). A cut-off score of $\geq$40 was suggested for antepartum women with a sensitivity of 80.95% and specificity of 79.75% (Grant et al., 2008).

The EPDS-3A subscale (comprising items 3, 4, and 5) has an internal consistency of 0.86 (Matthey, 2008). A score of ≥ 6 is used to identify antepartum women at risk of clinically significant levels of anxiety (Matthey, 2008; Matthey, Della Vedova, 2018). The sensitivity and specificity in the postpartum population are 66.7% and 88.2%, respectively (Matthey, 2008; Brouwers et al., 2001; Matthey et al. 2013).

4.3. Statistical analysis

A statistical analysis including descriptive, univariate analyses and stepwise multiple logistic regression models was conducted. For descriptive analyses, frequencies and percentages were calculated for categorical variables. Analyses of variance were computed to test for differences in the prevalence of symptoms (either anxiety, or depression, or CAD symptoms) among women at different stages in pregnancy within the third trimester (27–31, 32–36 and 37–40 weeks). The Student's t-test or chi-square test (or Fisher exact test) were used to test for differences between women with CAD and women with a single morbidity for each characteristic (socio-demographic, obstetric or mental health). After univariate estimations were calculated, multivariable analyses were conducted for three groups of characteristics: i) sociodemographic factors (Model 1), ii) obstetric factors (Model 2), and iii) mental health factors (Model 3). Each variable that was associated with CAD symptoms with a $p < 0.10$ was included in the final model (Model 4); subsequently, multivariable analysis was repeated by including only the variables with $p \leq 0.05$ in the final mutually adjusted model. The discriminatory power of the final model in detecting CAD was assessed using the Hosmer-Lemeshow goodness-of-fit test and the receiver operating characteristic (ROC) curve. Area under the curve (AUC) values, derived from the ROC curve, represent the overall accuracy and were reported with 95% confidence intervals. An AUC of 1.0 indicates perfect discrimination, whereas an AUC of 0.50 suggests complete absence of discrimination. Any intermediate value is a quantitative measure of the ability of the risk predictor model to distinguish between CAD and single morbidity. All analyses were performed using the Statistical Package for Social Sciences (SPSS) version 26.

5. Results

5.1. Sample characteristics

Of the 1282 women with Italian nationality who were asked to participate in the study, 1082 agreed to join and fulfilled the eligible criteria, while 199 refused (15.5%) and 1 did not meet eligible criteria (0.1%; for the presence of psychotic symptoms) (Fig. 1). Of the 1082 eligible women who agreed to participate, 959 (89%) were in their third trimester and, of these, 934 (97%) provided valid complete EPDS and/or PHQ-9, and STAI-S and/or EPDS-3A. The characteristics of these 934 women are presented in Tables 1–3. The range of their third trimester stage of pregnancy was 27–40 weeks and the median 33 weeks.

The prevalence of CAD was 6.8%, while 21.0% of the sample suffered from single morbidity (19% anxiety and 2% depression). No significant differences were found in the prevalence of CAD or single morbidity symptoms among women at different third trimester stages of gestation.

5.2. Significant associations

In the univariate analyses, significant differences between women with CAD and women with single morbidity were found regarding economic status (chi-square: 9.7, 2 df, $p < 0.01$), emotional support from partners (chi-square: 6.1, 2 df, $p < 0.05$), practical support from friends and relatives (chi-square: 17.7, 2 df, $p < 0.001$), emotional support from friends and relatives (chi-square: 13.3, 2 df, $p < 0.001$), current sleep problems (chi-square: 41.8; 1 df, $p < 0.001$) and history of mood disorder (chi-square: 12.8; 1 df, $p < 0.001$).

In the multivariate analyses, among the sociodemographic factors (Model 1), maternal age was positively and significantly associated with CAD, whereas economic status and practical support from friends and relatives were inversely associated with comorbidity (Table 1). Among the obstetric factors (Model 2), no variables were significantly associated with CAD (Table 2). Among the mental health factors (Model 3), current sleep disorders and prior history of mood disorders were significantly associated with CAD (Table 3). All significant variables in the three models were $p < 0.05$.

5.3. Model for CAD

After including all significant variables from the three factor-specific models, five variables remained statistically significant in Model 4 ($p \leq$

Table 1
Socio-demographic features of whole sample and subsamples.

