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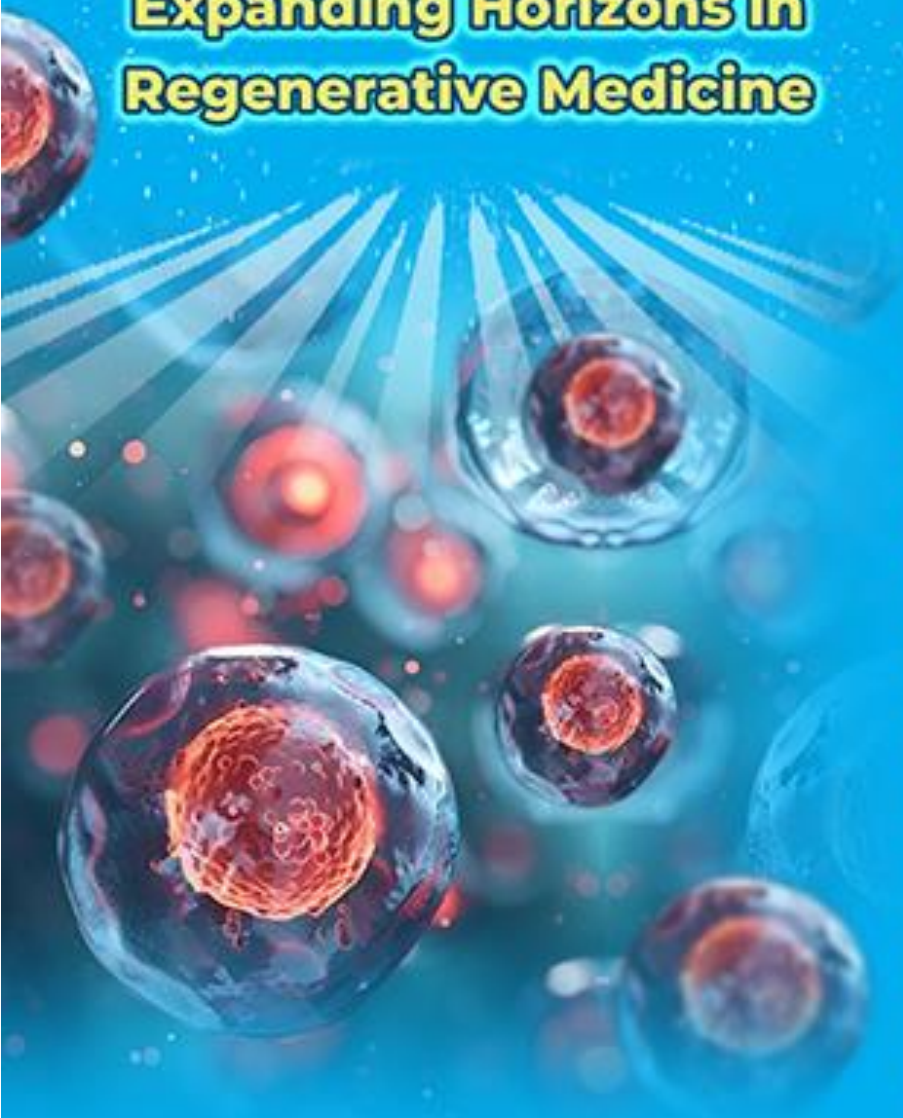

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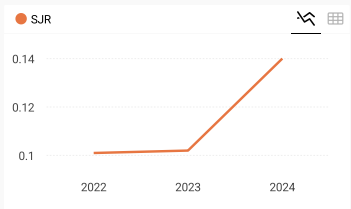

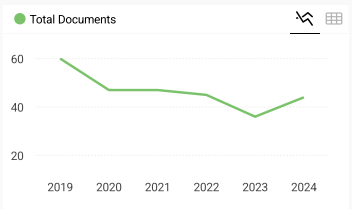

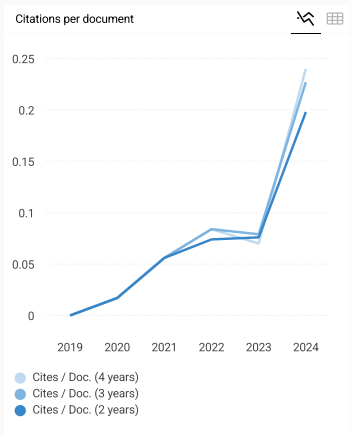

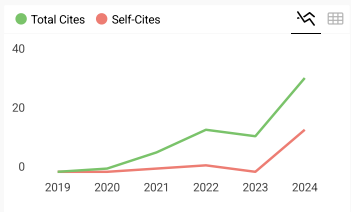

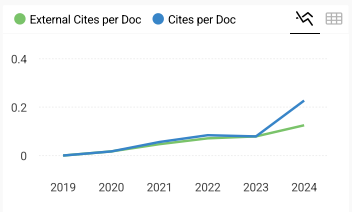

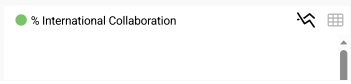

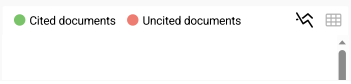

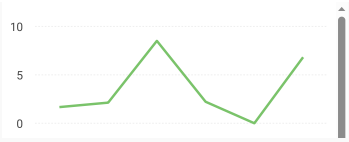

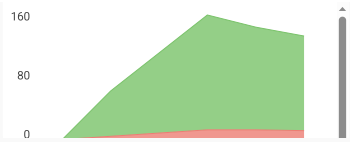

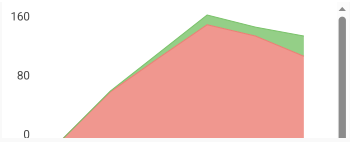

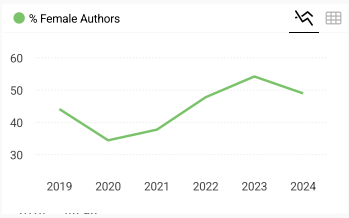

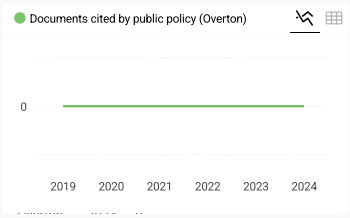

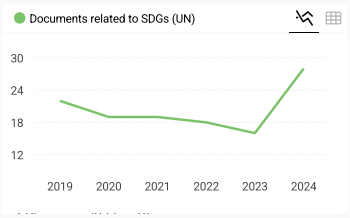

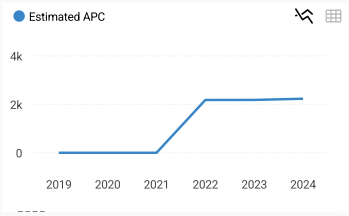

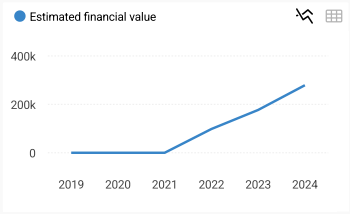

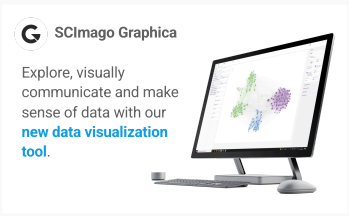

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Literature Review

Anxiety in Pregnant Women During the Covid-19 Pandemic

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Abstract

Objective: This study systematically reviewed and meta-analysis the prevalence and factors associated with anxiety in pregnant women during the pandemic.

Methods: We searched PubMed MEDLINE, Web of Science, Scopus, ProQuest, EBSCO, Science Direct, and Garuda journal databases in July 2021 and updated them in October 2021. All articles from December 2019 and the English and Bahasa Journal articles were included in the search. We included studies that investigate factors affecting anxiety exclusively in pregnant women. The primary outcome was the prevalence ratio. The secondary outcome was the risk and protective factors as the independent variable. Joanna Briggs Institute Critical Appraisal Tools and RevMan 5.4 were used for the analysis.

Results: After screening 2082 articles, we included 21 studies with 42.177 pregnant women. The pooled prevalence of anxiety was estimated at 28% (95% CI, 23-33.3). We found that 12 of the 21 studies contributed to 8 risks and one protective factor in the meta-analysis. Not married/divorced/widowed, monthly income < 780 USD, screen time > 3 hours/day, history of exposure to COVID-19, complications in the current pregnancy, sleep less than 7 hours per day, subjective poor sleep quality, and high perception of vulnerability were risk factors. Meanwhile, the protective factor was trust in the government's official media.

Conclusion: There is a significant increase in the prevalence of maternal anxiety during the pandemic. Mental health screening during the antenatal visit must be carried out, and interventions to lower the anxiety level must be planned to prevent further harm.

Keywords: anxiety, COVID-19, mental health, pandemics, pregnancy.

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INTRODUCTION

The COVID-19 pandemic causes psychological distress and fear in some individuals due to periods of isolation, quarantine, and hospitalization[1]. As one of the vulnerable populations, pregnant women experience increased anxiety, which has been reported in various countries[2–4]. Anxiety is a normal response to threats and is an attempt to save oneself [5]. However, there will be interference if the response is excessive.

In pregnant women, anxiety is associated with an increased risk of obstetrics problems, cesarean delivery, increased chances of preterm birth, small for gestational age, and smaller infant head circumference[6], including premature rupture of the membrane[7] If not prevented, anxiety during pregnancy could lead to more extensive harm. Therefore, knowing the risk and protective factors for anxiety during pregnancy is essential, especially during a pandemic.

Several systematic literature reviews discussed the psychological impact of COVID-19 on pregnant and postpartum women during the pandemic[8,9]. However, none specifically discusses the prevalence of anxiety during pregnancy and its determinants using a systematic review accompanied by a meta-analysis method. Therefore, this study aims to systematically review risk and protective factors, estimate the

pooled effect size of risk and protective factors, and estimate the pooled prevalence of anxiety in pregnant women during the COVID-19 pandemic.

METHODS

The organization of this manuscript followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines[10], and the research protocol was registered in PROSPERO CRD42021270107. The literature search was carried out in July – August 2021 and updated in October 2021. We used PUBMED Medline, Web of Science, Scopus, Science Direct, ProQuest, EBSCOhost, and the Garuda journal database to conduct our search.

The search for titles and abstracts was carried out systematically using the thesaurus and MeSH. Combination of keywords: pregnant*, antenatal, prenatal, perinatal, maternal, gravid, prepartum, peripartum, antepartum, expectant mother, anxiety, worry, mental health, stress, distress, COVID, Coronavirus, Wuhan virus, Wuhan Pneumonia, SARS-CoV-2, 2019-nCOV, and pandemic both in English and Bahasa were used. All English and Bahasa journal articles from December 2019 to July 2021 were included in the search.

The Population, Intervention/Exposure, Comparison, Outcome, and Study design frameworks were used to clarify the inclusion and exclusion criteria (see Table 1).

Table 1. PICOS Design Frameworks

	Inclusion	Exclusion
Population	Studies on pregnant women only or pregnant and postpartum women	Studies that did not dissociate pregnant and postpartum women in the analysis.
Intervention/ Exsposure	COVID-19 pandemic	
Comparator		
Outcome	The primary outcome was the prevalence of anxiety among pregnant women. The secondary outcome was the risk and protective factors as the independent variable and anxiety as the dependent variable with Odds Ratio/ Prevalence Odds Ratio, p <0.05, and 95% CI.	Studies only mention descriptive analysis for the outcome and studies that combine anxiety and other mental health problems as the dependent variable.
Study Design	Cross-sectional, case-control. cohort	Reviews, editorials, letters, opinions, purely qualitative studies, conferences, and proceedings.

The articles obtained from the initial search were then imported into Rayyan[11], checked for duplication and screened. Preliminary screening through titles and abstracts was carried out independently by CPP. After selecting the title and abstract, the full text of potential articles was screened based on the data extraction compared to inclusion and exclusion criteria. Articles that did not meet the requirements were removed with a description of the reason. In case of doubt, CPP consulted with other reviewers (BAT, MS). Articles that did not provide access to the full text were excluded.

According to the study design, articles passed the title, abstract, and full-text screening process, then assessed for quality using the Joanna Briggs Institute (JBI) Critical Appraisal Tools[12] and scored. Articles that did not meet the minimum cut-off value of included studies (50%) were excluded to prevent bias due to study quality.

Th data extraction process is carried out by CPP independently. Studies containing statistical data were synthesized quantitatively during the meta-analysis. The combined prevalence was calculated using the proportion formula for pregnant women with anxiety disorders based on the cut-off score of the anxiety measurement instrument provided in the article. Because one article can contain more than one risk factor, each risk factor was analyzed separately. Articles that did not report odds ratio but had 2x2 table data were included in the meta-analysis.

Revman 5.4 software was used to analyze the data. The heterogeneity assessment used the I2 test (I2 > 50%) and the Q test.[13] The random-effects model was used in heterogeneous study conditions otherwise, the fix-effects model was used. The prevalence and 95% confidence intervals for each study were presented in a forest plot. Jamovi 2.0 software was used to assess publication bias by using the Egger and Begg test and the Fail Safe-N test result.[14] The significance of publication bias was obtained when the $P < .05$.

RESULTS

In the initial search, 2802 articles were obtained from 7 journal databases, leaving 21 articles to synthesize the narrative quantitatively after screening. All 21 articles were cross-sectional, with China being the most studied country (66.67%). The two most widely used measuring instruments were GAD-7 (Generalized Anxiety Disorder-7) and SAS (Zung Self-rating Anxiety Scale), with 38.09% each. There were nine articles with a sample size of >1000 pregnant women. Based on the JBI assessment, two studies scored 100%, and five scored 62.5%. The summary of the characteristics of the study is provided in Table 2.

Table 2. Summary of Study Characteristics of 21 Articles Included in the Analysis

Characteristics	n (%)
Study design	
Cross-Sectional	21 (100)
Country of origin	
China	14 (66.67)
Turkey	2 (9.52)
Poland	1 (4.76)
Canada	1 (4.76)
United States	1 (4.76)
Iran	2 (9.52)
Publication year	
2020	2 (9.52)
2021	19 (90.48)
Time of data collection	
The first 6 months of pandemic	19 (90.48)
After 6 months of pandemic	2 (9.52)
Methods of data collection	
Online questionnaire	16 (76.19)
Physical questionnaire	5 (23.81)
Anxiety measurement instruments	
GAD-7	8 (38.09)
SAS	8 (38.09)
HADS-A	1 (4.76)
PROMIS	1 (4.76)
PRAQ	1 (4.76)
DASS-A	2 (9.52)
Sample size	
< 500	5 (23.81)
501 – 1000	7 (33.33)
> 1000	9 (42.86)

Abbreviations: DASS-A, The Depression Anxiety and Stress Scale-Anxiety subscale; GAD-7, Generalized Anxiety Disorder-7; HADS-A, Hospital Anxiety and Depression Scale-Anxiety subscale; PRAQ, Pregnancy Related Anxiety Questionnaire; PROMIS, Patient Reported Outcomes Measurement System; SAS, Self-report Anxiety Scale

Narrative Synthesis

Sociodemographic factors

There were four modifiable sociodemographic factors associated with anxiety. The first was a residential area. Living in a pandemic epicentre location[15,16] or experiencing a lockdown in the place of residence[17] was associated with increased anxiety. The second was socioeconomic status. During the pandemic, the decline in income was associated with anxiety, with higher declines leading to higher anxiety.[18] Lower income (< 780 USD/ month or 7000 USD/ year) was associated with increased anxiety.[19,20]

On the other hand, higher income and a better economic level were protective factors for anxiety.[15,21] The third factor was education, but this study's findings indicate inconsistencies in the variables and outcomes of the effect of education on anxiety. The fourth factor related to anxiety was marital status. Unmarried/divorced/ widowed had a higher risk of anxiety.[18] Age was positively correlated with anxiety in some studies, but the results were inconsistent across studies.

Environmental Exposure Factors

The time spent watching television and cell phones, more than 3 hours per day, was associated with high anxiety in pregnant women. The longer the time spent, the higher the risk of anxiety,[20] especially when watching the news about COVID-19.[22] Increased use of social media was also associated with anxiety.[23] On the other hand, less than 2 hours of screen time was a protective factor even when accompanied by lack of sleep.[20] The presence of COVID-19 infection in close relatives was associated with anxiety.[17] The presence of suspected or confirmed cases around[22], family members who died from COVID-19,[15] and COVID-19 infection during pregnancy was associated with increased anxiety.[2,23]

Occupational Factor

Not working or losing a job during the pandemic was associated with increased anxiety in 4 studies[18,21,23,24] but not in one study.[25] Working as farmers[26] and civil servants[20] was a protective factor for anxiety.

Lifestyle Factor

Physical inactivity was associated with anxiety.[24] On the other hand, being physically active was a protective factor.[20,22,27] In particular, [22]

the interaction between lack of time for physical exercise (< 30 minutes per day) and sleep (< 7 hours per day), and spending more than one hour per day on social media increased the prevalence of anxiety in pregnant women. Sitting more than 10 hours per day and drinking alcohol were also associated with increased anxiety.[18]

Physiological Factors

Nine articles discussed pregnancy complications and comorbidities and their association with anxiety. The result was consistent. Pregnancy complications and comorbidities were associated with increased anxiety in pregnant women.[2,15–18,20,21,25,26,28,29] Planning for vaginal delivery is a protective factor for anxiety.[18]

Sleep time of more than 6 hours per day was a protective factor for anxiety. The longer sleep time, the lower the anxiety,[20] and the lower the sleep time (< 7 hours per day), the higher the anxiety.[30] Further, inconsistent time to sleep, sleep after 00:00, and difficulty initiating sleep was associated with anxiety.[30] Subjective poor sleep quality was also associated with anxiety.[30,31] Research[29] stated that obesity was protective against anxiety. However, this finding was not consistent with [15] research, which stated that obesity and overweight were risk factors for anxiety.

Psychological Factor

Three articles consistently stated that a previous history of anxiety and depression was associated with high anxiety in pregnant women during the pandemic.[23,32,33] Good knowledge of COVID-19[28,34] and its prevention,[15] the simplicity of mothers accessing antenatal information from hospitals,[28] and trust in official government media as sources of information were protective factors for anxiety.[2,34]

On the other hand, mothers who did not receive information about the impact of COVID-19 on pregnancy and mothers who did not receive information from doctors/nurses/midwives about the impact of COVID-19 on the baby's health experienced increased anxiety.[24]

Response to Trauma

The perception of COVID-19's severe impact on their lives [17,26,27,30] or their psychological well-being[30] was associated with increased anxiety. In addition, the perceived susceptibility was also associated with anxiety, both concern for oneself[22,34] and the baby.[31,35]

Mothers who felt uncomfortable during antenatal visits and mothers who did not delay/reduce the number of antenatal visits were associated with higher anxiety.[24,34] In addition, worrying about pandemic control and being afraid to leave the house were also associated with increased anxiety.[2] In contrast, self-efficacy was associated with lower anxiety.[26]

High levels of stress during the pandemic and its relationship with high anxiety levels in pregnant women were described in three articles.[16,31,32] Worrying about the baby, family, friends, and financial adequacy was also associated with higher anxiety levels.[15,26,27] Conversely, not worrying about contracting COVID-19 was associated with less anxiety in pregnant women.[34]

Relational Factor

Social restrictions due to the pandemic increased the anxiety level of pregnant women.[23,35] Family dysfunction, tension with partners, and lack of support from others during the pandemic were associated with increased anxiety.[16,18] On the other hand, high support from a spouse,[30,35] family,[22,33] and generally, was associated with lower anxiety levels.[17,21,35]

Quantitative Synthesis

Anxiety Prevalence

The range of anxiety prevalence was 10 to 65% (k=21), and the pooled prevalence of anxiety was 28% (95%CI; 23-33; N=42,177). There was a significant study heterogeneity (Q = 3150.66; P < .001 and I2 = 99.62%); hence, the most appropriate model used to analyze was a random-effect model. The meta-regression results showed that the country of origin variable significantly moderated the existing heterogeneity (P < .001). There were significant differences in anxiety prevalence between groups from China, Turkey, Iran, and others. The prevalence of anxiety was higher in Turkiye (63%, 95% CI, 60-66), followed by other countries (39%, 95% CI, 15-62), China (22%, 95% CI, 17-27), and finally Iran (20%, 95% CI, 17-23). The forest plot of prevalence is presented in Figure 1.

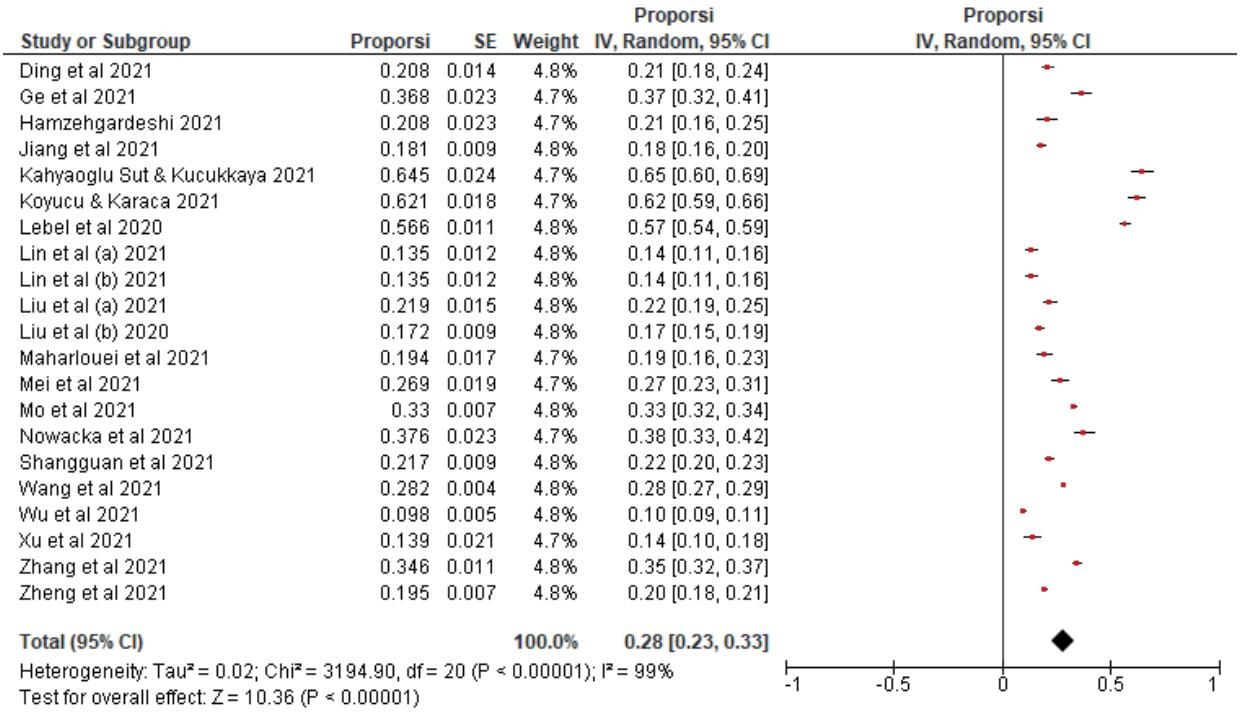

Figure 1. Forest Plot of Prevalence of the Anxiety

In this study, the pooled prevalence of anxiety in pregnant women during the pandemic from 21 studies was 28%. This result is higher than the systematic review of antenatal anxiety before the pandemic (1950 - 2016) [36], which is 22.9% (95% CI; 20.25-25.2; N = 142,833) but not much different from the prevalence of anxiety in the general population during the COVID-19 pandemic of 27.3% (95% CI: 23.7-31.2; N = 140.732)[37] and 31.9% (95%CI; 27.5-36.7; N = 63.439).[38]

However, the prevalence of anxiety in pregnant women in this study was lower than other systematic reviews during the pandemic [8] (37%, 95%CI; 25-49; N = 20.569). One of the possible causes was the origin of the study. In this study, most studies came from China (k = 14, 67%). Cross-cultural aspects influence this difference in anxiety levels. Contextual factors, how one perceives one's body, and dependence on others influence anxiety. Considering this condition, people in Asia generally have lower anxiety levels than other races in the world.[39] This finding is consistent with data from WHO which shows that the prevalence of anxiety in the Asian region is relatively low compared to other countries in the world.[40]

Factors Associated with Anxiety

Twelve studies contribute to 18 factors of anxiety in pregnant women during the pandemic. Of the 18 factors, only nine gave significant results (8 risk factors and one protective factor). They were marital status, monthly income, screen time, history of COVID-19 exposure, pregnancy complications, sleep duration, sleep quality, perceived susceptibility, and trust in the official government social media. Heterogeneity in each study varied, ranging from 0% to 93%. A summary of the combined effects can be seen in Table 3.

Table 3. Summary of 18 Articles Included in the Meta-Analysis of Risk and Protective Factors

Factors	No of studies (k)	Combined sample size	Pooled OR (95% CI)	*P-value*	I^2 (%)
High school education/ lower	6	9107	1.18 (0.82-1.69)	.37	89
Not married/ divorced/ widowed	2	4185	2,20 (1.59-3.04)	<.001	0
Age > 35 y.o	4	5717	1.11 (0.64-1.94)	.70	77
Monthly income < 5000 CNY (~780 USD)	2	2545	1.31 (1.09-1.57)	.004	0
Screen time > 3 hours/ day	2	2545	1.89 (1.43-2.51)	<.001	0
History of exposure to COVID-19	3	3137	1.96 (1.39-2.76)	<.001	0
Not working during pandemic	6	9260	1.20 (0.97-1.50)	.10	58
Work as civil servant	2	2160	1.67 (0.75-3.75)	.21	90
Daily physical exercise	2	4185	0.59 (0.23-1.53)	.28	93
3rd Trimester	9	10,960	1.14 (0.93-1.40)	.22	68
Multipara	7	9924	0.92 (0.74-1.14)	.45	73
Complications and Comorbidities	8	11,394	1.77 (1.39-2.24)	<.001	66
Sleep duration <7 hours/ day	2	2545	1.51 (1.12-2.02)	.007	27
Subjective poor sleep quality	2	1025	7.35 (2.11-25.57)	.002	87
Prepregnancy Overweight/ obesity	2	3509	1.71 (0.59-5.01)	.33	93
Official media trust	2	2764	0.65 (0.52-0.81)	<.001	0
High risk of susceptibility	3	1842	3.91 (2.37-6.45)	<.001	0
Live in the city	2	2081	0.89 (0.40-1.99)	.78	84

Abbreviations: CNY, Chinese Yuan; OR, Odds Ratio; USD, United States Dollar.

The risk of cross-study bias was assessed using an Egger and Begg regression test and the Fail-Safe N value. The p-value in the regression test is .14, which means that there was no bias in the publication of the meta-analysis study. The Fail Safe-N score in this study was 92,340 with P < .001. Because the value of 5k+10 (115) is less than the Fail Safe-N value, it can be concluded that there was no publication bias problem in this study.

DISCUSSION

In this study, the pooled prevalence of anxiety in pregnant women during the pandemic from 21 studies was 28%. This result is higher than the systematic review of antenatal anxiety before the pandemic (1950 - 2016)[36], which is 22.9% (95% CI; 20.25-25.2; N = 142.833) but not much different from the prevalence of anxiety in the general population during the COVID-19 pandemic of 27.3% (95% CI: 23.7-31.2; N = 140,732) [37] and 31.9% (95%CI; 27.5-36.7; N = 63,439) [38].

However, the prevalence of anxiety in pregnant women in this study was lower than other systematic reviews during the pandemic.[8], (37%, 95%CI; 25-49; N = 20,569). One of the possible causes was the origin of the study. In this study, most studies came from China (k = 14, 67%). The results of the sub-group analysis showed that in the group of studies from China, the prevalence of anxiety tended to be lower (22%), while in the study by Yan et al., only four studies were from China. Another nine studies were from Canada, Italy, and other countries. Consistently, the results of studies [8], also show that the prevalence of anxiety in China is lower (33%) than in other countries (Canada 37%, Italy 49%). Cross-cultural aspects influence this difference in anxiety levels. Contextual factors, how one perceives one's body, and dependence on others influence anxiety. Considering this condition, people in Asia generally have lower anxiety levels than other races in the world [39]. This finding is consistent with data from WHO, which shows that the prevalence of anxiety in the Asian region is relatively low compared to other countries in the world [40].

Based on the results of the narrative synthesis, sociodemographic factors that are consistently associated with increased anxiety are living near the pandemic's epicentre, experiencing lockdown, low income, poor economic level, and unmarried/divorced/widow status. However, only marital status and low-income factors are supported by data from the meta-analysis. This can happen because not all studies use the same variables to assess anxiety risk factors, and not all studies provide sociodemographic data.

From the narrative and quantitative synthesis results, the protective factor for pregnant women's anxiety is public trust in the official government media. It was explained before that obtaining too much information from various media during the

pandemic led to increased anxiety.[22,23,41] However, if the duration can be controlled and social media is used to get information about COVID-19 from the government and hospitals, it could reduce anxiety.[2,28,34] Public trust in the national media has a protective effect on anxiety.[42] On the other hand, the perception of COVID-19 politicization and the number of confusing news sources related to COVID-19 are related to anxiety.[43] Hence, it is hoped that public health messages announced by the government must also provide solutions with one consistent message and from one source to increase trust.

Strengths and Limitations of the Study

This study involved quite a lot of articles (k=21). However, there is high heterogeneity between studies. In addition, the definition of a variable as a risk factor is also inconsistent between studies. These differences make it challenging to compare age, education level, parity, and trimester from one study to another.

Another limitation of this study is the use of various measuring instruments and differences in the cut-off value of anxiety even with the same measuring instrument. Almost all studies use a self-report questionnaire that can increase the possibility of bias in answering and is not a standard in determining the diagnosis of anxiety. However, this method is still acceptable for use as an initial screening. Another limitation of this study lies in the design of the articles included in the study. All studies used a cross-sectional design, so we can not conclude the causal relationship.

Most studies use online questionnaires with potential selection bias that limits the possibility of subjects with no internet connection being involved in the study. As a result, we must not generalize the findings without caution.[44,45] However, several authors have described the methods used to reduce bias in using this online questionnaire, including telephone contact for willingness to fill out a questionnaire and the use of previously validated questionnaires. However, given that in the context of a pandemic and physical contact restrictions, online questionnaires are the best option to collect data without the risk of contracting the disease.

The strength of this study lies in the size of the combined sample and the comprehensive discussion of anxiety during pregnancy exclusively, which, to the best of our knowledge, is the first systematic review to address anxiety and specific risk factors during pregnancy with a meta-analysis. In addition, the exclusion of low-quality articles also minimizes the possibility of bias towards the study results.

CONCLUSIONS

Our findings from this research can emphasize that pregnant women's services at Public Health Centers, Hospitals, Clinics, Private Practice Midwives, and other service places must consider the anxiety factor. This research can also serve as a guideline to identify pregnant women at risk of experiencing anxiety, which is essential during this pandemic, given the high level of anxiety and the magnitude of the impact. Screening for anxiety is recommended when the mother has an antenatal visit as it was shown a good result in a previous study.46 This study's limited source of articles with only a cross-sectional design indicates the need for a better design, such as a cohort or case-control, to better assess anxiety and conclude causality. Future research designs should also pay attention to and minimize bias when forced to use online questionnaires.

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Literature Review

Anxiety in Pregnant Women during the Covid-19 Pandemic

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Abstract
Objective : This study systematically reviewed and meta-analysis the prevalence and factors associated with anxiety in pregnant women during the pandemic.
Methods : We searched PubMed MEDLINE, Web of Science, Scopus, ProQuest, EBSCO, Science Direct, and Garuda journal databases in July 2021 and updated them in October 2021. All English and Bahasa journal articles from December 2019 were included in the search. We included studies that investigate factors affecting anxiety exclusively in pregnant women. The primary outcome was the prevalence ratio. The secondary outcome was the risk and protective factors as the independent variable. Joanna Briggs Institute Critical Appraisal Tools and RevMan 5.4 were used to do the analysis.
Results: After screening 2082 articles, we included 21 studies with 42.177 pregnant women. The pooled prevalence of anxiety was estimated at 28% (95% CI, 23-33.3). We found that 12 of the 21 studies contributed to 8 risks and 1 protective factor significantly in the meta-analysis. Not married/divorced/widowed, monthly income < 780 USD, screen time > 3 hours/day, history of exposure to COVID-19, complications in the current pregnancy, sleep less than 7 hours per day, subjective poor sleep quality, and high perception of vulnerability were risk factors. Meanwhile, the protective factor was trust in the government's official media.
Conclusion : There is a significant increase in the prevalence of maternal anxiety during the pandemic. Mental health screening during the antenatal visit must be carried out, and interventions to lower the anxiety level must be planned to prevent further harm.
Keywords:, anxiety, COVID-19, mental health, pandemics, pregnancy

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INTRODUCTION

The COVID-19 pandemic causes psychological distress and fear in some individuals due to periods of isolation, quarantine, and hospitalization[1]. As one of the vulnerable populations, pregnant women experience increased anxiety, which has been reported in various countries[2–4]. Anxiety is a normal response to threats and is an attempt to save oneself[5]. However, there will be interference if the response is excessive.

In pregnant women, anxiety is associated with an increased risk of obstetrics problems, cesarean delivery, increased chances of preterm birth, small for gestational age, and smaller infant head circumference[6], including premature rupture of the membrane[7]. If not prevented, anxiety during pregnancy could lead to more extensive harm. Therefore, knowing the risk and protective factors for anxiety during pregnancy is essential, especially during a pandemic.

Several systematic literature reviews discussed the psychological impact of COVID-19 on pregnant and postpartum women during the pandemic[8,9]. However, none specifically discusses the prevalence of anxiety during pregnancy and its determinants using a systematic review accompanied by a meta-analysis method. Therefore, this study aims to conduct a systematic review of risk and protective factors, estimate the pooled effect size of risk and protective factors, and estimate the pooled prevalence of anxiety in pregnant women during the COVID-19 pandemic.

METHODS

The organization of this manuscript followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines[10], and the research protocol was registered in PROSPERO CRD42021270107. The literature search was carried out in July – August 2021 and updated in October 2021. We used PUBMED Medline, Web of Science, Scopus, Science Direct, ProQuest, EBSCOhost, and the Garuda journal database to conduct our search.

The search was carried out systematically on titles and abstracts using the thesaurus and MeSH. Combination of keywords: pregnant*, antenatal, prenatal, perinatal, maternal, gravid, prepartum, peripartum, antepartum, expectant mother, anxi*, worry, mental health, stress, distress, COVID, Coronavirus, Wuhan virus, Wuhan Pneumonia, SARS-CoV-2, 2019-nCOV, pandemic both in English and Bahasa were used. All English and Bahasa journal articles in December 2019 to July 2021 were included in the search.

The Population, Intervention/Exposure, Comparison, Outcome, and Study design frameworks were used to clarify the inclusion and exclusion criteria (see Table 1).

Table 1. PICOS Design Frameworks

	Inclusion	Exclusion
Population	Studies on pregnant women only or pregnant and postpartum women	Studies that did not dissociate pregnant and postpartum women in the analysis.
Intervention/ Exsposure	COVID-19 pandemic	
Comparator	-	
Outcome	Primary: prevalence of anxiety among pregnant women. Second: risk and protective factors as the independent variable and anxiety as the dependent variable with Odds Ratio/ Prevalence Odds Ratio, p <0.05, and 95% CI.	Studies only mention descriptive analysis for the outcome and studies that combine anxiety and other mental health problems as the dependent variable.
Study Design	Cross-sectional, case-control. cohort	Reviews, editorials, letters, opinions, purely qualitative studies, conferences, and proceedings.

The articles obtained from the initial search were then imported into Rayyan[11], checked for duplication and screened. Preliminary screening through titles and abstracts was carried out independently by CPP. After selecting the title and abstract, the full text of potential articles was screened based on the data extraction compared to inclusion and exclusion criteria. Articles that did not meet the requirements were removed with a description of the reason. In case of doubt, CPP consulted with other reviewers (BAT, MS). Articles that did not provide access to the full text were excluded.

According to the study design, articles passed the title, abstract, and full-text screening process then assessed for quality using the Joanna Briggs Institute (JBI) Critical Appraisal Tools[12] and scored. To prevent bias due to study quality, articles that did not meet the minimum cut-off value of included studies (50%) were excluded.

Data extraction process is carried out by CPP independently. Studies containing statistical data were synthesized quantitatively during the meta-analysis. The combined prevalence was calculated using the proportion formula for pregnant women with anxiety disorders based on the cut-off score of the anxiety measurement instrument provided in the article. Because one article can contain more than one risk factor, each risk factor was analyzed separately. Articles that did not report odds ratio but had 2x2 table data were included in the meta-analysis.

Revman 5.4 software was used to analyze the data. The heterogeneity assessment was carried out using the I^2 test ($I^2 > 50\%$) and the Q test.[13] The random-effects model was used in heterogeneous study conditions, and otherwise, the fix-effects model was used. The prevalence and 95% confidence intervals for each study were presented in forest plot.

Jamovi 2.0 software was used to assess publication bias by the Egger and Begg test and Fail Safe-N test result.[14] The significance of publication bias was obtained when the $P < .05$.

RESULT AND DISCUSSION

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In the initial search, 2802 articles were obtained from 7 journal databases, leaving 21 articles to synthesize narrative and quantitatively after screening. All 21 articles had a cross-sectional design, with China being the most studied country (66.67%). The two most widely used measuring instruments were GAD-7 (Generalized Anxiety Disorder-7) and SAS (Zung Self-rating Anxiety Scale), with 38.09% each. There were nine articles with a sample size of >1000 pregnant women. Based on the JBI assessment, two studies scored 100%, and five studies were 62.5%. The summary of the study characteristics is provided in table 2.

Table 2. Summary of Study Characteristics of 21 Articles Included in the Analysis

Characteristics	n (%)
Study design	
Cross-Sectional	21 (100)
Country of origin	
China	14 (66.67)
Turkey	2 (9.52)
Poland	1 (4.76)
Canada	1 (4.76)
United States	1 (4.76)
Iran	2 (9.52)
Publication year	
2020	2 (9.52)
2021	19 (90.48)
Time of data collection	
The first 6 months of pandemic	19 (90.48)
After 6 months of pandemic	2 (9.52)
Methods of data collection	
Online questionnaire	16 (76.19)
Physical questionnaire	5 (23.81)
Anxiety measurement instruments	
GAD-7	8 (38.09)
SAS	8 (38.09)
HADS-A	1 (4.76)
PROMIS	1 (4.76)
PRAQ	1 (4.76)
DASS-A	2 (9.52)
Sample size	
< 500	5 (23.81)
501 – 1000	7 (33.33)
> 1000	9 (42.86)

Abbreviations: DASS-A, The Depression Anxiety and Stress Scale-Anxiety subscale; GAD-7, Generalized Anxiety Disorder-7; HADS-A, Hospital Anxiety and Depression Scale-Anxiety subscale; PRAQ, Pregnancy Related Anxiety Questionnaire; PROMIS, Patient Reported Outcomes Measurement System; SAS, Self-report Anxiety Scale

Narrative Synthesis

There were four modifiable sociodemographic factors associated with anxiety. The first was a residential area. Living in a pandemic epicenter location[15,16] or experiencing a lockdown in the place of residence[17] was associated with increased anxiety. The second was socioeconomic status. During the pandemic, the decline in income was associated with anxiety, with higher declines leading to higher anxiety.[18] Lower income (< 780 USD/ month or 7000 USD/ year) was associated with increased anxiety.[19,20]

On the other hand, higher income and a better economic level were protective factors for anxiety.[15,21] The third factor was education, but this study's findings indicate inconsistencies in the variables and outcomes of the effect of education on anxiety. The fourth factor related to anxiety was marital status. Unmarried/divorced/widowed had a higher risk of anxiety.[18] Age was positively correlated with anxiety in some studies, but the results were inconsistent across studies.