Characteristics	Whole sample	Single morbidity		CAD		Statistics[$]	
	N = 934	*n* = 196	%	*n* = 64	%	OR	95% CI
Age							
18–29	205	54	26.3	12	5.9	1.00	
30–35	444	85	19.1	36	8.1	3.68	1.49–9.07
>35	284	56	19.7	16	5.6	1.69	0.61–4.70
Marital status							
Single	70	16	22.9	7	10.0	1.00	
Married or cohabiting	858	179	20.9	57	6.6	0.72	0.24–2.14
Education							
Elementary	99	32	32.3	12	12.1	1.00	
College or trade school	335	66	19.7	26	7.8	0.96	0.36–2.56
University degree	494	97	19.6	26	5.3	0.58	0.20–1.59
Work activity							
Homemaker or unemployed	149	45	30.2	14	9.4	1.00	
Temporary employee	88	16	18.2	6	6.8	1.44	0.40–5.23
Permanent employee	686	134	19.5	43	6.3	1.41	0.61–3.30
Economic status **							
Some or many problems	57	13	22.8	12	21.1	1.00	
A few problems	425	92	21.6	32	7.5	0.41	0.14–1.19
Average high status	441	89	20.2	20	4.5	0.27	0.09–0.83
Practical support from partner							
Not enough support	72	22	30.6	12	16.7	1.00	
Enough support	216	55	25.5	22	10.2	2.02	0.59–6.96
More than enough support	636	116	18.2	29	4.6	1.34	0.36–5.06
Emotional support from partner *							
Not enough support	104	34	32.7	20	19.2	1.00	
Enough support	216	59	27.3	18	8.3	0.68	0.24–1.89
More than enough support	605	101	16.7	25	4.1	0.86	0.22–2.17
Practical support from friends and relatives ***							
Not enough support	110	27	24.5	24	21.8	1.00	
Enough support	272	69	25.4	18	6.6	0.32	0.13–0.81
More than enough support	542	98	18.1	21	3.9	0.37	0.14–0.97
Emotional support from friends and relatives ***							
Not enough support	149	48	32.2	29	19.5	1.00	
Enough support	297	72	24.2	23	7.7	0.71	0.31–1.62
More than enough support	477	74	15.5	11	2.3	0.41	0.14–1.19

Note. *$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$, difference between women with single morbidity and women with CAD as resulted in the univariate analysis.
[$] Odds ratio (OR) from multiple logistic regression analysis for evaluating the associations of sociodemographic factors with CAD compared to single morbidity.

Table 2
Obstetric features of whole sample and subsamples.

Characteristics	Whole sample	Single morbidity		CAD		Statistics[$]	
	N = 934	*n* = 196	%	*n* = 64	%	OR	95% CI
Previous pregnancies							
No	699	151	21.6	42	6.0	1.00	
Yes	235	45	19.1	22	9.4	1.46	0.50–4.30
Living children							
No	779	166	21.3	47	6.0	1.00	
Yes	155	30	19.4	17	11.0	1.50	0.50–4.54
History of abortions							
No	687	135	19.7	44	6.4	1.00	
Yes	239	60	25.1	20	8.4	0.84	0.42–1.70
Planned pregnancy							
No	252	70	27.8	24	9.5	1.00	
Yes	672	124	18.5	39	5.8	0.88	0.48–1.61
Assisted reproductive technology							
No	862	183	21.2	62	7.2	1.00	
Yes	66	12	18.2	2	3.0	0.54	0.11–1.54

[$] Odds ratio (OR) from multiple logistic regression analysis for evaluating the associations of obstetric factors with CAD compared to single morbidity.

Table 3
Mental health features of whole sample and subsamples.

Characteristics	Whole sample	Single morbidity		CAD		Statistics[$]	
	N = 934	*n* = 196	%	*n* = 64	%	OR	95% CI
Current sleep problems *							
No	692	146	21.1	19	2.7	1.00	
Yes	242	50	20.7	45	18.6	7.14	3.70–13.80
Anxiety history							
No	826	161	19.5	51	6.2	1.00	
Yes	96	33	34.3	13	13.5	0.58	0.23–1.44
Mood disorder history *							
No	773	158	20.4	37	4.8	1.00	
Yes	143	35	25.5	26	18.2	3.06	1.44–6.53
Other disorder history							
No	883	180	20.4	57	6.5	1.00	
Yes	39	13	33.3	6	15.4	1.51	0.46–5.01

Note. *$p \leq 0.001$; difference between women with single morbidity and women with CAD as resulted in the univariate analysis.
[$] Odds ratio (OR) from multiple logistic regression analysis for evaluating the associations of mental health features with CAD compared to single morbidity.