Environmental Exposure Factors

The time spent watching television and cell phones, more than 3 hours per day, was associated with high anxiety in pregnant women. The longer the time spent, the higher the risk of anxiety,[20] especially when watching the news about COVID-19.[22] Increased use of social media was also associated with anxiety.[23] On the other hand, less than 2 hours of screen time was a protective factor even when accompanied by lack of sleep.[20] The presence of COVID-19 infection in close relatives was associated with anxiety.[17] The presence of suspected or confirmed cases around[22], family members died from COVID-19,[15] and COVID-19 infection during pregnancy was associated with increased anxiety.[3,23]

Occupational Factor

Not working or losing a job during the pandemic was associated with increased anxiety in 4 studies[18,21,23,24] but not in one study.[25] Working as farmers[26] and civil servants[20] was a protective factor for anxiety.

Lifestyle Factor

Physical inactivity was associated with anxiety.[24] On the other hand, being physically active was a protective factor.[20,22,27] In particular,[22] stated that the interaction between lack of time for physical exercise (< 30 minutes per day) and sleep (< 7 hours per day), and spending more than one hour per day on social media increased the prevalence of anxiety in pregnant women. Sitting more than 10 hours per day and drinking alcohol were also associated with increased anxiety.[18]

Physiological Factors

Nine articles discussed pregnancy complications and comorbidities and their association with anxiety. The result was consistent. Pregnancy complications and comorbidities were associated with increased anxiety in pregnant women.[3,15–18,20,21,25,26,28,29] Planning for vaginal delivery is a protective factor for anxiety.[18]

Sleep time more than 6 hours per day was a protective factor for anxiety. The longer sleep time, the lower the anxiety,[20] and the lower the sleep time (< 7 hours per day), the higher the anxiety.[30] Further, inconsistent time to sleep, sleep after 00:00, and difficulty initiating sleep was associated with anxiety.[30] Subjective poor sleep quality was also associated with anxiety.[30,31] Research[29] stated that obesity was protective against anxiety. However, this finding was not consistent [15] research, which stated that obesity and overweight were risk factors for anxiety.

Psychological Factor

Three articles consistently stated that a previous history of anxiety and depression was associated with high anxiety in pregnant women during the pandemic.[23,32,33] Good knowledge of COVID-19[28,34] and its prevention,[15] the simplicity of mothers accessing antenatal information from hospitals,[28] and trust in official government media as sources of information were protective factors for anxiety.[3,34]

On the other hand, mothers who did not receive information about the impact of COVID-19 on pregnancy and mothers who did not receive information from doctors/nurses/midwives about the impact of COVID-19 on the baby's health experienced increased anxiety.[24]

Response to Trauma

The perception of COVID-19's severe impact on their lives [17,26,27,30] or their psychological well-being[30] was associated with increased anxiety. In addition, the perceived susceptibility was also associated with anxiety, both concern for oneself[22,34] and the baby.[31,35]

Mothers who felt uncomfortable during antenatal visits and mothers who did not delay/reduce the number of antenatal visits were associated with higher anxiety.[24,34] In addition, worrying about pandemic control and being afraid to leave the house were also associated with increased anxiety.[3] In contrast, self-efficacy was associated with lower anxiety.[26]

High levels of stress during the pandemic and its relationship with high anxiety levels in pregnant women were described in three articles.[16,31,32] Worrying about the baby, family, friends, and financial adequacy was also associated with higher anxiety levels.[15,26,27] Conversely, not worrying about contracting COVID-19 was associated with less anxiety in pregnant women.[34]

Relational Factor

Social restriction due to the pandemic increased the anxiety level of pregnant women.[23,35] Family dysfunction, tension with partners, and lack of support from others during the pandemic were associated with increased anxiety.[16,18] On the other hand, high support from a spouse,[30,35] family,[22,33] and generally, was associated with lower anxiety levels.[17,21,35]

Quantitative Synthesis

Anxiety Prevalence

The range of anxiety prevalence was 10 to 65% (k=21), and the pooled prevalence of anxiety was 28% (95%CI; 23-33; N=42,177). There was a significant study heterogeneity (Q = 3150.66; P < .001 and I^2 = 99.62%); hence the most appropriate model used to analyze was a random-effect model. The meta-regression results showed that the country of origin variable significantly moderated the existing heterogeneity (P < .001). There were significant differences in anxiety prevalence between groups of China, Turkey, Iran, and others. The prevalence of anxiety was higher in Turkey (63%, 95% CI, 60-66), followed by other countries (39%, 95% CI, 15-62), China (22%, 95% CI, 17-27), and finally Iran (20%, 95% CI, 17-23). The forest plot of prevalence was presented in figure 1.

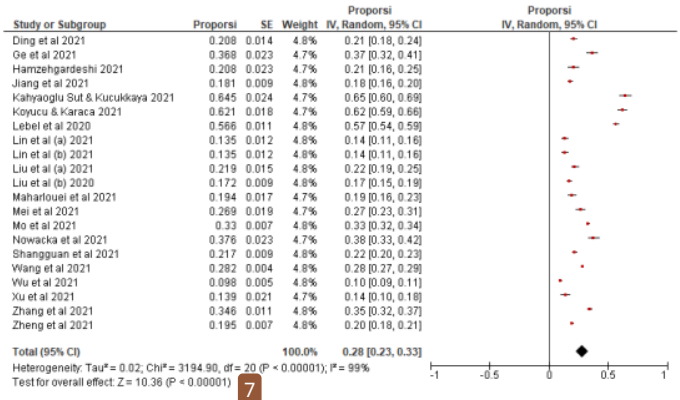

Figure 1. Forest Plot of Prevalence of the Anxiety

In this study, the pooled prevalence for anxiety in pregnant women during the pandemic from 21 studies was 28%. This result is higher than the systematic review of antenatal anxiety before the pandemic (1950 - 2016) proposed[36], which is 22.9% (95% CI; 20.25-25.2; N = 142,833) but not much different from the prevalence of anxiety in the general population during the COVID-19 pandemic of 27.3% (95% CI: 23.7-31.2; N = 140,732)[37] and 31.9% (95%CI; 26.6-36.7; N = 63.439).[38]

However, the prevalence of anxiety in pregnant women in this study was lower than other systematic reviews during the pandemic.,[8] (37%, 95%CI; 25-49; N = 20,569). One of the possible causes was the origin of the study. In this study, most studies came from China (k = 14. 67%). Cross-cultural aspects influence this difference in anxiety levels. Contextual factors, how one perceives one's body, and dependence on others influence anxiety.

Considering this condition, people in Asia generally have lower anxiety levels than other races in the world.[39] This finding is consistent with data from WHO which shows that the prevalence of anxiety in the Asian region is relatively low compared to other countries in the world.[40]

Factors Associated with Anxiety

Twelve studies contribute to 18 factors of anxiety in pregnant women during the pandemic. Of the 18 factors, only nine gave significant results (8 risk factors and one protective factor). They were marital status, monthly income, screen time, history of COVID-19 exposure, pregnancy complications, sleep duration, sleep quality, perceived susceptibility, and trust in the official government social media. Heterogeneity in each study varied, ranging from 0% to 93%. A summary of the combined effects can be seen in table 3.

Table 3. Summary of 18 Articles Included in the Meta-Analysis of Risk and Protective Factors

Factors	No of studies (k)	Combined sample size	*Pooled* OR (95% CI)	*P- Value*	I^2 (%)
High school education/ lower	6	9107	1.18 (0.82-1.69)	.37	89
Not married/ divorced/ widowed	2	4185	2,20 (1.59-3.04)	<.001	0
Age ≥ 35 y.o	4	5717	1.11 (0.64-1.94)	.70	77
Monthly income < 5000 CNY (~780 USD)	2	2545	1.31 (1.09-1.57)	.004	0
Screen time ≥ 3 hours/ day	2	2545	1.89 (1.43-2.51)	<.001	0
History of exposure to COVID-19	3	3137	1.96 (1.39-2.76)	<.001	0
Not working during pandemic	6	9260	1.20 (0.97-1.50)	.10	58
Work as civil servant	2	2160	1.67 (0.75-3.75)	.21	90
Daily physical exercise	2	4185	0.59 (0.23-1.53)	.28	93
3rd Trimester	9	10,960	1.14 (0.93-1.40)	.22	68
Multipara	7	9924	0.92 (0.74-1.14)	.45	73
Complications and Comorbidities	8	11,394	1.77 (1.39-2.24)	<.001	66
Sleep duration <7 hours/ day	2	2545	1.51 (1.12-2.02)	.007	27
Subjective poor sleep quality	2	1025	7.35 (2.11-25.57)	.002	87
Prepregnancy *Overweight*/ obesity	2	3509	1.71 (0.59-5.01)	.33	93
Official media trust	2	2764	0.65 (0.52-0.81)	<.001	0
High risk of susceptibility	3	1842	3.91 (2.37-6.45)	<.001	0
Live in the city	2	2081	0.89 (0.40-1.99)	.78	84

Abbreviations: CNY, Chinese Yuan; OR, Odds Ratio; USD, United States Dollar.

The risk of cross-study bias was assessed using an Egger and Begg regression test and the Fail-Safe N value. The p-value in the regression test is *.14*, which means that there was no bias in the publication of the meta-analysis study. The Fail Safe-N score in this study was 92.340 with $P < .001$. Because the value of 5k+10 (115) is less than the Fail Safe-N value, it can be concluded that there was no publication bias problem in this study.

Risk Factors

Based on the results of the narrative synthesis, sociodemographic factors that are consistently associated with increased anxiety are living near the pandemic's epicenter, experiencing lockdown, low income, poor economic level, and unmarried/divorced/widow status. However, only marital status and low-income factors are supported by data from the meta-analysis. This can happen because not all studies use the same variables to assess anxiety risk factors, and not all studies provide sociodemographic data.

Protective Factors

Based on the narrative and quantitative synthesis results, the protective factor for pregnant women's anxiety is public trust in the official government media. It was explained before that obtaining too much information from various media during the pandemic led to increased anxiety.[22,23,41] However, if the duration can be controlled and social media was used to get information about COVID-19 from the government and hospitals, it could reduce anxiety.[3,28,34] Public trust in the national media has a protective effect on anxiety.[42] On the other hand, the perception of COVID-19 politicization and the number of confusing news sources related to COVID-19 are related to anxiety.[43] Hence, it is hoped that public health messages announced by the government must also provide solutions with one consistent message and from one source to increase trust.

Strengths and Limitations of the Study

This study involved quite a lot of articles (k=21). However, there is high heterogeneity between studies. In addition, the definition of a variable as a risk factor is also inconsistent between studies. These differences make it challenging to compare age, education level, parity, and trimester from one study to another.

Another limitation of this study is the use of various measuring instruments and differences in the cut-off value of anxiety even with the same measuring instrument. Almost all studies use a self-report questionnaire that can increase the possibility of bias in answering and is not a standard in determining the diagnosis of anxiety. However, this method is still acceptable for use as an initial screening. Another limitation of this study lies in the design of the articles of included studies. All studies used a cross-sectional design, so we can not conclude the causal relationship.

Most studies use online questionnaires with potential selection bias that limit the possibility of subjects with no internet connection being involved in the study. As a result, we must not generalize the finding without cautions.[44,45] However, several authors have described the methods used to reduce bias in using this online questionnaire, including telephone contact for willingness to fill out a questionnaire and the use of previously validated questionnaires. However, given that in the context of a pandemic and physical contact restrictions, online questionnaires are the best option to collect data without the risk of contracting the disease.

The strength of this study lies in the size of the combined sample and the comprehensive discussion of anxiety during pregnancy exclusively in which, to the best of our knowledge, is the first systematic review to address anxiety and specific risk factors during pregnancy with a meta-analysis. In addition, the exclusion of low-quality articles also minimizes the possibility of bias towards the study results.

CONCLUSIONS

Our findings from this research can emphasize that pregnant women's services at Public Health Centers, Hospitals, Clinics, Private Practice Midwives, and other service places must consider the anxiety factor. This research can also serve as a guideline to identify pregnant women at risk of experiencing anxiety, which is essential during this pandemic given the high level of anxiety and the magnitude of the impact. Screening for anxiety is recommended when the mother has an antenatal visit as it was shown a good result in previous study.[46] This study's limited source of articles with only a cross-sectional design indicates the need for a better design, such as a cohort or case-control, to better assess anxiety and conclude causality. Future research designs should also pay attention to and minimize bias when forced to use online questionnaires.

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Comments for the Editor

Participants Edit

Budi I santoso (budi_iman)

Cyntia Puspa Pitaloka (cyntiapitaloka)

Messages

Note	From
Dear Junita Indarti, Dr. dr., SpOG, Subsp. Obginsos(K) Editor in Chief We wish to submit our manuscript entitled "Anxiety in Pregnant Women During the Covid-19 Pandemic: A Systematic Review with Meta-Analysis", authorized by Cyntia Puspa Pitaloka, Muji Sulistyowati, and Brahmana Askandar Tjokroprawiro. We believe that it will interest readers of the Journal of Midwifery and Women's Health. We confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere. In this paper, we systematically reviewed and conducted a meta-analysis of prevalence and factors associated with anxiety among pregnant women exclusively. We believe this is the first one in this subject area. We found an increased anxiety level among pregnant women. Nine factors contribute significantly to anxiety and need to be put into deep consideration. We believe that this manuscript is suitable for publication in the Indonesia Journal of Obstetrics and Gynecology. It adds to the body of knowledge relating to the determinants factor of mental health problems in pregnant women. It provides a recommendation about what we can do to improve our pregnant women's health globally. We have no conflict of interest to disclose. Please address all correspondence concerning this manuscript to cyntia.pitaloka@petra.ac.id. We thank you for your consideration of this manuscript. Sincerely, Cyntia Puspa Pitaloka, dr. M.Kes. (Universitas Kristen Petra)	cyntiapitaloka 2023-07-13 03:27 AM

Add Message

Anxiety in Pregnant Women During the Covid-19 Pandemic: A Systematic Review with Meta-Analysis

Kecemasan pada Ibu Hamil selama Pandemi COVID-19: Systemetic Review dengan Meta-Analysis

Abstract

Objective : This study systematically reviewed and meta-analysis the prevalence and factors associated with anxiety in pregnant women during the pandemic.

Methods : We searched PubMed MEDLINE, Web of Science, Scopus, ProQuest, EBSCO, Science Direct, and Garuda journal databases in July 2021 and updated them in October 2021. All English and Bahasa journal articles from December 2019 were included in the search. We included studies that investigate factors affecting anxiety exclusively in pregnant women. The primary outcome was the prevalence ratio. The secondary outcome was the risk and protective factors as the independent variable. Joanna Briggs Institute Critical Appraisal Tools and RevMan 5.4 were used to do the analysis.

Results: After screening 2082 articles, we included 21 studies with 42.177 pregnant women. The pooled prevalence of anxiety was estimated at 28% (95% CI, 23-33.3). We found that 12 of the 21 studies contributed to 8 risks and 1 protective factor significantly in the meta-analysis. Not married/divorced/widowed, monthly income < 780 USD, screen time > 3 hours/day, history of exposure to COVID-19, complications in the current pregnancy, sleep less than 7 hours per day, subjective poor sleep quality, and high perception of vulnerability were risk factors. Meanwhile, the protective factor was trust in the government's official media.

Conclusion : There is a significant increase in the prevalence of maternal anxiety during the pandemic. Mental health screening during the antenatal visit must be carried out, and interventions to lower the anxiety level must be planned to prevent further harm.

Keywords: pregnancy, anxiety, mental health, COVID-19, pandemics

Abstrak

Tujuan: Penelitian ini meninjau secara sistematis dan meta-analisis prevalensi dan faktor yang berhubungan dengan kecemasan pada ibu hamil selama pandemi.

Metode: Pencarian dilakukan pada *database* jurnal PubMed MEDLINE, Web of Science, Scopus, ProQuest, EBSCO, Science Direct, dan Garuda pada Juli 2021 dan memperbaruinya pada Oktober 2021. Semua artikel jurnal berbahasa Inggris dan Indonesia dari Desember 2019 dimasukkan dalam pencarian. Kami menyertakan penelitian yang menyelidiki faktor-faktor yang mempengaruhi kecemasan secara eksklusif pada wanita hamil. Hasil utama adalah prevalensi. Hasil sekunder adalah faktor risiko dan protektif sebagai variabel independen. Joanna Briggs Institute (JBI) *critical appraisal guideline* digunakan untuk menilai kualitas penelitian yang disertakan. RevMan 5.4 dan Jamovi 2.0 digunakan untuk melakukan analisis kuantitatif

Hasil : Setelah menyaring 2082 artikel, kami menyertakan 21 penelitian dengan 42.177 wanita hamil. Prevalensi kecemasan yang terkumpul diperkirakan sebesar 28% (95% CI, 23-33,3). Kami menemukan bahwa 12 dari 21 studi berkontribusi terhadap 8 risiko dan 1 faktor pelindung secara signifikan dalam meta-analisis. Faktor risiko yaitu kondisi tidak menikah/bercerai/janda, pendapatan bulanan < 780 USD, waktu layar > 3 jam/hari, riwayat paparan COVID-19, komplikasi pada kehamilan saat ini, tidur kurang dari 7 jam per hari, kualitas tidur subyektif buruk, dan tingginya persepsi kerentanan. Sedangkan faktor protektif adalah kepercayaan terhadap media resmi pemerintah.

Kesimpulan : Terdapat peningkatan prevalensi kecemasan ibu yang signifikan selama pandemi. Skrining kesehatan mental selama kunjungan antenatal harus dilakukan, dan intervensi untuk menurunkan tingkat kecemasan harus direncanakan untuk mencegah bahaya lebih lanjut.

Kata kunci: kehamilan, kecemasan, kesehatan mental, COVID-19, pandemi

INTRODUCTION

The COVID-19 pandemic causes psychological distress and fear in some individuals due to periods of isolation, quarantine, and hospitalization[1]. As one of the vulnerable populations, pregnant women experience increased anxiety, which has been reported in various countries[2–4]. Anxiety is a normal response to threats and is an attempt to save oneself[5]. However, there will be interference if the response is excessive.

In pregnant women, anxiety is associated with an increased risk of obstetrics problems, cesarean delivery, increased chances of preterm birth, small for gestational age, and smaller infant head circumference[6]. If not prevented, anxiety during pregnancy could lead to more extensive harm. Therefore, knowing the risk and protective factors for anxiety during pregnancy is essential, especially during a pandemic.

Several systematic literature reviews discussed the psychological impact of COVID-19 on pregnant and postpartum women during the pandemic[7–9]. However, none specifically discusses the prevalence of anxiety during pregnancy and its determinants using a systematic review accompanied by a meta-analysis method. Therefore, this study aims to conduct a systematic review of risk and protective factors, estimate the pooled effect size of risk and protective factors, and estimate the pooled prevalence of anxiety in pregnant women during the COVID-19 pandemic.

METHODS

Sources

The organization of this manuscript followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines[10], and the research protocol was registered in PROSPERO CRD42021270107. The literature search was carried out in July – August 2021 and updated in October 2021. We used PUBMED Medline, Web of Science, Scopus, Science Direct, ProQuest, EBSCOhost, and the Garuda journal database to conduct our search.

The search was carried out systematically on titles and abstracts using the thesaurus and MeSH. Combination of keywords: *pregnan*, antenatal, prenatal, perinatal, maternal, gravid, prepartum, peripartum, antepartum, expectant mother, anxi*, worry, mental health, stress, distress, COVID, Coronavirus, Wuhan virus, Wuhan Pneumonia, SARS-CoV-2, 2019-nCOV, and pandemic* both in English and Bahasa were used. All English and Bahasa journal articles from December 2019 to July 2021 were included in the search.

Study Selection

The Population, Intervention/Exposure, Comparison, Outcome, and Study design frameworks were used to clarify the inclusion and exclusion criteria (see Table 1).

Table 1. PICOS Design Frameworks

	Inclusion	Exclusion
Population	Studies on pregnant women only or pregnant and postpartum women	Studies that did not dissociate pregnant and postpartum women in the analysis.
Intervention/ Exsposure	COVID-19 pandemic	-
Comparator	-	-
Outcome	The primary outcome was the prevalence of anxiety among pregnant women. The secondary outcome was the risk and protective factors as the independent variable and anxiety as the dependent variable with Odds Ratio/ Prevalence Odds Ratio, p <0.05, and 95% CI.	Studies only mention descriptive analysis for the outcome and studies that combine anxiety and other mental health problems as the dependent variable.
Study Design	Cross-sectional, case-control. cohort	Reviews, editorials, letters, opinions, purely

	qualitative studies, conferences, and proceedings.

Study Design

The articles obtained from the initial search were then imported into Rayyan[11], checked for duplication and screened. Preliminary screening through titles and abstracts was carried out independently by CPP. After selecting the title and abstract, the full text of potential articles was screened based on the data extraction compared to inclusion and exclusion criteria. Articles that did not meet the requirements were removed with a description of the reason. In case of doubt, CPP consulted with other reviewers (BAT, MS). Articles that did not provide access to the full text were excluded.

According to the study design, articles passed the title, abstract, and full-text screening process then assessed for quality using the Joanna Briggs Institute (JBI) Critical Appraisal Tools[12] and scored. To prevent bias due to study quality, articles that did not meet the minimum cut-off value of included studies (50%) were excluded.

Data extraction process is carried out by CPP independently. Studies containing statistical data were synthesized quantitatively during the meta-analysis. The combined prevalence was calculated using the proportion formula for pregnant women with anxiety disorders based on the cut-off score of the anxiety measurement instrument provided in the article. Because one article can contain more than one risk factor, each risk factor was analyzed separately. Articles that did not report odds ratio but had 2x2 table data were included in the meta-analysis.

Revman 5.4 software was used to analyze the data. The heterogeneity assessment was carried out using the I^2 test ($I^2 > 50\%$) and the Q test.[13] The random-effects model was used in heterogeneous study conditions, and otherwise, the fix-effects model was used. The prevalence and 95% confidence intervals for each study were presented in forest plot. Jamovi 2.0 software was used to assess publication bias by the Egger and Begg test and Fail Safe-N test result.[14] The significance of publication bias was obtained when the $P < .05$.

RESULT AND DISCUSSION

In the initial search, 2802 articles were obtained from 7 journal databases, leaving 21 articles to synthesize narrative and quantitatively after screening. All 21 articles had a cross-sectional design, with China being the most studied country (66.67%). The two most widely used measuring instruments were GAD-7 (Generalized Anxiety Disorder-7) and SAS (Zung Self-rating Anxiety Scale), with 38.09% each. There were nine articles with a sample size of >1000 pregnant women. Based on the JBI assessment, two studies were scored 100%, and five studies were 62.5%. The summary of the study characteristics is provided in table 2.

Table 2. Summary of Study Characteristics of 21 Articles Included in the Analysis

Characteristics	n (%)
Study design	
Cross-Sectional	21 (100)
Country of origin	
China	14 (66.67)
Turkey	2 (9.52)
Poland	1 (4.76)
Canada	1 (4.76)
United States	1 (4.76)
Iran	2 (9.52)
Publication year	
2020	2 (9.52)
2021	19 (90.48)
Time of data collection	
The first 6 months of pandemic	19 (90.48)

After 6 months of pandemic	2 (9.52)
Methods of data collection	
Online questionnaire	16 (76.19)
Physical questionnaire	5 (23.81)
Anxiety measurement instruments	
GAD-7	8 (38.09)
SAS	8 (38.09)
HADS-A	1 (4.76)
PROMIS	1 (4.76)
PRAQ	1 (4.76)
DASS-A	2 (9.52)
Sample size	
< 500	5 (23.81)
501 – 1000	7 (33.33)
> 1000	9 (42.86)

Abbreviations: DASS-A, The Depression Anxiety and Stress Scale-Anxiety subscale; GAD-7, Generalized Anxiety Disorder-7; HADS-A, Hospital Anxiety and Depression Scale-Anxiety subscale; PRAQ, Pregnancy Related Anxiety Questionnaire; PROMIS, Patient Reported Outcomes Measurement System; SAS, Self-report Anxiety Scale

Narrative Synthesis

Sociodemographic factors

There were four modifiable sociodemographic factors associated with anxiety. The first was a residential area. Living in a pandemic epicenter location[15,16] or experiencing a lockdown in the place of residence[17] was associated with increased anxiety. The second was socioeconomic status. During the pandemic, the decline in income was associated with anxiety, with higher declines leading to higher anxiety.[18] Lower income (< 780 USD/ month or 7000 USD/ year) was associated with increased anxiety.[19,20]

On the other hand, higher income and a better economic level were protective factors for anxiety.[15,21] The third factor was education, but this study's findings indicate inconsistencies in the variables and outcomes of the effect of education on anxiety. The fourth factor related to anxiety was marital status. Unmarried/divorced/widowed had a higher risk of anxiety.[18] Age was positively correlated with anxiety in some studies, but the results were inconsistent across studies.

Environmental Exposure Factors

The time spent watching television and cell phones, more than 3 hours per day, was associated with high anxiety in pregnant women. The longer the time spent, the higher the risk of anxiety,[20] especially when watching the news about COVID-19.[22] Increased use of social media was also associated with anxiety.[23] On the other hand, less than 2 hours of screen time was a protective factor even when accompanied by lack of sleep.[20] The presence of COVID-19 infection in close relatives was associated with anxiety.[17] The presence of suspected or confirmed cases around[22], family members died from COVID-19,[15] and COVID-19 infection during pregnancy was associated with increased anxiety.[3,23]

Occupational Factor

Not working or losing a job during the pandemic was associated with increased anxiety in 4 studies[18,21,23,24] but not in one study.[25] Working as farmers[26] and civil servants[20] was a protective factor for anxiety.

Lifestyle Factor

Physical inactivity was associated with anxiety.[24] On the other hand, being physically active was a protective factor.[20,22,27] In particular, Lin et al.[22] stated that the interaction between

lack of time for physical exercise (< 30 minutes per day) and sleep (< 7 hours per day), and spending more than one hour per day on social media increased the prevalence of anxiety in pregnant women. Sitting more than 10 hours per day and drinking alcohol were also associated with increased anxiety.[18]

Physiological Factors

Nine articles discussed pregnancy complications and comorbidities and their association with anxiety. The result was consistent. Pregnancy complications and comorbidities were associated with increased anxiety in pregnant women.[3,15–18,20,21,25,26,28,29] Planning for vaginal delivery is a protective factor for anxiety.[18]

Sleep time more than 6 hours per day was a protective factor for anxiety. The longer sleep time, the lower the anxiety,[20] and the lower the sleep time (< 7 hours per day), the higher the anxiety.[30] Further, inconsistent time to sleep, sleep after 00:00, and difficulty initiating sleep was associated with anxiety.[30] Subjective poor sleep quality was also associated with anxiety.[30,31] Research by Mei et al.[29] stated that obesity was protective against anxiety. However, this finding was not consistent with Liu et al.'s[15] research, which stated that obesity and overweight were risk factors for anxiety.

Psychological Factor

Three articles consistently stated that a previous history of anxiety and depression was associated with high anxiety in pregnant women during the pandemic.[23,32,33] Good knowledge of COVID-19[28,34] and its prevention,[15] the simplicity of mothers accessing antenatal information from hospitals,[28] and trust in official government media as sources of information were protective factors for anxiety.[3,34]

On the other hand, mothers who did not receive information about the impact of COVID-19 on pregnancy and mothers who did not receive information from doctors/nurses/midwives about the impact of COVID-19 on the baby's health experienced increased anxiety.[24]

Response to Trauma

The perception of COVID-19's severe impact on their lives [17,26,27,30] or their psychological well-being[30] was associated with increased anxiety. In addition, the perceived susceptibility was also associated with anxiety, both concern for oneself[22,34] and the baby.[31,35]

Mothers who felt uncomfortable during antenatal visits and mothers who did not delay/reduce the number of antenatal visits were associated with higher anxiety.[24,34] In addition, worrying about pandemic control and being afraid to leave the house were also associated with increased anxiety.[3] In contrast, self-efficacy was associated with lower anxiety.[26]

High levels of stress during the pandemic and its relationship with high anxiety levels in pregnant women were described in three articles.[16,31,32] Worrying about the baby, family, friends, and financial adequacy was also associated with higher anxiety levels.[15,26,27] Conversely, not worrying about contracting COVID-19 was associated with less anxiety in pregnant women.[34]

Relational Factor

Social restriction due to the pandemic increased the anxiety level of pregnant women.[23,35] Family dysfunction, tension with partners, and lack of support from others during the

pandemic were associated with increased anxiety.[16,18] On the other hand, high support from a spouse,[30,35] family,[22,33] and generally, was associated with lower anxiety levels.[17,21,35]

Quantitative Synthesis

Anxiety Prevalence

The range of anxiety prevalence was 10 to 65% (k=21), and the pooled prevalence of anxiety was 28% (95%CI; 23-33; N=42,177). There was a significant study heterogeneity (Q = 3150.66; P < .001 and I^2 = 99.62%); hence the most appropriate model used to analyze was a random-effect model. The meta-regression results showed that the country of origin variable significantly moderated the existing heterogeneity (P < .001). There were significant differences in anxiety prevalence between groups of China, Turkey, Iran, and others. The prevalence of anxiety was higher in Turkey (63%, 95% CI, 60-66), followed by other countries (39%, 95% CI, 15-62), China (22%, 95% CI, 17-27), and finally Iran (20%, 95% CI, 17-23). The forest plot of prevalence was presented in figure 1.

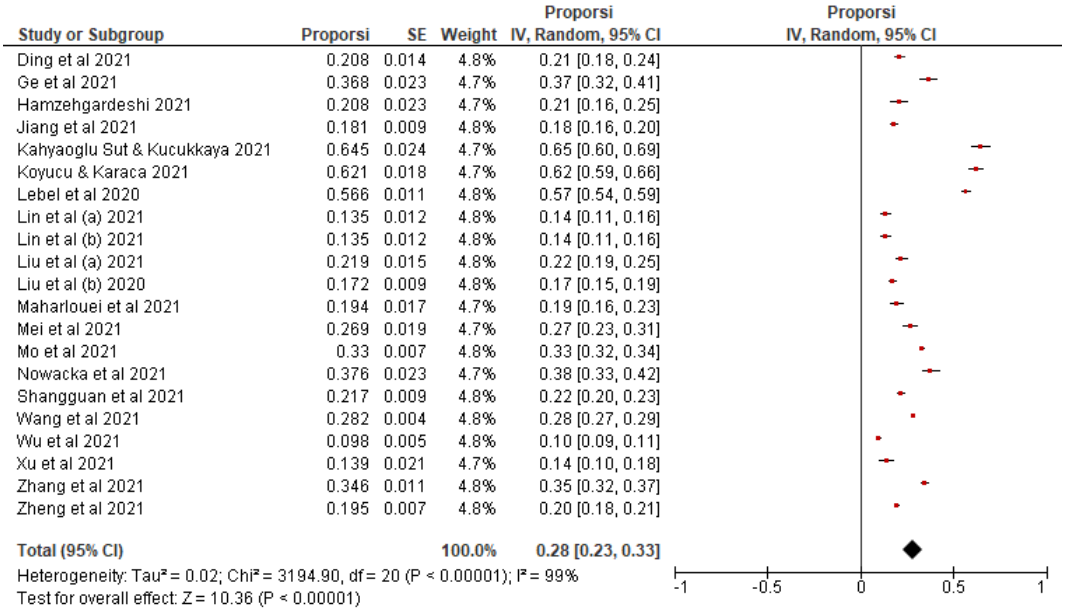

Figure 1 Forest Plot of Prevalence of the Anxiety

In this study, the pooled prevalence for anxiety in pregnant women during the pandemic from 21 studies was 28%. This result is higher than the systematic review of antenatal anxiety before the pandemic (1950 - 2016) proposed by Dennis et al.[36], which is 22.9% (95% CI; 20.25-25.2; N = 142,833) but not much different from the prevalence of anxiety in the general population during the COVID-19 pandemic of 27.3% (95% CI: 23.7-31.2; N = 140,732)[37] and 31.9% (95%CI; 27.5-36.7; N = 63,439).[38]

However, the prevalence of anxiety in pregnant women in this study was lower than other systematic reviews during the pandemic conducted by Yan et al.,[7] (37%, 95%CI; 25-49; N = 20,569). One of the possible causes was the origin of the study. In this study, most studies came from China (k = 14, 67%). Cross-cultural aspects influence this difference in anxiety levels. Contextual factors, how one perceives one's body, and dependence on others influence anxiety. Considering this condition, people in Asia generally have lower anxiety levels than other races in the world.[39] This finding is consistent with data from WHO which shows that the prevalence of anxiety in the Asian region is relatively low compared to other countries in the world.[40]

Factors Associated with Anxiety

Twelve studies contribute to 18 factors of anxiety in pregnant women during the pandemic. Of the 18 factors, only nine gave significant results (8 risk factors and one protective factor). They were marital status, monthly income, screen time, history of COVID-19 exposure, pregnancy complications, sleep duration, sleep quality, perceived susceptibility, and trust in the official government social media. Heterogeneity in each study varied, ranging from 0% to 93%. A summary of the combined effects can be seen in table 3.

Table 3. Summary of 18 Articles Included in the Meta-Analysis of Risk and Protective Factors

Factors	No of studies (k)	Combined sample size	*Pooled* OR (95% CI)	*P* Value	I^2 (%)
High school education/ lower	6	9107	1.18 (0.82-1.69)	.37	89
Not married/ divorced/ widowed	2	4185	2,20 (1.59-3.04)	**<.001**	0
Age ≥ 35 y.o	4	5717	1.11 (0.64-1.94)	.70	77
Monthly income < 5000 CNY (~780 USD)	2	2545	1.31 (1.09-1.57)	**.004**	0
Screen time ≥ 3 hours/ day	2	2545	1.89 (1.43-2.51)	**<.001**	0
History of exposure to COVID-19	3	3137	1.96 (1.39-2.76)	**<.001**	0
Not working during pandemic	6	9260	1.20 (0.97-1.50)	.10	58
Work as civil servant	2	2160	1.67 (0.75-3.75)	.21	90
Daily physical exercise	2	4185	0.59 (0.23-1.53)	.28	93
3rd Trimester	9	10,960	1.14 (0.93-1.40)	.22	68
Multipara	7	9924	0.92 (0.74-1.14)	.45	73
Complications and Comorbidities	8	11,394	1.77 (1.39-2.24)	**<.001**	66
Sleep duration <7 hours/ day	2	2545	1.51 (1.12-2.02)	**.007**	27
Subjective poor sleep quality	2	1025	7.35 (2.11-25.57)	**.002**	87
Prepregnancy *Overweight*/ obesity	2	3509	1.71 (0.59-5.01)	.33	93
Official media trust	2	2764	0.65 (0.52-0.81)	**<.001**	0
High risk of susceptibility	3	1842	3.91 (2.37-6.45)	**<.001**	0
Live in the city	2	2081	0.89 (0.40-1.99)	.78	84

Abbreviations: CNY, Chinese Yuan; OR, Odds Ratio; USD, United States Dollar.

The risk of cross-study bias was assessed using an Egger and Begg regression test and the Fail-Safe N value. The p-value in the regression test is .14, which means that there was no bias in the publication of the meta-analysis study. The Fail Safe-N score in this study was 92,340 with $P < .001$. Because the value of 5k+10 (115) is less than the Fail Safe-N value, it can be concluded that there was no publication bias problem in this study.

Risk Factors

Based on the results of the narrative synthesis, sociodemographic factors that are consistently associated with increased anxiety are living near the pandemic's epicenter, experiencing lockdown, low income, poor economic level, and unmarried/divorced/widow status. However, only marital status and low-income factors are supported by data from the meta-analysis. This can happen because not all studies use the same variables to assess anxiety risk factors, and not all studies provide sociodemographic data.

Protective Factors

Based on the narrative and quantitative synthesis results, the protective factor for pregnant women's anxiety is public trust in the official government media. It was explained before that obtaining too much information from various media during the pandemic led to increased anxiety.[22,23,41] However, if the duration can be controlled and social media was used to get information about COVID-19 from the government and hospitals, it could reduce anxiety.[3,28,34] Public trust in the national media has a protective effect on anxiety.[42] On the other hand, the perception of COVID-19 politicization and the number of confusing

news sources related to COVID-19 are related to anxiety.[43] Hence, it is hoped that public health messages announced by the government must also provide solutions with one consistent message and from one source to increase trust.

Strengths and Limitations of the Study

This study involved quite a lot of articles (k=21). However, there is high heterogeneity between studies. In addition, the definition of a variable as a risk factor is also inconsistent between studies. These differences make it challenging to compare age, education level, parity, and trimester from one study to another.

Another limitation of this study is the use of various measuring instruments and differences in the cut-off value of anxiety even with the same measuring instrument. Almost all studies use a self-report questionnaire that can increase the possibility of bias in answering and is not a standard in determining the diagnosis of anxiety. However, this method is still acceptable for use as an initial screening. Another limitation of this study lies in the design of the articles of included studies. All studies used a cross-sectional design, so we can not conclude the causal relationship.

Most studies use online questionnaires with potential selection bias that limit the possibility of subjects with no internet connection being involved in the study. As a result, we must not generalize the finding without cautions.[44,45] However, several authors have described the methods used to reduce bias in using this online questionnaire, including telephone contact for willingness to fill out a questionnaire and the use of previously validated questionnaires. However, given that in the context of a pandemic and physical contact restrictions, online questionnaires are the best option to collect data without the risk of contracting the disease.

The strength of this study lies in the size of the combined sample and the comprehensive discussion of anxiety during pregnancy exclusively in which, to the best of our knowledge, is the first systematic review to address anxiety and specific risk factors during pregnancy with a meta-analysis. In addition, the exclusion of low-quality articles also minimizes the possibility of bias towards the study results.

CONCLUSIONS

Our findings from this research can emphasize that pregnant women's services at Public Health Centers, Hospitals, Clinics, Private Practice Midwives, and other service places must consider the anxiety factor. This research can also serve as a guideline to identify pregnant women at risk of experiencing anxiety, which is essential during this pandemic given the high level of anxiety and the magnitude of the impact. Screening for anxiety is recommended when the mother has an antenatal visit as it was shown a good result in previous study.[46] This study's limited source of articles with only a cross-sectional design indicates the need for a better design, such as a cohort or case-control, to better assess anxiety and conclude causality. Future research designs should also pay attention to and minimize bias when forced to use online questionnaires.