0.05) (Table 4). Age between 30 and 35 years (ORs: 3.01, 95% CI: 1.22–7.45), current sleep disorders (OR: 7.88, 95% CI: 3.83–16.23), and preconception mood disorder episodes (OR: 2.76, 95% CI: 1.31–5.84) were found to be associated with higher odds of CAD. Conversely, the presence of no or a few economic problems (OR: 0.21, 95% CI: 0.07–0.65; OR: 0.26, 95% CI: 0.09–0.77) and the perception of enough or more than enough practical support from friends or relatives (OR: 0.32, 95% CI: 0.13–0.80; OR: 0.22, 95% CI: 0.09–0.53) were associated with lower odds of developing comorbidity. The Hosmer-Lemeshow goodness-of-fit test showed a chi-square value of 8.20 (8 df, $p = 0.414$), which indicates a good accuracy of the model. The AUC-ROC was 0.84 (95% CI: 0.77 to 0.90), which indicates excellent discriminatory ability (Fig. 2).

Table 4
Significant associations with CAD from the three characteristic-specific models.

Characteristic	OR	95% CI	*p-value*
Age			
18–29	1.00		
30–35	3.01	1.22–7.45	0.017
>35	1.69	0.61–4.66	0.308
Economic status			
Some or many problems	1.00		
A few problems	0.26	0.09–0.77	0.016
Average high status	0.21	0.07–0.65	0.007
Practical support from friends and relatives			
Not enough support	1.00		
Enough support	0.32	0.13–0.80	0.015
More than enough support	0.22	0.09–0.53	0.001
Current sleep problems			
No	1.00		
Yes	7.88	3.83–16.23	<0.001
Mood disorder history			
No	1.00		
Yes	2.76	1.31–5.84	0.008

Abbreviations: OR, odds ratio.

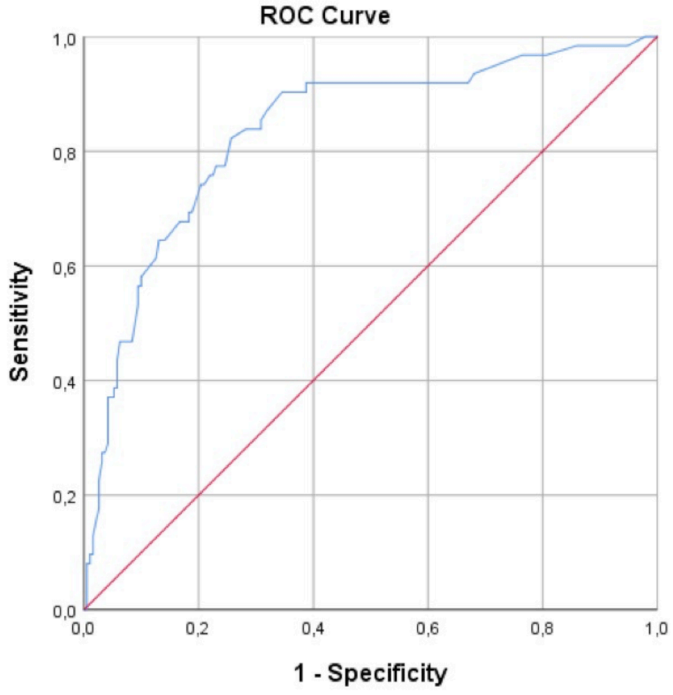

Fig. 2. Receiver operator curve analysis for CAD.

The critical threshold of probability of positive occurrence value was 0.22 (criterion used for classifying subjects as having comorbidity, if the probability was greater than or equal to 0.22). The Youden index (TPR-FPR) was 0.57 with a true positive rate at 83% and a false positive rate at 26% (specificity: 0.74).