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2. Submission acknowledgment received from the journal editor – 17 July 2023

[INAJOG] Submission Acknowledgement

Participants

Junita indarti (junita_indarti)

Cyntia Puspa Pitaloka (cyntiapitaloka)

Messages

Note	From
Cyntia Puspa Pitaloka: Thank you for submitting the manuscript, "Anxiety in Pregnant Women During the Covid-19 Pandemic: A Systematic Review with Meta-Analysis" to Indonesian Journal of Obstetrics and Gynecology. With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site: Manuscript URL: https://inajog.com/index.php/journal/authorDashboard/submission/2057 Username: {$authorUsername} If you have any questions, please contact me. Thank you for considering this journal as a venue for your work. Junita indarti junitaindarti06@gmail.com The following message is being delivered on behalf of Indonesian journal of obstetrics and gynecology	junita_indarti 2023-07-17 04:10 AM
Thank you Dr. Junita Indarti, dr., SpOG, Subsp. Obginsos(K) Hope to hear good news from the editorial and reviewer team. Regards, Cyntia Puspa Pitaloka cyntia.pitaloka@petra.ac.id	cyntiapitaloka 2023-07-18 03:38 AM

Add Message

3. Request from the journal for plagiarism check, author's statement, and latest manuscript version – 24 August 2023
4. Plagiarism check, author's statement, and updated manuscript submitted – 25 August 2023

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CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id>

Author's Statement INAJOG and Plagiarism Check (Time Limit: August 31th, 2023)

5 messages

Support Inajog <support@inajog.com> Thu, Aug 24, 2023 at 1:28 PM
To: thomasyohanj@gmail.com, Devi putri Amalia suryani <deviputriamaliasuryani@gmail.com>, yohanasamosir2003@gmail.com, Aladdin Spog <dr.aladin.spog@gmail.com>, hana.andrina@gmail.com, m masrur <m.masrur.rizal-2021@fk.unair.ac.id>, jessicalevina95@gmail.com, vyncadotcom@gmail.com, cyntia.pitaloka@petra.ac.id, patriciaalika278@gmail.com, aureliusbonifasius@gmail.com

Dear Author,

Here we attached the Author's Statement below. Please fill it and send it back to me until Thursday, August 31th, 2023 with the result of plagiarism check (≤20% with Turnitin or Plagscan) also the latest version of manuscript if there are any changes.

Thank you for your attention and cooperation.

Best regards,
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Support Inajog <support@inajog.com> Tue, Aug 29, 2023 at 11:01 AM
To: CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id>

Dear Author,

We've received it.
Please wait for the next process and will be notified by email.

Thank you for your attention.

Best regards,
INAJOG

Pada tanggal Jum, 25 Agu 2023 pukul 10.13 CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id> menulis:

> Dear Editor,
> Thank you for your previous email. Here we attached:
> 01. Author's Statement
> 02. Turnitin Plagiarism Check Results
> 03. My latest Manuscript
>
> Thank you very much.
>
> Sincerely,
>
> Cyntia Puspa Pitaloka

5. Inquiry sent to the editor regarding the decision status – 6 October 2023

[Quoted text hidden]

CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id> Fri, Sep 8, 2023 at 9:53 AM
To: Support Inajog <support@inajog.com>

Dear Editor,

Thank you for your confirmation.
Looking forward to hearing from you

Best regards,

Cyntia.

[Quoted text hidden]

CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id> Fri, Oct 6, 2023 at 9:42 AM
To: Support Inajog <support@inajog.com>

Dear Junita Indarti, Dr. dr., SpOG, Subsp. Obginsos(K)
Editor in Chief

I hope this message finds you well. I am writing to inquire about the status of the article that I submitted to the Indonesian Journal of Obstetrics and Gynecology on July 13, 2023. The article is titled "Anxiety in Pregnant Women During the Covid-19 Pandemic: A Systematic Review with Meta-Analysis" and was submitted for consideration for publication in the Indonesian Journal of Obstetrics and Gynecology.

As I have completed all the requirements, I am eager to know if there have been any updates or decisions regarding the article. I understand that the peer-review process can take some time, but I am interested in knowing the status of my submission and whether any feedback or decisions have been made by the reviewers.

If further information or revisions are required from my end to facilitate the review process, please do not hesitate to inform me, and I will promptly provide any necessary materials or revisions. I am committed to ensuring that the article meets the standards and requirements of the Indonesian Journal of Obstetrics and Gynecology.

I greatly appreciate your attention to this matter and your dedication to maintaining the quality of publications in the Indonesian Journal of Obstetrics and Gynecology. If you could kindly provide an update or an estimated timeline for when I can expect to receive feedback on my submission, it would be greatly appreciated.

Thank you for your time and consideration. I look forward to your response and hope for a positive outcome for my submission.

Sincerely,

Cyntia Puspa Pitaloka
cyntia.pitaloka@petra.ac.id

[Quoted text hidden]

Support Inajog <support@inajog.com> Fri, Oct 6, 2023 at 10:56 AM
To: CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id>

Dear Author,

We are sorry that the process took so long.
Your manuscript is in the review process.
Please wait for the next process and will be notified by email.

Thank you for your attention.

Best regards,
INAJOG

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> [Quoted text hidden]
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> 

6. Paper accepted; payment information received – 15 October 2024
7. Payment completed – 16 October 2024

UNIVERSITAS KRISTEN PETRA

CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id>

[INAJOG] Article Publishing Invoice (Time Limit : October 20 th, 2024)

3 messages

Support Inajog <support@inajog.com> Tue, Oct 15, 2024 at 9:01 PM
To: CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id>

Dear

Chyntia Puspa Pitaloka

With respect,

It was informed that the peer-reviewed manuscript titled **"Anxiety in Pregnant Women During the Covid-19 Pandemic"**. Based on the recommendation of the editorial team, and peer reviewers, it will be loaded and published on INAJOG.

In connection with the publication of the manuscript, colleagues are requested to complete a publishing fee 2.000.000 IDR. **Payment no later than October 20th, 2024. Proof of transfer sent via email: support@inajog.com.**

Thank you for your attention and cooperation.

Best regards,
INAJOG Editorial Team

2 attachments

Fast Track Invoice_Chyntia Puspa Pitaloka.pdf
760K

Article Publish Notice_Cyntia Puspa Pitaloka.pdf
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CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id> Wed, Oct 16, 2024 at 3:19 PM
To: Support Inajog <support@inajog.com>

Dear Editor in Chief INAJOG,

Prof. Dr. dr. Junita Indarti, Sp.OG(K)

Thank you for your notification regarding the acceptance of my peer-reviewed manuscript titled "Anxiety in Pregnant Women During the Covid-19 Pandemic" for publication in INAJOG. I am very pleased to hear this news.

In accordance with your request, I have completed the payment of the publishing fee of 2,000,000 IDR. Please find the proof of transfer attached to this email.

I look forward to receiving further information regarding the publication process. Thank you for your attention and cooperation.

Best regards,

Cyntia Puspa Pitaloka
Petra Christian University
[Quoted text hidden]
--
Salam,

Cyntia Puspa Pitaloka
Petra Christian University

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Support Inajog <support@inajog.com> Wed, Oct 16, 2024 at 6:22 PM
To: CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id>

Dear Author,

We've received the payment.
Please wait for the next update and we will inform you by email.

Thank you.
Salam hormat,
Redaksi INAJOG

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8. Email notification received regarding manuscript revision – 18 October 2024

UNIVERSITAS KRISTEN PETRA

CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id>

[INAJOG] Revisi Naskah (Time Limit: 22 Oktober 2024)

3 messages

Support Inajog <support@inajog.com> Fri, Oct 18, 2024 at 2:14 PM
To: CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id>

Yth. Penulis,

Berikut terlampir draft naskah yang harus diperbaiki kembali.
Silakan perbaiki naskah sesuai komentar.
Dimohon untuk perhatikan time limit karena naskah akan diproses lebih lanjut.

Terima kasih atas perhatiannya.
Best regards,
INAJOG Editorial Team

Anxiety in Pregnant Women During the Covid-19 Pandemic_edited_4Okt24.docx
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CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id> Tue, Oct 22, 2024 at 12:23 AM
To: Support Inajog <support@inajog.com>

Yth. INAJOG Editorial Team

Berikut adalah draft naskah yang sudah saya perbaiki sesuai dengan komentar sebagai berikut:
1. Melengkapi Identitas dan Afiliasi Penulis
2. Melengkapi correspondence author
3. Memisahkan Result dengan Discussion
4. Memperbaiki References

Terima kasih atas perhatian yang diberikan oleh INAJOG Editorial Team.

Salam,

Cyntia Puspa Pitaloka
Petra Christian University
[Quoted text hidden]
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Anxiety in Pregnant Women During the Covid-19 Pandemic_edited_22Okt24.docx
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Support Inajog <support@inajog.com> Tue, Oct 22, 2024 at 7:49 AM
To: CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id>

yth. Penulis
Naskah perbaikan telah kami terima.
Naskah akan di proses ke tahap selanjutnya, dimohon untuk menunggu informasi selanjutnya melalui email.
terima kasih.
Salam hormat,
Redaksi INAJOG

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Literature Review

Anxiety in Pregnant Women during the Covid-19 Pandemic

Cyntia Puspa Pitaloka, Brahmana Askandar Tjokroprawiro, Muji Sulistyowati

Universitas Kristen Petra
Surabaya

Abstract
Objective : This study systematically reviewed and meta-analysis the prevalence and factors associated with anxiety in pregnant women during the pandemic.
Methods : We searched PubMed MEDLINE, Web of Science, Scopus, ProQuest, EBSCO, Science Direct, and Garuda journal databases in July 2021 and updated them in October 2021. All English and Bahasa journal articles from December 2019 were included in the search. We included studies that investigate factors affecting anxiety exclusively in pregnant women. The primary outcome was the prevalence ratio. The secondary outcome was the risk and protective factors as the independent variable. Joanna Briggs Institute Critical Appraisal Tools and RevMan 5.4 were used to do the analysis.
Results: After screening 2082 articles, we included 21 studies with 42.177 pregnant women. The pooled prevalence of anxiety was estimated at 28% (95% CI, 23-33.3). We found that 12 of the 21 studies contributed to 8 risks and 1 protective factor significantly in the meta-analysis. Not married/divorced/widowed, monthly income < 780 USD, screen time > 3 hours/day, history of exposure to COVID-19, complications in the current pregnancy, sleep less than 7 hours per day, subjective poor sleep quality, and high perception of vulnerability were risk factors. Meanwhile, the protective factor was trust in the government's official media.
Conclusion : There is a significant increase in the prevalence of maternal anxiety during the pandemic. Mental health screening during the antenatal visit must be carried out, and interventions to lower the anxiety level must be planned to prevent further harm.
Keywords:, anxiety, COVID-19, mental health, pandemics, pregnancy

Correspondence author.???

INTRODUCTION

The COVID-19 pandemic causes psychological distress and fear in some individuals due to periods of isolation, quarantine, and hospitalization[1]. As one of the vulnerable populations, pregnant women experience increased anxiety, which has been reported in various countries[2–4]. Anxiety is a normal response to threats and is an attempt to save oneself[5]. However, there will be interference if the response is excessive.

In pregnant women, anxiety is associated with an increased risk of obstetrics problems, cesarean delivery, increased chances of preterm birth, small for gestational age, and smaller infant head circumference[6], including premature rupture of the membrane[7]. If not prevented, anxiety during pregnancy could lead to more extensive harm. Therefore, knowing the risk and protective factors for anxiety during pregnancy is essential, especially during a pandemic.

Several systematic literature reviews discussed the psychological impact of COVID-19 on pregnant and postpartum women during the pandemic[8,9]. However, none specifically discusses the prevalence of anxiety during pregnancy and its determinants using a systematic review accompanied by a meta-analysis method. Therefore, this study aims to conduct a systematic review of risk and protective factors, estimate the pooled effect size of risk and protective factors, and estimate the pooled prevalence of anxiety in pregnant women during the COVID-19 pandemic.

METHODS

The organization of this manuscript followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines[10], and the research protocol was registered in PROSPERO CRD42021270107. The literature search was carried out in July – August 2021 and updated in October 2021. We used PUBMED Medline, Web of Science, Scopus, Science Direct, ProQuest, EBSCOhost, and the Garuda journal database to conduct our search.

The search was carried out systematically on titles and abstracts using the thesaurus and MeSH. Combination of keywords: pregnant*, antenatal, prenatal, perinatal, maternal, gravid, prepartum, peripartum, antepartum, expectant mother, anxi*, worry, mental health, stress, distress, COVID, Coronavirus, Wuhan virus, Wuhan Pneumonia, SARS-CoV-2, 2019-nCOV, and pandemic both in English and Bahasa were used. All English and Bahasa journal articles from December 2019 to July 2021 were included in the search.

The Population, Intervention/Exposure, Comparison, Outcome, and Study design frameworks were used to clarify the inclusion and exclusion criteria (see Table 1).

Table 1. PICOS Design Frameworks

	Inclusion	Exclusion
Population	Studies on pregnant women only or pregnant and postpartum women	Studies that did not dissociate pregnant and postpartum women in the analysis.
Intervention/ Exsposure	COVID-19 pandemic	
Comparator	-	
Outcome	Primary: prevalence of anxiety among pregnant women. Secondary: risk and protective factors as the independent variable and anxiety as the dependent variable with Odds Ratio/ Prevalence Odds Ratio, p <0.05, and 95% CI.	Studies only mention descriptive analysis for the outcome and studies that combine anxiety and other mental health problems as the dependent variable.
Study Design	Cross-sectional, case-control. cohort	Reviews, editorials, letters, opinions, purely qualitative studies, conferences, and proceedings.

The articles obtained from the initial search were then imported into Rayyan[11], checked for duplication and screened. Preliminary screening through titles and abstracts was carried out independently by CPP. After selecting the title and abstract, the full text of potential articles was screened based on the data extraction compared to inclusion and exclusion criteria. Articles that did not meet the requirements were removed with a description of the reason. In case of doubt, CPP consulted with other reviewers (BAT, MS). Articles that did not provide access to the full text were excluded.

According to the study design, articles passed the title, abstract, and full-text screening process then assessed for quality using the Joanna Briggs Institute (JBI) Critical Appraisal Tools[12] and scored. To prevent bias due to study quality, articles that did not meet the minimum cut-off value of included studies (50%) were excluded.

Data extraction process is carried out by CPP independently. Studies containing statistical data were synthesized quantitatively during the meta-analysis. The combined prevalence was calculated using the proportion formula for pregnant women with anxiety disorders based on the cut-off score of the anxiety measurement instrument provided in the article. Because one article can contain more than one risk factor, each risk factor was analyzed separately. Articles that did not report odds ratio but had 2x2 table data were included in the meta-analysis.

Revman 5.4 software was used to analyze the data. The heterogeneity assessment was carried out using the I^2 test (I^2 > 50%) and the Q test.[13] The random-effects model was used in heterogeneous study conditions, and otherwise, the fix-effects model was used. The prevalence and 95% confidence intervals for each study were presented in forest plot.

Jamovi 2.0 software was used to assess publication bias by the Egger and Begg test and Fail Safe-N test result.[14] The significance of publication bias was obtained when the $P < .05$.

RESULT AND DISCUSSION

In the initial search, 2802 articles were obtained from 7 journal databases, leaving 21 articles to synthesize narrative and quantitatively after screening. All 21 articles had a cross-sectional design, with China being the most studied country (66.67%). The two most widely used measuring instruments were GAD-7 (Generalized Anxiety Disorder-7) and SAS (Zung Self-rating Anxiety Scale), with 38.09% each. There were nine articles with a sample size of >1000 pregnant women. Based on the JBI assessment, two studies scored 100%, and five studies were 62.5%. The summary of the study characteristics is provided in table 2.

Table 2. Summary of Study Characteristics of 21 Articles Included in the Analysis

Characteristics	n (%)
Study design	
Cross-Sectional	21 (100)
Country of origin	
China	14 (66.67)
Turkey	2 (9.52)
Poland	1 (4.76)
Canada	1 (4.76)
United States	1 (4.76)
Iran	2 (9.52)
Publication year	
2020	2 (9.52)
2021	19 (90.48)
Time of data collection	
The first 6 months of pandemic	19 (90.48)
After 6 months of pandemic	2 (9.52)
Methods of data collection	
Online questionnaire	16 (76.19)
Physical questionnaire	5 (23.81)
Anxiety measurement instruments	
GAD-7	8 (38.09)
SAS	8 (38.09)
HADS-A	1 (4.76)
PROMIS	1 (4.76)
PRAQ	1 (4.76)
DASS-A	2 (9.52)
Sample size	
< 500	5 (23.81)
501 – 1000	7 (33.33)
> 1000	9 (42.86)

Abbreviations: DASS-A, The Depression Anxiety and Stress Scale-Anxiety subscale; GAD-7, Generalized Anxiety Disorder-7; HADS-A, Hospital Anxiety and Depression Scale-Anxiety subscale; PRAQ, Pregnancy Related Anxiety Questionnaire; PROMIS, Patient Reported Outcomes Measurement System; SAS, Self-report Anxiety Scale

Narrative Synthesis

There were four modifiable sociodemographic factors associated with anxiety. The first was a residential area. Living in a pandemic epicenter location[15,16] or experiencing a lockdown in the place of residence[17] was associated with increased anxiety. The second was socioeconomic status. During the pandemic, the decline in income was associated with anxiety, with higher declines leading to higher anxiety.[18] Lower income (< 780 USD/ month or 7000 USD/ year) was associated with increased anxiety.[19,20]

On the other hand, higher income and a better economic level were protective factors for anxiety.[15,21] The third factor was education, but this study's findings indicate inconsistencies in the variables and outcomes of the effect of education on anxiety. The fourth factor related to anxiety was marital status. Unmarried/divorced/widowed had a higher risk of anxiety.[18] Age was positively correlated with anxiety in some studies, but the results were inconsistent across studies.

Environmental Exposure Factors

The time spent watching television and cell phones, more than 3 hours per day, was associated with high anxiety in pregnant women. The longer the time spent, the higher the risk of anxiety,[20] especially when watching the news about COVID-19.[22] Increased use of social media was also associated with anxiety.[23] On the other hand, less than 2 hours of screen time was a protective factor even when accompanied by lack of sleep.[20] The presence of COVID-19 infection in close relatives was associated with anxiety.[17] The presence of suspected or confirmed cases around[22], family members died from COVID-19,[15] and COVID-19 infection during pregnancy was associated with increased anxiety.[3,23]

Occupational Factor

Not working or losing a job during the pandemic was associated with increased anxiety in 4 studies[18,21,23,24] but not in one study.[25] Working as farmers[26] and civil servants[20] was a protective factor for anxiety.

Lifestyle Factor

Physical inactivity was associated with anxiety.[24] On the other hand, being physically active was a protective factor.[20,22,27] In particular,[22] stated that the interaction between lack of time for physical exercise (< 30 minutes per day) and sleep (< 7 hours per day), and spending more than one hour per day on social media increased the prevalence of anxiety in pregnant women. Sitting more than 10 hours per day and drinking alcohol were also associated with increased anxiety.[18]

Physiological Factors

Nine articles discussed pregnancy complications and comorbidities and their association with anxiety. The result was consistent. Pregnancy complications and comorbidities were associated with increased anxiety in pregnant women.[3,15–18,20,21,25,26,28,29] Planning for vaginal delivery is a protective factor for anxiety.[18]

Sleep time more than 6 hours per day was a protective factor for anxiety. The longer sleep time, the lower the anxiety,[20] and the lower the sleep time (< 7 hours per day), the higher the anxiety.[30] Further, inconsistent time to sleep, sleep after 00:00, and difficulty initiating sleep was associated with anxiety.[30] Subjective poor sleep quality was also associated with anxiety.[30,31] Research[29] stated that obesity was protective against anxiety. However, this finding was not consistent [15] research, which stated that obesity and overweight were risk factors for anxiety.

Psychological Factor

Three articles consistently stated that a previous history of anxiety and depression was associated with high anxiety in pregnant women during the pandemic.[23,32,33] Good knowledge of COVID-19[28,34] and its prevention,[15] the simplicity of mothers accessing antenatal information from hospitals,[28] and trust in official government media as sources of information were protective factors for anxiety.[3,34]

On the other hand, mothers who did not receive information about the impact of COVID-19 on pregnancy and mothers who did not receive information from doctors/nurses/midwives about the impact of COVID-19 on the baby's health experienced increased anxiety.[24]

Response to Trauma

The perception of COVID-19's severe impact on their lives [17,26,27,30] or their psychological well-being[30] was associated with increased anxiety. In addition, the perceived susceptibility was also associated with anxiety, both concern for oneself[22,34] and the baby.[31,35]

Mothers who felt uncomfortable during antenatal visits and mothers who did not delay/reduce the number of antenatal visits were associated with higher anxiety.[24,34] In addition, worrying about pandemic control and being afraid to leave the house were also associated with increased anxiety.[3] In contrast, self-efficacy was associated with lower anxiety.[26]

High levels of stress during the pandemic and its relationship with high anxiety levels in pregnant women were described in three articles.[16,31,32] Worrying about the baby, family, friends, and financial adequacy was also associated with higher anxiety levels.[15,26,27] Conversely, not worrying about contracting COVID-19 was associated with less anxiety in pregnant women.[34]

Relational Factor

Social restriction due to the pandemic increased the anxiety level of pregnant women.[23,35] Family dysfunction, tension with partners, and lack of support from others during the pandemic were associated with increased anxiety.[16,18] On the other hand, high support from a spouse,[30,35] family,[22,33] and generally, was associated with lower anxiety levels.[17,21,35]

Quantitative Synthesis

Anxiety Prevalence

The range of anxiety prevalence was 10 to 65% (k=21), and the pooled prevalence of anxiety was 28% (95%CI; 23-33; N=42,177). There was a significant study heterogeneity (Q = 3150.66; P < .001 and I^2 = 99.62%); hence the most appropriate model used to analyze was a random-effect model. The meta-regression results showed that the country of origin variable significantly moderated the existing heterogeneity (P < .001). There were significant differences in anxiety prevalence between groups of China, Turkey, Iran, and others. The prevalence of anxiety was higher in Turkey (63%, 95% CI, 60-66), followed by other countries (39%, 95% CI, 15-62), China (22%, 95% CI, 17-27), and finally Iran (20%, 95% CI, 17-23). The forest plot of prevalence was presented in figure 1.

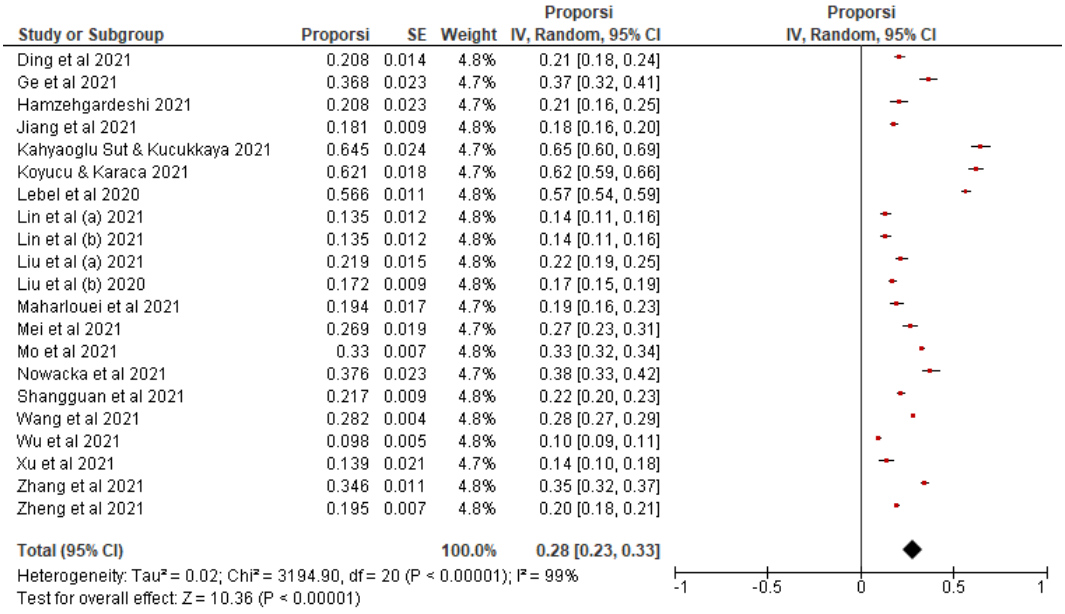

Figure 1. Forest Plot of Prevalence of the Anxiety

In this study, the pooled prevalence for anxiety in pregnant women during the pandemic from 21 studies was 28%. This result is higher than the systematic review of antenatal anxiety before the pandemic (1950 - 2016) proposed[36], which is 22.9% (95% CI; 20.25-25.2; N = 142,833) but not much different from the prevalence of anxiety in the general population during the COVID-19 pandemic of 27.3% (95% CI: 23.7-31.2; N = 140,732)[37] and 31.9% (95%CI; 27.5-36.7; N = 63.439).[38]

However, the prevalence of anxiety in pregnant women in this study was lower than other systematic reviews during the pandemic.,[8] (37%, 95%CI; 25-49; N = 20,569). One of the possible causes was the origin of the study. In this study, most studies came from China (k = 14. 67%). Cross-cultural aspects influence this difference in anxiety levels. Contextual factors, how one perceives one's body, and dependence on others influence anxiety.

Considering this condition, people in Asia generally have lower anxiety levels than other races in the world.[39] This finding is consistent with data from WHO which shows that the prevalence of anxiety in the Asian region is relatively low compared to other countries in the world.[40]

Factors Associated with Anxiety

Twelve studies contribute to 18 factors of anxiety in pregnant women during the pandemic. Of the 18 factors, only nine gave significant results (8 risk factors and one protective factor). They were marital status, monthly income, screen time, history of COVID-19 exposure, pregnancy complications, sleep duration, sleep quality, perceived susceptibility, and trust in the official government social media. Heterogeneity in each study varied, ranging from 0% to 93%. A summary of the combined effects can be seen in table 3.

Table 3. Summary of 18 Articles Included in the Meta-Analysis of Risk and Protective Factors

Factors	No of studies (k)	Combined sample size	*Pooled* OR (95% CI)	*P- Value*	I^2 (%)
High school education/ lower	6	9107	1.18 (0.82-1.69)	.37	89
Not married/ divorced/ widowed	2	4185	2,20 (1.59-3.04)	<.001	0
Age ≥ 35 y.o	4	5717	1.11 (0.64-1.94)	.70	77
Monthly income < 5000 CNY (~780 USD)	2	2545	1.31 (1.09-1.57)	.004	0
Screen time ≥ 3 hours/ day	2	2545	1.89 (1.43-2.51)	<.001	0
History of exposure to COVID-19	3	3137	1.96 (1.39-2.76)	<.001	0
Not working during pandemic	6	9260	1.20 (0.97-1.50)	.10	58
Work as civil servant	2	2160	1.67 (0.75-3.75)	.21	90
Daily physical exercise	2	4185	0.59 (0.23-1.53)	.28	93
3rd Trimester	9	10,960	1.14 (0.93-1.40)	.22	68
Multipara	7	9924	0.92 (0.74-1.14)	.45	73
Complications and Comorbidities	8	11,394	1.77 (1.39-2.24)	<.001	66
Sleep duration <7 hours/ day	2	2545	1.51 (1.12-2.02)	.007	27
Subjective poor sleep quality	2	1025	7.35 (2.11-25.57)	.002	87
Prepregnancy *Overweight*/ obesity	2	3509	1.71 (0.59-5.01)	.33	93
Official media trust	2	2764	0.65 (0.52-0.81)	<.001	0
High risk of susceptibility	3	1842	3.91 (2.37-6.45)	<.001	0
Live in the city	2	2081	0.89 (0.40-1.99)	.78	84

Abbreviations: CNY, Chinese Yuan; OR, Odds Ratio; USD, United States Dollar.

The risk of cross-study bias was assessed using an Egger and Begg regression test and the Fail-Safe N value. The p-value in the regression test is *.14*, which means that there was no bias in the publication of the meta-analysis study. The Fail Safe-N score in this study was 92.340 with $P < .001$. Because the value of 5k+10 (115) is less than the Fail Safe-N value, it can be concluded that there was no publication bias problem in this study.

Risk Factors

Based on the results of the narrative synthesis, sociodemographic factors that are consistently associated with increased anxiety are living near the pandemic's epicenter, experiencing lockdown, low income, poor economic level, and unmarried/divorced/widow status. However, only marital status and low-income factors are supported by data from the meta-analysis. This can happen because not all studies use the same variables to assess anxiety risk factors, and not all studies provide sociodemographic data.

Protective Factors

Based on the narrative and quantitative synthesis results, the protective factor for pregnant women's anxiety is public trust in the official government media. It was explained before that obtaining too much information from various media during the pandemic led to increased anxiety.[22,23,41] However, if the duration can be controlled and social media was used to get information about COVID-19 from the government and hospitals, it could reduce anxiety.[3,28,34] Public trust in the national media has a protective effect on anxiety.[42] On the other hand, the perception of COVID-19 politicization and the number of confusing news sources related to COVID-19 are related to anxiety.[43] Hence, it is hoped that public health messages announced by the government must also provide solutions with one consistent message and from one source to increase trust.

Strengths and Limitations of the Study

This study involved quite a lot of articles (k=21). However, there is high heterogeneity between studies. In addition, the definition of a variable as a risk factor is also inconsistent between studies. These differences make it challenging to compare age, education level, parity, and trimester from one study to another.

Another limitation of this study is the use of various measuring instruments and differences in the cut-off value of anxiety even with the same measuring instrument. Almost all studies use a self-report questionnaire that can increase the possibility of bias in answering and is not a standard in determining the diagnosis of anxiety. However, this method is still acceptable for use as an initial screening. Another limitation of this study lies in the design of the articles of included studies. All studies used a cross-sectional design, so we can not conclude the causal relationship.

Most studies use online questionnaires with potential selection bias that limit the possibility of subjects with no internet connection being involved in the study. As a result, we must not generalize the finding without cautions.[44,45] However, several authors have described the methods used to reduce bias in using this online questionnaire, including telephone contact for willingness to fill out a questionnaire and the use of previously validated questionnaires. However, given that in the context of a pandemic and physical contact restrictions, online questionnaires are the best option to collect data without the risk of contracting the disease.

The strength of this study lies in the size of the combined sample and the comprehensive discussion of anxiety during pregnancy exclusively in which, to the best of our knowledge, is the first systematic review to address anxiety and specific risk factors during pregnancy with a meta-analysis. In addition, the exclusion of low-quality articles also minimizes the possibility of bias towards the study results.

CONCLUSIONS

Our findings from this research can emphasize that pregnant women's services at Public Health Centers, Hospitals, Clinics, Private Practice Midwives, and other service places must consider the anxiety factor. This research can also serve as a guideline to identify pregnant women at risk of experiencing anxiety, which is essential during this pandemic given the high level of anxiety and the magnitude of the impact. Screening for anxiety is recommended when the mother has an antenatal visit as it was shown a good result in previous study.[46] This study's limited source of articles with only a cross-sectional design indicates the need for a better design, such as a cohort or case-control, to better assess anxiety and conclude causality. Future research designs should also pay attention to and minimize bias when forced to use online questionnaires.

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Literature Review

Anxiety in Pregnant Women During the Covid-19 Pandemic

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Abstract
Objective : This study systematically reviewed and meta-analysis the prevalence and factors associated with anxiety in pregnant women during the pandemic.
Methods : We searched PubMed MEDLINE, Web of Science, Scopus, ProQuest, EBSCO, Science Direct, and Garuda journal databases in July 2021 and updated them in October 2021. All English and Bahasa journal articles from December 2019 were included in the search. We included studies that investigate factors affecting anxiety exclusively in pregnant women. The primary outcome was the prevalence ratio. The secondary outcome was the risk and protective factors as the independent variable. Joanna Briggs Institute Critical Appraisal Tools and RevMan 5.4 were used to do the analysis.
Results: After screening 2082 articles, we included 21 studies with 42.177 pregnant women. The pooled prevalence of anxiety was estimated at 28% (95% CI, 23-33.3). We found that 12 of the 21 studies contributed to 8 risks and 1 protective factor significantly in the meta-analysis. Not married/divorced/widowed, monthly income < 780 USD, screen time > 3 hours/day, history of exposure to COVID-19, complications in the current pregnancy, sleep less than 7 hours per day, subjective poor sleep quality, and high perception of vulnerability were risk factors. Meanwhile, the protective factor was trust in the government's official media.
Conclusion : There is a significant increase in the prevalence of maternal anxiety during the pandemic. Mental health screening during the antenatal visit must be carried out, and interventions to lower the anxiety level must be planned to prevent further harm.
Keywords: anxiety, COVID-19, mental health, pandemics, pregnancy.

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INTRODUCTION

The COVID-19 pandemic causes psychological distress and fear in some individuals due to periods of isolation, quarantine, and hospitalization[1]. As one of the vulnerable populations, pregnant women experience increased anxiety, which has been reported in various countries[2–4]. Anxiety is a normal response to threats and is an attempt to save oneself[5]. However, there will be interference if the response is excessive.

In pregnant women, anxiety is associated with an increased risk of obstetrics problems, cesarean delivery, increased chances of preterm birth, small for gestational age, and smaller infant head circumference[6], including premature rupture of the membrane[7] If not prevented, anxiety during pregnancy could lead to more extensive harm. Therefore, knowing the risk and protective factors for anxiety during pregnancy is essential, especially during a pandemic.

Several systematic literature reviews discussed the psychological impact of COVID-19 on pregnant and postpartum women during the pandemic[8,9]. However, none specifically discusses the prevalence of anxiety during pregnancy and its determinants using a systematic review accompanied by a meta-analysis method. Therefore, this study aims to conduct a systematic review of risk and protective factors, estimate the pooled effect size of

risk and protective factors, and estimate the pooled prevalence of anxiety in pregnant women during the COVID-19 pandemic.

METHODS

The organization of this manuscript followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines[10], and the research protocol was registered in PROSPERO CRD42021270107. The literature search was carried out in July – August 2021 and updated in October 2021. We used PUBMED Medline, Web of Science, Scopus, Science Direct, ProQuest, EBSCOhost, and the Garuda journal database to conduct our search.

The search was carried out systematically on titles and abstracts using the thesaurus and MeSH. Combination of keywords: pregnan*, antenatal, prenatal, perinatal, maternal, gravid, prepartum, peripartum, antepartum, expectant mother, anxi*, worry, mental health, stress, distress, COVID, Coronavirus, Wuhan virus, Wuhan Pneumonia, SARS-CoV-2, 2019-nCOV, and pandemic both in English and Bahasa were used. All English and Bahasa journal articles from December 2019 to July 2021 were included in the search.

The Population, Intervention/Exposure, Comparison, Outcome, and Study design frameworks were used to clarify the inclusion and exclusion criteria (see Table 1).

Table 1. PICOS Design Frameworks

	Inclusion	Exclusion
Population	Studies on pregnant women only or pregnant and postpartum women	Studies that did not dissociate pregnant and postpartum women in the analysis.
Intervention/ Exsposure	COVID-19 pandemic	-
Comparator	-	-
Outcome	The primary outcome was the prevalence of anxiety among pregnant women. The secondary outcome was the risk and protective factors as the independent variable and anxiety as the dependent variable with Odds Ratio/ Prevalence Odds Ratio, p <0.05, and 95% CI.	Studies only mention descriptive analysis for the outcome and studies that combine anxiety and other mental health problems as the dependent variable.
Study Design	Cross-sectional, case-control. cohort	Reviews, editorials, letters, opinions, purely qualitative studies, conferences, and proceedings.

The articles obtained from the initial search were then imported into Rayyan[11], checked for duplication and screened. Preliminary screening through titles and abstracts was carried out independently by CPP. After selecting the title and abstract, the full text of potential articles was screened based on the data extraction compared to inclusion and exclusion criteria. Articles that did not meet the requirements were removed with a description of the reason. In case of doubt, CPP consulted with other reviewers (BAT, MS). Articles that did not provide access to the full text were excluded.

According to the study design, articles passed the title, abstract, and full-text screening process then assessed for quality using the Joanna Briggs Institute (JBI) Critical Appraisal Tools[12] and scored. To prevent bias due to study quality, articles that did not meet the minimum cut-off value of included studies (50%) were excluded.

Data extraction process is carried out by CPP independently. Studies containing statistical data were synthesized quantitatively during the meta-analysis. The combined prevalence was calculated using the proportion formula for pregnant women with anxiety disorders based on the cut-off score of the anxiety measurement instrument provided in the article. Because one article can contain more than one risk factor, each risk factor was analyzed separately. Articles that did not report odds ratio but had 2x2 table data were included in the meta-analysis.

Revman 5.4 software was used to analyze the data. The heterogeneity assessment was carried out using the I^2 test (I^2 > 50%) and the *Q* test.[13] The random-effects model was used in heterogeneous study conditions, and otherwise, the fix-effects model was used. The prevalence and 95% confidence intervals for each study were presented in forest plot. Jamovi 2.0 software was used to assess publication bias by the Egger and Begg test and Fail Safe-N test result.[14] The significance of publication bias was obtained when the $P < .05$.

RESULT

In the initial search, 2802 articles were obtained from 7 journal databases, leaving 21 articles to synthesize narrative and quantitatively after screening. All 21 articles had a cross-sectional design, with China being the most studied country (66.67%). The two most widely used measuring instruments were GAD-7 (Generalized Anxiety Disorder-7) and SAS (Zung Self-rating Anxiety Scale), with 38.09% each. There were nine articles with a sample size of >1000 pregnant women. Based on the JBI assessment, two studies were scored 100%, and five studies were 62.5%. The summary of the study characteristics is provided in table 2.

Table 2. Summary of Study Characteristics of 21 Articles Included in the Analysis

Characteristics	n (%)
Study design	
Cross-Sectional	21 (100)
Country of origin	
China	14 (66.67)
Turkey	2 (9.52)
Poland	1 (4.76)
Canada	1 (4.76)
United States	1 (4.76)
Iran	2 (9.52)
Publication year	
2020	2 (9.52)
2021	19 (90.48)
Time of data collection	
The first 6 months of pandemic	19 (90.48)
After 6 months of pandemic	2 (9.52)
Methods of data collection	
Online questionnaire	16 (76.19)
Physical questionnaire	5 (23.81)
Anxiety measurement instruments	
GAD-7	8 (38.09)
SAS	8 (38.09)
HADS-A	1 (4.76)
PROMIS	1 (4.76)
PRAQ	1 (4.76)
DASS-A	2 (9.52)
Sample size	
< 500	5 (23.81)
501 – 1000	7 (33.33)
> 1000	9 (42.86)

Abbreviations: DASS-A, The Depression Anxiety and Stress Scale-Anxiety subscale; GAD-7, Generalized Anxiety Disorder-7; HADS-A, Hospital Anxiety and Depression Scale-Anxiety subscale; PRAQ, Pregnancy Related Anxiety Questionnaire; PROMIS, Patient Reported Outcomes Measurement System; SAS, Self-report Anxiety Scale

Narrative Synthesis

Sociodemographic factors

There were four modifiable sociodemographic factors associated with anxiety. The first was a residential area. Living in a pandemic epicenter location[15,16] or experiencing a lockdown in the place of residence[17] was associated with increased anxiety. The second was socioeconomic status. During the pandemic, the decline in income was associated with anxiety, with higher declines leading to higher anxiety.[18] Lower income (< 780 USD/ month or 7000 USD/ year) was associated with increased anxiety.[19,20]

On the other hand, higher income and a better economic level were protective factors for anxiety.[15,21] The third factor was education, but this study's findings indicate inconsistencies in the variables and outcomes of the effect of education on anxiety. The fourth factor related to anxiety was marital status. Unmarried/divorced/widowed had a higher risk of anxiety.[18] Age was positively correlated with anxiety in some studies, but the results were inconsistent across studies.