6. Discussion

This cross-sectional study is one of the largest to evaluate the prevalence of CAD in a sample of third trimester antepartum women. The socio-demographic characteristics of study participants are comparable to those from other Italian studies conducted in peripartum settings, which describe mothers' conditions comparable to those reported here (Palumbo et al., 2017). However, in general, the sample in this study involved women who had higher level of education and better financial situation as compared to the general population of Italian women, of whom, for example, among those aged 25–64 and those aged 30–34 years, about 22% and 33% have received a University degree, respectively (Istat, 2020). Although the relationships between CAD and some socio-economic factors (i.e., education and socio-economic condition) are likely to be underestimated because, as said, the sample was primarily made up of women who were in better education and financial condition compared to the general population of pregnant women, with regard to mental and social support factors, our findings are consistent with those found in previous studies conducted on general population samples for evaluating antepartum depression ~~or~~ and anxiety (Yin et al., 2020; Biaggi et al., 2016), suggesting that a past history of mental health problems and lack of social support are risk factors also among women who have better education and socio-economic situation.

Our finding of a CAD prevalence rate of 6.8% is in line with that from a recent meta-analysis showing a prevalence of 6.3% for antepartum and postpartum self-reported comorbid anxiety symptoms and moderate-to-severe depressive symptoms during pregnancy (Falah-Hassani et al., 2017).

Regarding the instruments used in this study, it must be noted that EPDS, PHQ-9, and STAI have demonstrated good discriminant and predictive validity (Cena et al., 2021); Benvenuti et al., 1999; Mazzotti et al., 2003; Agostini et al., 2019; Vàzquez, Mìguez, 2019; Marcos-Nàjera et al., 2018; Gallis et al., 2018; Spielberger, 1989; Grant et al., 2008), and are the most used self-report measures in the peripartum research field for the assessment of anxiety and depression. Therefore, through their use, it is possible to provide a reasonably accurate estimate of prevalence, and enable meaningful comparisons among countries inside and outside the EU as well as for new studies on the possible protective and risk factors of peripartum CAD in these countries. One concern is that the reference time frame differed for the PHQ-9 (over the last two weeks) and EPDS (in the last week), so that it could be argued that we cannot be sure that women were in the same mental state when they reported the outcomes. However, there is evidence that the PHQ-9 and the EPDS have comparable peripartum depression outcome results as well as being remarkably similar in terms of their operating characteristics (Wang et al., 2021).

The risk factors of antepartum CAD symptomatology have not been frequently examined; to our knowledge only two relevant studies exist on this matter until today and they involve a low- and a lower-middle-income country (Premji et al., 2020, Bante et al., 2021). The first of them, conducted on a sample of pregnant Pakistani women, investigated several predictors such as age, household income, perceived stress, number of previous children, husband's employer and adverse childhood experiences. Not consistently with our results, that study did not find significant associations between age or household income and CAD. Stress and husband's employer only were significant predictors of comorbid anxiety and mild-to-severe depressive symptoms in that study (Premji et al. 2020). Of the risk factors assessed by the second study, conducted on a sample of pregnant Ethiopian women, only one was shared with our risk factors, which is marital status. Not consistently with our findings, the Ethiopian study found that being unmarried was positively associated with CAD (Bante et al., 2021). However, in Ethiopia compared to Italy, getting pregnant without formal marriage is strongly stigmatized by the community that may result in stress, and finally in depression and anxiety.

A relatively recent review examining the main risk factors involved in the onset of antepartum anxiety and depression (all the studies included in this review analysed risk factors separately either for anxiety or depression, not for their comorbidity) found that a history of previous anxiety or depression was one of the strongest risk factors along with a lack of social support to both conditions (Biaggi et al., 2016). On the other hand, studies examining the association between antepartum anxiety/depression, maternal age, and financial hardships reported contradictory results (Biaggi et al., 2016). For example, with regard to age, many studies have found a significant association between young age and anxiety/depression during pregnancy (e.g., Lee et al., 2007;

Martini et al., 2015; Bodecs et al., 2013) while other studies found that age was not associated with depression or anxiety (e.g., Abuidhail and Abujilban, 2014; Karmaliani et al., 2009; Srinivasan et al., 2015). While some studies (e.g., Fisher et al., 2013; Jeong et al., 2013; Leigh and Milgrom, 2008; Lydsdottir et al., 2014; Weobong et al., 2014; Zeng et al., 2015) found financial difficulties to be relevant risk factors, others (Josefsson et al., 2002; Abuidhail and Abujilban, 2014; Srinivasan et al., 2015) did not find any significant association.

Our results align with some studies indicating that either antepartum depression or anxiety are more prevalent among women with an older age (Ali et al., 2012; Fisher et al., 2013; Luke et al., 2009; Nasreen et al., 2011; Pampaka et al., 2018); however, they differ from those of many other studies that found a significant correlation between younger age and either depression or anxiety during pregnancy (e.g., Lee et al., 2007; Martini et al., 2015; Leigh and Milgrom 2008). In Italy, having a baby over the age of 30 might indicate that a woman has postponed pregnancy, for example because of lack of a permanent work or because of personal or fertility problems. Any of these difficulties could increase vulnerability to psychological morbidity.