Environmental Exposure Factors

The time spent watching television and cell phones, more than 3 hours per day, was associated with high anxiety in pregnant women. The longer the time spent, the higher the risk of anxiety,[20] especially when watching the news about COVID-19.[22] Increased use of social media was also associated with anxiety.[23] On the other hand, less than 2 hours of screen time was a protective factor even when accompanied by lack of sleep.[20] The presence of COVID-19 infection in close relatives was associated with anxiety.[17] The presence of suspected or confirmed cases around[22], family members died from COVID-19,[15] and COVID-19 infection during pregnancy was associated with increased anxiety.[2,23]

Occupational Factor

Not working or losing a job during the pandemic was associated with increased anxiety in 4 studies[18,21,23,24] but not in one study.[25] Working as farmers[26] and civil servants[20] was a protective factor for anxiety.

Lifestyle Factor

Physical inactivity was associated with anxiety.[24] On the other hand, being physically active was a protective factor.[20,22,27] In particular, Lin et al.[22] stated that the interaction between lack of time for physical exercise (< 30 minutes per day) and sleep (< 7 hours per day), and spending more than one hour per day on social media increased the prevalence of anxiety in pregnant women. Sitting more than 10 hours per day and drinking alcohol were also associated with increased anxiety.[18]

Physiological Factors

Nine articles discussed pregnancy complications and comorbidities and their association with anxiety. The result was consistent. Pregnancy complications and comorbidities were associated with increased anxiety in pregnant women.[2,15–18,20,21,25,26,28,29] Planning for vaginal delivery is a protective factor for anxiety.[18]

Sleep time more than 6 hours per day was a protective factor for anxiety. The longer sleep time, the lower the anxiety,[20] and the lower the sleep time (< 7 hours per day), the higher the anxiety.[30] Further, inconsistent time to sleep, sleep after 00:00, and difficulty initiating sleep was associated with anxiety.[30] Subjective poor sleep quality was also associated with anxiety.[30,31] Research by Mei et al.[29] stated that obesity was protective against anxiety. However, this finding was not consistent with Liu et al.'s[15] research, which stated that obesity and overweight were risk factors for anxiety.

Psychological Factor

Three articles consistently stated that a previous history of anxiety and depression was associated with high anxiety in pregnant women during the pandemic.[23,32,33] Good knowledge of COVID-19[28,34] and its prevention,[15] the simplicity of mothers accessing antenatal information from hospitals,[28] and trust in official government media as sources of information were protective factors for anxiety.[2,34]

On the other hand, mothers who did not receive information about the impact of COVID-19 on pregnancy and mothers who did not receive information from doctors/nurses/midwives about the impact of COVID-19 on the baby's health experienced increased anxiety.[24]

Response to Trauma

The perception of COVID-19's severe impact on their lives [17,26,27,30] or their psychological well-being[30] was associated with increased anxiety. In addition, the perceived susceptibility was also associated with anxiety, both concern for oneself[22,34] and the baby.[31,35]

Mothers who felt uncomfortable during antenatal visits and mothers who did not delay/reduce the number of antenatal visits were associated with higher anxiety.[24,34] In addition, worrying about pandemic control and being afraid to leave the house were also associated with increased anxiety.[2] In contrast, self-efficacy was associated with lower anxiety.[26]

High levels of stress during the pandemic and its relationship with high anxiety levels in pregnant women were described in three articles.[16,31,32] Worrying about the baby, family, friends, and financial adequacy was also associated with higher anxiety levels.[15,26,27] Conversely, not worrying about contracting COVID-19 was associated with less anxiety in pregnant women.[34]

Relational Factor

Social restriction due to the pandemic increased the anxiety level of pregnant women.[23,35] Family dysfunction, tension with partners, and lack of support from others during the pandemic were associated with increased anxiety.[16,18] On the other hand, high support from a spouse,[30,35] family,[22,33] and generally, was associated with lower anxiety levels.[17,21,35]

Quantitative Synthesis

Anxiety Prevalence

The range of anxiety prevalence was 10 to 65% (k=21), and the pooled prevalence of anxiety was 28% (95%CI; 23-33; N=42,177). There was a significant study heterogeneity (Q = 3150.66; P < .001 and I^2 = 99.62%); hence the most appropriate model used to analyze was a random-effect model. The meta-regression results showed that the country of origin variable significantly moderated the existing heterogeneity (P < .001). There were significant differences in anxiety prevalence between groups of China, Turkey, Iran, and others. The prevalence of anxiety was higher in Turkey (63%, 95% CI, 60-66), followed by other countries (39%, 95% CI, 15-62), China (22%, 95% CI, 17-27), and finally Iran (20%, 95% CI, 17-23). The forest plot of prevalence was presented in figure 1.

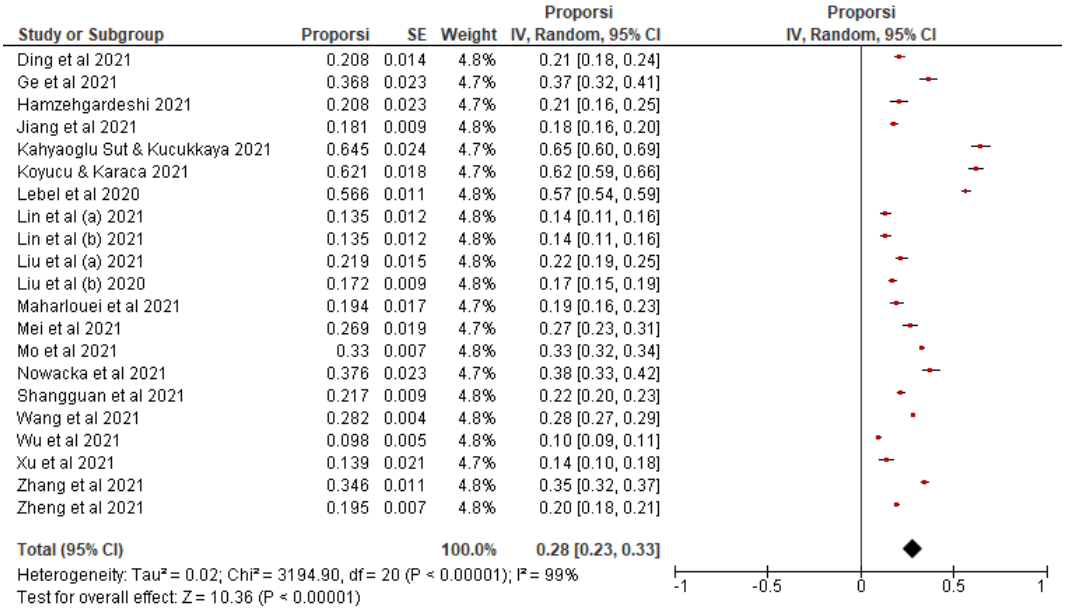

Figure 1. Forest Plot of Prevalence of the Anxiety

In this study, the pooled prevalence for anxiety in pregnant women during the pandemic from 21 studies was 28%. This result is higher than the systematic review of antenatal anxiety before the pandemic (1950 - 2016) proposed by Dennis et al.[36], which is 22.9% (95% CI; 20.25-25.2; N = 142,833) but not much different from the prevalence of anxiety in the general population during the COVID-19 pandemic of 27.3% (95% CI: 23.7-31.2; N = 140,732)[37] and 31.9% (95%CI; 27.5-36.7; N = 63,439).[38]

However, the prevalence of anxiety in pregnant women in this study was lower than other systematic reviews during the pandemic conducted by Yan et al.,[8] (37%, 95%CI; 25-49; N = 20,569). One of the possible causes was the origin of the study. In this study, most studies came from China (k = 14, 67%). Cross-cultural aspects influence this difference in anxiety levels. Contextual factors, how one perceives one's body, and dependence on others influence anxiety. Considering this condition, people in Asia generally have lower anxiety levels than other races in the world.[39] This finding is consistent with data from WHO which shows that the prevalence of anxiety in the Asian region is relatively low compared to other countries in the world.[40]

Factors Associated with Anxiety

Twelve studies contribute to 18 factors of anxiety in pregnant women during the pandemic. Of the 18 factors, only nine gave significant results (8 risk factors and one protective factor). They were marital status, monthly income, screen time, history of COVID-19 exposure, pregnancy complications, sleep duration, sleep quality, perceived susceptibility, and trust in the official government social media. Heterogeneity in each study varied, ranging from 0% to 93%. A summary of the combined effects can be seen in table 3.

Table 3. Summary of 18 Articles Included in the Meta-Analysis of Risk and Protective Factors

Factors	No of studies (k)	Combined sample size	*Pooled* OR (95% CI)	*P* Value	I^2 (%)
High school education/ lower	6	9107	1.18 (0.82-1.69)	.37	89
Not married/ divorced/ widowed	2	4185	2,20 (1.59-3.04)	**<.001**	0
Age ≥ 35 y.o	4	5717	1.11 (0.64-1.94)	.70	77
Monthly income < 5000 CNY (~780 USD)	2	2545	1.31 (1.09-1.57)	**.004**	0
Screen time ≥ 3 hours/ day	2	2545	1.89 (1.43-2.51)	**<.001**	0
History of exposure to COVID-19	3	3137	1.96 (1.39-2.76)	**<.001**	0
Not working during pandemic	6	9260	1.20 (0.97-1.50)	.10	58
Work as civil servant	2	2160	1.67 (0.75-3.75)	.21	90
Daily physical exercise	2	4185	0.59 (0.23-1.53)	.28	93
3rd Trimester	9	10,960	1.14 (0.93-1.40)	.22	68
Multipara	7	9924	0.92 (0.74-1.14)	.45	73
Complications and Comorbidities	8	11,394	1.77 (1.39-2.24)	**<.001**	66
Sleep duration <7 hours/ day	2	2545	1.51 (1.12-2.02)	**.007**	27
Subjective poor sleep quality	2	1025	7.35 (2.11-25.57)	**.002**	87
Prepregnancy *Overweight*/ obesity	2	3509	1.71 (0.59-5.01)	.33	93
Official media trust	2	2764	0.65 (0.52-0.81)	**<.001**	0
High risk of susceptibility	3	1842	3.91 (2.37-6.45)	**<.001**	0
Live in the city	2	2081	0.89 (0.40-1.99)	.78	84

Abbreviations: CNY, Chinese Yuan; OR, Odds Ratio; USD, United States Dollar.

The risk of cross-study bias was assessed using an Egger and Begg regression test and the Fail-Safe N value. The p-value in the regression test is *.14*, which means that there was no bias in the publication of the meta-analysis study. The Fail Safe-N score in this study was 92,340 with $P < .001$. Because the value of 5k+10 (115) is less than the Fail Safe-N value, it can be concluded that there was no publication bias problem in this study.

DISCUSSION

In this study, the pooled prevalence for anxiety in pregnant women during the pandemic from 21 studies was 28%. This result is higher than the systematic review of antenatal anxiety before the pandemic (1950 - 2016) proposed by Dennis et al.[36], which is 22.9% (95% CI; 20.25-25.2; N = 142,833) but not much different from the prevalence of anxiety in the general population during the COVID-19 pandemic of 27.3% (95% CI: 23.7-31.2; N = 140,732) [37] and 31.9% (95%CI; 27.5-36.7; N = 63,439) [38].

However, the prevalence of anxiety in pregnant women in this study was lower than other systematic reviews during the pandemic conducted by Yan et al.[8], (37%, 95%CI; 25-49; N = 20,569). One of the possible causes was the origin of the study. In this study, most studies came from China (k = 14, 67%). The results of the sub-group analysis showed that in the group of studies from China, the prevalence of anxiety tended to be lower (22%), while in the study by Yan et al., only 4 studies were from China. Another 9 studies were from Canada, Italy, and other countries. Consistently, the results of studies by Yan et al [8], also show that the prevalence of anxiety in China is lower (33%) than in other countries (Canada 37%, Italy 49%). Cross-cultural aspects influence this difference in anxiety levels. Contextual factors, how one perceives one's body, and dependence on others influence anxiety. Considering this condition, people in Asia generally have lower anxiety levels than other races in the world [39]. This finding is consistent with data from WHO which shows that the prevalence of anxiety in the Asian region is relatively low compared to other countries in the world [40].

Based on the results of the narrative synthesis, sociodemographic factors that are consistently associated with increased anxiety are living near the pandemic's epicenter, experiencing lockdown, low income, poor economic level, and unmarried/divorced/widow status. However, only marital status and low-income factors are supported by data from the meta-analysis. This can happen because not all studies use the same variables to assess anxiety risk factors, and not all studies provide sociodemographic data.

From the narrative and quantitative synthesis results, the protective factor for pregnant women's anxiety is public trust in the official government media. It was explained before that obtaining too much information from various media during the pandemic led to increased anxiety.[22,23,41] However, if the duration can be controlled and social media was used to get information about COVID-19 from the government and hospitals, it could reduce anxiety.[2,28,34] Public trust in the national media has a protective effect on anxiety.[42] On the other hand, the perception of COVID-19 politicization and the number of confusing news sources related to COVID-19 are related to anxiety.[43] Hence, it is hoped that public health messages announced by the government must also provide solutions with one consistent message and from one source to increase trust.

Strengths and Limitations of the Study

This study involved quite a lot of articles (k=21). However, there is high heterogeneity between studies. In addition, the definition of a variable as a risk factor is also inconsistent between studies. These differences make it challenging to compare age, education level, parity, and trimester from one study to another.

Another limitation of this study is the use of various measuring instruments and differences in the cut-off value of anxiety even with the same measuring instrument. Almost all studies use a self-report questionnaire that can increase the possibility of bias in answering and is not a standard in determining the diagnosis of anxiety. However, this method is still acceptable for use as an initial screening. Another limitation of this study lies in the design of the articles of included studies. All studies used a cross-sectional design, so we can not conclude the causal relationship.

Most studies use online questionnaires with potential selection bias that limit the possibility of subjects with no internet connection being involved in the study. As a result, we must not generalize the finding without cautions.[44,45] However, several authors have described the methods used to reduce bias in using this online questionnaire, including telephone contact for willingness to fill out a questionnaire and the use of previously validated questionnaires. However, given that in the context of a pandemic and physical contact restrictions, online questionnaires are the best option to collect data without the risk of contracting the disease.

The strength of this study lies in the size of the combined sample and the comprehensive discussion of anxiety during pregnancy exclusively in which, to the best of our knowledge, is the first systematic review to address anxiety and specific risk factors during pregnancy with a meta-analysis. In addition, the exclusion of low-quality articles also minimizes the possibility of bias towards the study results.

CONCLUSIONS

Our findings from this research can emphasize that pregnant women's services at Public Health Centers, Hospitals, Clinics, Private Practice Midwives, and other service places must consider the anxiety factor. This research can also serve as a guideline to identify pregnant women at risk of experiencing anxiety, which is essential during this pandemic given the high level of anxiety and the magnitude of the impact. Screening for anxiety is recommended when the mother has an antenatal visit as it was shown a good result in previous study.[46] This study's limited source of articles with only a cross-sectional design indicates the need for a better design, such as a cohort or case-control, to better assess anxiety and conclude causality. Future research designs should also pay attention to and minimize bias when forced to use online questionnaires.

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Dear Editorial Team,

I am attaching the manuscript that I have proofread. I found only one point that is incorrect, which is the author's name. The correct name is "Muji Sulistyowati", but it is written as Muji **Sulityowati**.

I have highlighted the incorrect section and kindly request that you make the necessary correction.

Thank you for your attention to this matter.

Best regards,

Cyntia Puspa Pitaloka
Petra Christian University

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- - -
Salam,
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On 20 Nov 2024, at 13.43, CYNTIA PUSPA PITALOKA <cyntia.pitaloka@petra.ac.id> wrote:

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Petra Christian University

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On 18 Nov 2024, at 09.49, Support Inajog <support@inajog.com> wrote:

Literature Review

Anxiety in Pregnant Women During the Covid-19 Pandemic

Cyntia Puspa Pitaloka[1], Brahmana Askandar Tjokroprawiro[2], Muji Sulityowati[3]

[1]Faculty of Medicine, Petra Christian University
[2]Departement of Obstetrics and Gynecology Dr. Soetomo General Academic Hospital Faculty of Medicine Universitas Airlangga, Surabaya
[3]Department of Health Promotion Faculty of Public Health Universitas Airlangga Surabaya

Abstract

Objective: This study systematically reviewed and meta-analysis the prevalence and factors associated with anxiety in pregnant women during the pandemic.

Methods: We searched PubMed MEDLINE, Web of Science, Scopus, ProQuest, EBSCO, Science Direct, and Garuda journal databases in July 2021 and updated them in October 2021. All articles from December 2019 and the English and Bahasa Journal articles were included in the search. We included studies that investigate factors affecting anxiety exclusively in pregnant women. The primary outcome was the prevalence ratio. The secondary outcome was the risk and protective factors as the independent variable. Joanna Briggs Institute Critical Appraisal Tools and RevMan 5.4 were used for the analysis.

Results: After screening 2082 articles, we included 21 studies with 42.177 pregnant women. The pooled prevalence of anxiety was estimated at 28% (95% CI, 23-33.3). We found that 12 of the 21 studies contributed to 8 risks and one protective factor in the meta-analysis. Not married/divorced/widowed, monthly income < 780 USD, screen time > 3 hours/day, history of exposure to COVID-19, complications in the current pregnancy, sleep less than 7 hours per day, subjective poor sleep quality, and high perception of vulnerability were risk factors. Meanwhile, the protective factor was trust in the government's official media.

Conclusion: There is a significant increase in the prevalence of maternal anxiety during the pandemic. Mental health screening during the antenatal visit must be carried out, and interventions to lower the anxiety level must be planned to prevent further harm.

Keywords: anxiety, COVID-19, mental health, pandemics, pregnancy.

Correspondence author. Cyntia Puspa Pitaloka. Faculty of Medicine, Petra Christian University.
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INTRODUCTION

The COVID-19 pandemic causes psychological distress and fear in some individuals due to periods of isolation, quarantine, and hospitalization[1]. As one of the vulnerable populations, pregnant women experience increased anxiety, which has been reported in various countries[2–4]. Anxiety is a normal response to threats and is an attempt to save oneself [5]. However, there will be interference if the response is excessive.

In pregnant women, anxiety is associated with an increased risk of obstetrics problems, cesarean delivery, increased chances of preterm birth, small for gestational age, and smaller infant head circumference[6], including premature rupture of the membrane[7] If not prevented, anxiety during pregnancy could lead to more extensive harm. Therefore, knowing the risk and protective factors for anxiety during pregnancy is essential, especially during a pandemic.

Several systematic literature reviews discussed the psychological impact of COVID-19 on pregnant and postpartum women during the pandemic[8,9]. However, none specifically discusses the prevalence of anxiety during pregnancy and its determinants using a systematic review accompanied by a meta-analysis method. Therefore, this study aims to systematically review risk and protective factors, estimate the

pooled effect size of risk and protective factors, and estimate the pooled prevalence of anxiety in pregnant women during the COVID-19 pandemic.