As previously said, history of prior mood disorder episodes turned out to be a predisposing factor for CAD in our study; this result is in line with the vast majority of the available studies which show that a history of anxiety or depression at any time during the lifetime is a well-established risk factor (and mainly the strongest) in the development of antenatal anxiety or depression (Biaggi et al., 2016). Further, the protective effect against CAD of perceiving enough or more than enough support from friends or relatives was in accordance with the results of a lot of previous studies which report that perceived lack of social support is an important risk factor for antenatal anxiety or depression (e.g., Bayrampour et al., 2015; Agostini et al., 2015; Martini et al., 2015; Waqas et al., 2015). The present study also shows that not having financial problems is protective against CAD. This is in line with many studies that found low income or financial difficulties to be associated with either antepartum depression or anxiety (e.g., Fisher et al., 2013; Faisal-Cury et al., 2007; Bodecs et al., 2013), although our results differ from other antepartum depression studies which did not find any correlation (Josefsson et al., 2002; Abuidhail and Abujilban, 2014; Srinivasan et al., 2015). Finally, our findings on the association between sleeping problems and CAD are clearly consistent with a nine-year follow-up Australian study of 9683 young women showing moderate-to-strong associations between frequent sleeping difficulties and self-reported diagnosis of depression and anxiety (Jackson et al., 2014).

Lastly, it should be noted that our findings regarding the association between antepartum CAD and both preconception episodes of mood disorders and current economic hardships may be particularly important considering the ongoing coronavirus disease 2019 pandemic. Indeed, the essential public health measures (Stefana et al., 2020a, 2020b) adopted to contain the spread of the virus have severely impacted national and global economies both in the short term and in the coming years (Nicola et al., 2020). Furthermore, as shown by both general and peripartum population surveys, these restriction measures play a key role in eliciting or exacerbating clinical anxiety and depression (Pancani et al., 2020; Qiu et al., 2020; Wu et al., 2020), which can persist for years afterward (Brooks et al., 2020). It should be borne in mind here that the pandemic has also had a negative impact on peripartum healthcare services and professionals (Cena et al., 2021a,b).

There are two main limitations of the present study. First, this was a cross-sectional study, and did not allow us to identify the CAD symptom trajectories throughout the entire peripartum period. Second, it was based on self-report questionnaires (which may be subject to bias) without supplementing that assessment with a diagnostic interview enabling DSM-5 diagnosis for either anxiety or depression. However, as diagnoses of several mental disorders, including anxiety and depression, are based primarily on self-perceived symptoms (Stefana and Gamba, 2013), assessing them using valid and feasible self-rating scales should be considered a valid option for research purposes.

The findings of the current study indicate that a non-negligible number of antepartum women experience CAD in the late stage of pregnancy. In light of the well-documented adverse consequences of CAD, including a seventeen-fold higher risk for suicide (Tavares et al., 2012) and an increased risk of developing recurrent long-term mood disorders (Dipietro et al., 2008), this is a critical public health issue that warrants further research and the development or implementation of early prevention programs as well as an evidence-based assessment approach (Cena et al., 2020; Youngstrom et al., 2017; Youngstrom et al., 2018) to diagnosis and treatment. Despite the great attention paid to peripartum depression, albeit only in more recent years, research on the comorbidity in such disorders is still limited. In our study, antepartum women were more likely to have CAD symptoms if they were aged between 30 and 35, as compared to younger women, had ongoing sleep disorders, history of mood disorders, low economic status, or perceived lack of relatives and friends who provided practical support. Further investigation is needed to understand the prevalence and factors associated with CAD symptoms as well as the clinical diagnosis of CAD across the entire peripartum period.

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Data availability statement

The complete dataset is available from the corresponding author upon request.

Ethics approval

Ethical approval was obtained from the ethics committee of the Health Care Centre of Bologna (registration number 77808, dated 6/27/2017), and was conducted in accordance with the World Medical Association (WMA) Declaration of Helsinki.

Consent to participate

All participants provided written informed consent in the study.

Availability of data and material

The complete dataset is available from the corresponding author upon request.

Declaration of Competing Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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