METHODS

The organization of this manuscript followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines[10], and the research protocol was registered in PROSPERO CRD42021270107. The literature search was carried out in July – August 2021 and updated in October 2021. We used PUBMED Medline, Web of Science, Scopus, Science Direct, ProQuest, EBSCOhost, and the Garuda journal database to conduct our search.

The search for titles and abstracts was carried out systematically using the thesaurus and MeSH. Combination of keywords: pregnant*, antenatal, prenatal, perinatal, maternal, gravid, prepartum, peripartum, antepartum, expectant mother, anxiety, worry, mental health, stress, distress, COVID, Coronavirus, Wuhan virus, Wuhan Pneumonia, SARS-CoV-2, 2019-nCOV, and pandemic both in English and Bahasa were used. All English and Bahasa journal articles from December 2019 to July 2021 were included in the search.

The Population, Intervention/Exposure, Comparison, Outcome, and Study design frameworks were used to clarify the inclusion and exclusion criteria (see Table 1).

Table 1. PICOS Design Frameworks

	Inclusion	Exclusion
Population	Studies on pregnant women only or pregnant and postpartum women	Studies that did not dissociate pregnant and postpartum women in the analysis.
Intervention/ Exsposure	COVID-19 pandemic	
Comparator		
Outcome	The primary outcome was the prevalence of anxiety among pregnant women. The secondary outcome was the risk and protective factors as the independent variable and anxiety as the dependent variable with Odds Ratio/ Prevalence Odds Ratio, p <0.05, and 95% CI.	Studies only mention descriptive analysis for the outcome and studies that combine anxiety and other mental health problems as the dependent variable.
Study Design	Cross-sectional, case-control. cohort	Reviews, editorials, letters, opinions, purely qualitative studies, conferences, and proceedings.

The articles obtained from the initial search were then imported into Rayyan[11], checked for duplication and screened. Preliminary screening through titles and abstracts was carried out independently by CPP. After selecting the title and abstract, the full text of potential articles was screened based on the data extraction compared to inclusion and exclusion criteria. Articles that did not meet the requirements were removed with a description of the reason. In case of doubt, CPP consulted with other reviewers (BAT, MS). Articles that did not provide access to the full text were excluded.

According to the study design, articles passed the title, abstract, and full-text screening process, then assessed for quality using the Joanna Briggs Institute (JBI) Critical Appraisal Tools[12] and scored. Articles that did not meet the minimum cut-off value of included studies (50%) were excluded to prevent bias due to study quality.

Th data extraction process is carried out by CPP independently. Studies containing statistical data were synthesized quantitatively during the meta-analysis. The combined prevalence was calculated using the proportion formula for pregnant women with anxiety disorders based on the cut-off score of the anxiety measurement instrument provided in the article. Because one article can contain more than one risk factor, each risk factor was analyzed separately. Articles that did not report odds ratio but had 2x2 table data were included in the meta-analysis.

Revman 5.4 software was used to analyze the data. The heterogeneity assessment used the I2 test (I2 > 50%) and the Q test.[13] The random-effects model was used in heterogeneous study conditions otherwise, the fix-effects model was used. The prevalence and 95% confidence intervals for each study were presented in a forest plot. Jamovi 2.0 software was used to assess publication bias by using the Egger and Begg test and the Fail Safe-N test result.[14] The significance of publication bias was obtained when the $P < .05$.

RESULTS

In the initial search, 2802 articles were obtained from 7 journal databases, leaving 21 articles to synthesize the narrative quantitatively after screening. All 21 articles were cross-sectional, with China being the most studied country (66.67%). The two most widely used measuring instruments were GAD-7 (Generalized Anxiety Disorder-7) and SAS (Zung Self-rating Anxiety Scale), with 38.09% each. There were nine articles with a sample size of >1000 pregnant women. Based on the JBI assessment, two studies scored 100%, and five scored 62.5%. The summary of the characteristics of the study is provided in Table 2.

Table 2. Summary of Study Characteristics of 21 Articles Included in the Analysis

Characteristics	n (%)
Study design	
Cross-Sectional	21 (100)
Country of origin	
China	14 (66.67)
Turkey	2 (9.52)
Poland	1 (4.76)
Canada	1 (4.76)
United States	1 (4.76)
Iran	2 (9.52)
Publication year	
2020	2 (9.52)
2021	19 (90.48)
Time of data collection	
The first 6 months of pandemic	19 (90.48)
After 6 months of pandemic	2 (9.52)
Methods of data collection	
Online questionnaire	16 (76.19)
Physical questionnaire	5 (23.81)
Anxiety measurement instruments	
GAD-7	8 (38.09)
SAS	8 (38.09)
HADS-A	1 (4.76)
PROMIS	1 (4.76)
PRAQ	1 (4.76)
DASS-A	2 (9.52)
Sample size	
< 500	5 (23.81)
501 – 1000	7 (33.33)
> 1000	9 (42.86)

Abbreviations: DASS-A, The Depression Anxiety and Stress Scale-Anxiety subscale; GAD-7, Generalized Anxiety Disorder-7; HADS-A, Hospital Anxiety and Depression Scale-Anxiety subscale; PRAQ, Pregnancy Related Anxiety Questionnaire; PROMIS, Patient Reported Outcomes Measurement System; SAS, Self-report Anxiety Scale

Narrative Synthesis

Sociodemographic factors

There were four modifiable sociodemographic factors associated with anxiety. The first was a residential area. Living in a pandemic epicentre location[15,16] or experiencing a lockdown in the place of residence[17] was associated with increased anxiety. The second was socioeconomic status. During the pandemic, the decline in income was associated with anxiety, with higher declines leading to higher anxiety.[18] Lower income (< 780 USD/ month or 7000 USD/ year) was associated with increased anxiety.[19,20]

On the other hand, higher income and a better economic level were protective factors for anxiety.[15,21] The third factor was education, but this study's findings indicate inconsistencies in the variables and outcomes of the effect of education on anxiety. The fourth factor related to anxiety was marital status. Unmarried/divorced/ widowed had a higher risk of anxiety.[18] Age was positively correlated with anxiety in some studies, but the results were inconsistent across studies.

Environmental Exposure Factors

The time spent watching television and cell phones, more than 3 hours per day, was associated with high anxiety in pregnant women. The longer the time spent, the higher the risk of anxiety,[20] especially when watching the news about COVID-19.[22] Increased use of social media was also associated with anxiety.[23] On the other hand, less than 2 hours of screen time was a protective factor even when accompanied by lack of sleep.[20] The presence of COVID-19 infection in close relatives was associated with anxiety.[17] The presence of suspected or confirmed cases around[22], family members who died from COVID-19,[15] and COVID-19 infection during pregnancy was associated with increased anxiety.[2,23]

Occupational Factor

Not working or losing a job during the pandemic was associated with increased anxiety in 4 studies[18,21,23,24] but not in one study.[25] Working as farmers[26] and civil servants[20] was a protective factor for anxiety.

Lifestyle Factor

Physical inactivity was associated with anxiety.[24] On the other hand, being physically active was a protective factor.[20,22,27] In particular, [22]

the interaction between lack of time for physical exercise (< 30 minutes per day) and sleep (< 7 hours per day), and spending more than one hour per day on social media increased the prevalence of anxiety in pregnant women. Sitting more than 10 hours per day and drinking alcohol were also associated with increased anxiety.[18]

Physiological Factors

Nine articles discussed pregnancy complications and comorbidities and their association with anxiety. The result was consistent. Pregnancy complications and comorbidities were associated with increased anxiety in pregnant women.[2,15–18,20,21,25,26,28,29] Planning for vaginal delivery is a protective factor for anxiety.[18]

Sleep time of more than 6 hours per day was a protective factor for anxiety. The longer sleep time, the lower the anxiety,[20] and the lower the sleep time (< 7 hours per day), the higher the anxiety.[30] Further, inconsistent time to sleep, sleep after 00:00, and difficulty initiating sleep was associated with anxiety.[30] Subjective poor sleep quality was also associated with anxiety.[30,31] Research[29] stated that obesity was protective against anxiety. However, this finding was not consistent with [15] research, which stated that obesity and overweight were risk factors for anxiety.

Psychological Factor

Three articles consistently stated that a previous history of anxiety and depression was associated with high anxiety in pregnant women during the pandemic.[23,32,33] Good knowledge of COVID-19[28,34] and its prevention,[15] the simplicity of mothers accessing antenatal information from hospitals,[28] and trust in official government media as sources of information were protective factors for anxiety.[2,34]

On the other hand, mothers who did not receive information about the impact of COVID-19 on pregnancy and mothers who did not receive information from doctors/nurses/midwives about the impact of COVID-19 on the baby's health experienced increased anxiety.[24]

Response to Trauma

The perception of COVID-19's severe impact on their lives [17,26,27,30] or their psychological well-being[30] was associated with increased anxiety. In addition, the perceived susceptibility was also associated with anxiety, both concern for oneself[22,34] and the baby.[31,35]

Mothers who felt uncomfortable during antenatal visits and mothers who did not delay/reduce the number of antenatal visits were associated with higher anxiety.[24,34] In addition, worrying about pandemic control and being afraid to leave the house were also associated with increased anxiety.[2] In contrast, self-efficacy was associated with lower anxiety.[26]

High levels of stress during the pandemic and its relationship with high anxiety levels in pregnant women were described in three articles.[16,31,32] Worrying about the baby, family, friends, and financial adequacy was also associated with higher anxiety levels.[15,26,27] Conversely, not worrying about contracting COVID-19 was associated with less anxiety in pregnant women.[34]

Relational Factor

Social restrictions due to the pandemic increased the anxiety level of pregnant women.[23,35] Family dysfunction, tension with partners, and lack of support from others during the pandemic were associated with increased anxiety.[16,18] On the other hand, high support from a spouse,[30,35] family,[22,33] and generally, was associated with lower anxiety levels.[17,21,35]

Quantitative Synthesis

Anxiety Prevalence

The range of anxiety prevalence was 10 to 65% (k=21), and the pooled prevalence of anxiety was 28% (95%CI; 23-33; N=42,177). There was a significant study heterogeneity (Q = 3150.66; P < .001 and I2 = 99.62%); hence, the most appropriate model used to analyze was a random-effect model. The meta-regression results showed that the country of origin variable significantly moderated the existing heterogeneity (P < .001). There were significant differences in anxiety prevalence between groups from China, Turkey, Iran, and others. The prevalence of anxiety was higher in Turkiye (63%, 95% CI, 60-66), followed by other countries (39%, 95% CI, 15-62), China (22%, 95% CI, 17-27), and finally Iran (20%, 95% CI, 17-23). The forest plot of prevalence is presented in Figure 1.

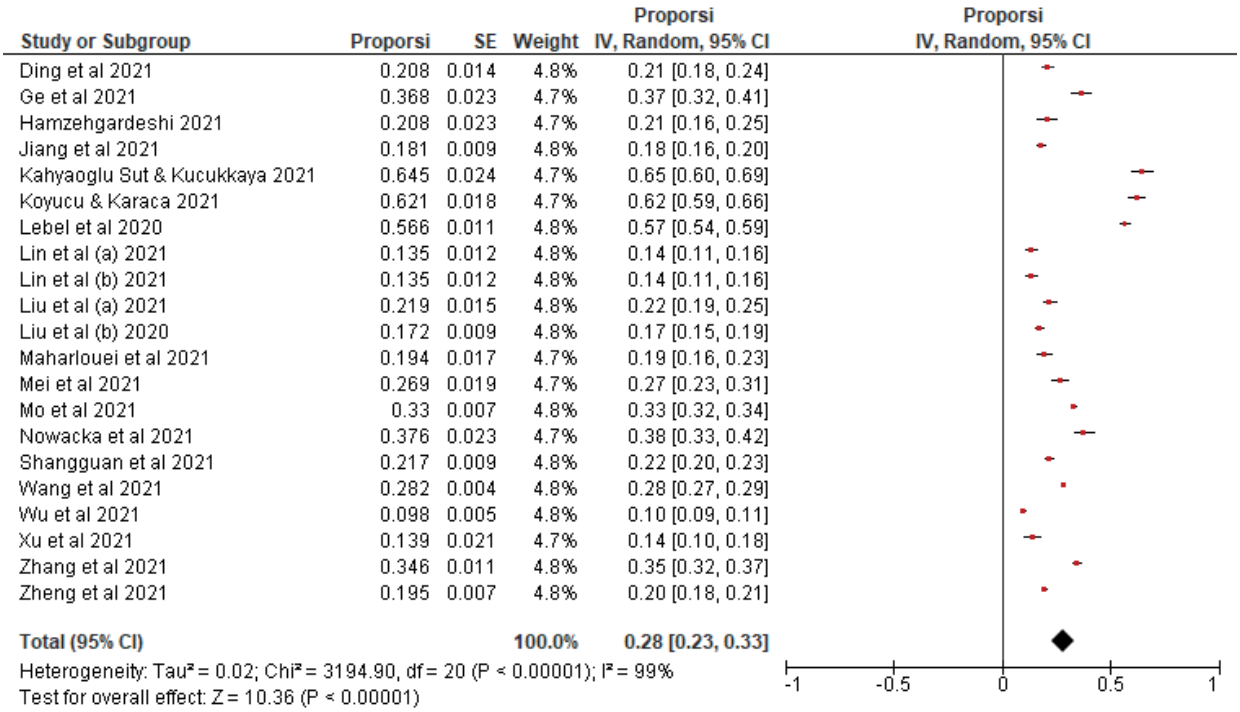

Figure 1. Forest Plot of Prevalence of the Anxiety

In this study, the pooled prevalence of anxiety in pregnant women during the pandemic from 21 studies was 28%. This result is higher than the systematic review of antenatal anxiety before the pandemic (1950 - 2016) [36], which is 22.9% (95% CI; 20.25-25.2; N = 142,833) but not much different from the prevalence of anxiety in the general population during the COVID-19 pandemic of 27.3% (95% CI: 23.7-31.2; N = 140.732)[37] and 31.9% (95%CI; 27.5-36.7; N = 63.439).[38]

However, the prevalence of anxiety in pregnant women in this study was lower than other systematic reviews during the pandemic [8] (37%, 95%CI; 25-49; N = 20.569). One of the possible causes was the origin of the study. In this study, most studies came from China (k = 14, 67%). Cross-cultural aspects influence this difference in anxiety levels. Contextual factors, how one perceives one's body, and dependence on others influence anxiety. Considering this condition, people in Asia generally have lower anxiety levels than other races in the world.[39] This finding is consistent with data from WHO which shows that the prevalence of anxiety in the Asian region is relatively low compared to other countries in the world.[40]

Factors Associated with Anxiety

Twelve studies contribute to 18 factors of anxiety in pregnant women during the pandemic. Of the 18 factors, only nine gave significant results (8 risk factors and one protective factor). They were marital status, monthly income, screen time, history of COVID-19 exposure, pregnancy complications, sleep duration, sleep quality, perceived susceptibility, and trust in the official government social media. Heterogeneity in each study varied, ranging from 0% to 93%. A summary of the combined effects can be seen in Table 3.

Table 3. Summary of 18 Articles Included in the Meta-Analysis of Risk and Protective Factors

Factors	No of studies (k)	Combined sample size	Pooled OR (95% CI)	*P-value*	I^2 (%)
High school education/ lower	6	9107	1.18 (0.82-1.69)	.37	89
Not married/ divorced/ widowed	2	4185	2,20 (1.59-3.04)	<.001	0
Age > 35 y.o	4	5717	1.11 (0.64-1.94)	.70	77
Monthly income < 5000 CNY (~780 USD)	2	2545	1.31 (1.09-1.57)	.004	0
Screen time > 3 hours/ day	2	2545	1.89 (1.43-2.51)	<.001	0
History of exposure to COVID-19	3	3137	1.96 (1.39-2.76)	<.001	0
Not working during pandemic	6	9260	1.20 (0.97-1.50)	.10	58
Work as civil servant	2	2160	1.67 (0.75-3.75)	.21	90
Daily physical exercise	2	4185	0.59 (0.23-1.53)	.28	93
3rd Trimester	9	10,960	1.14 (0.93-1.40)	.22	68
Multipara	7	9924	0.92 (0.74-1.14)	.45	73
Complications and Comorbidities	8	11,394	1.77 (1.39-2.24)	<.001	66
Sleep duration <7 hours/ day	2	2545	1.51 (1.12-2.02)	.007	27
Subjective poor sleep quality	2	1025	7.35 (2.11-25.57)	.002	87
Prepregnancy Overweight/ obesity	2	3509	1.71 (0.59-5.01)	.33	93
Official media trust	2	2764	0.65 (0.52-0.81)	<.001	0
High risk of susceptibility	3	1842	3.91 (2.37-6.45)	<.001	0
Live in the city	2	2081	0.89 (0.40-1.99)	.78	84

Abbreviations: CNY, Chinese Yuan; OR, Odds Ratio; USD, United States Dollar.

The risk of cross-study bias was assessed using an Egger and Begg regression test and the Fail-Safe N value. The p-value in the regression test is .14, which means that there was no bias in the publication of the meta-analysis study. The Fail Safe-N score in this study was 92,340 with P < .001. Because the value of 5k+10 (115) is less than the Fail Safe-N value, it can be concluded that there was no publication bias problem in this study.

DISCUSSION

In this study, the pooled prevalence of anxiety in pregnant women during the pandemic from 21 studies was 28%. This result is higher than the systematic review of antenatal anxiety before the pandemic (1950 - 2016)[36], which is 22.9% (95% CI; 20.25-25.2; N = 142.833) but not much different from the prevalence of anxiety in the general population during the COVID-19 pandemic of 27.3% (95% CI: 23.7-31.2; N = 140,732) [37] and 31.9% (95%CI; 27.5-36.7; N = 63,439) [38].

However, the prevalence of anxiety in pregnant women in this study was lower than other systematic reviews during the pandemic.[8], (37%, 95%CI; 25-49; N = 20,569). One of the possible causes was the origin of the study. In this study, most studies came from China (k = 14, 67%). The results of the sub-group analysis showed that in the group of studies from China, the prevalence of anxiety tended to be lower (22%), while in the study by Yan et al., only four studies were from China. Another nine studies were from Canada, Italy, and other countries. Consistently, the results of studies [8], also show that the prevalence of anxiety in China is lower (33%) than in other countries (Canada 37%, Italy 49%). Cross-cultural aspects influence this difference in anxiety levels. Contextual factors, how one perceives one's body, and dependence on others influence anxiety. Considering this condition, people in Asia generally have lower anxiety levels than other races in the world [39]. This finding is consistent with data from WHO, which shows that the prevalence of anxiety in the Asian region is relatively low compared to other countries in the world [40].

Based on the results of the narrative synthesis, sociodemographic factors that are consistently associated with increased anxiety are living near the pandemic's epicentre, experiencing lockdown, low income, poor economic level, and unmarried/divorced/widow status. However, only marital status and low-income factors are supported by data from the meta-analysis. This can happen because not all studies use the same variables to assess anxiety risk factors, and not all studies provide sociodemographic data.

From the narrative and quantitative synthesis results, the protective factor for pregnant women's anxiety is public trust in the official government media. It was explained before that obtaining too much information from various media during the

pandemic led to increased anxiety.[22,23,41] However, if the duration can be controlled and social media is used to get information about COVID-19 from the government and hospitals, it could reduce anxiety.[2,28,34] Public trust in the national media has a protective effect on anxiety.[42] On the other hand, the perception of COVID-19 politicization and the number of confusing news sources related to COVID-19 are related to anxiety.[43] Hence, it is hoped that public health messages announced by the government must also provide solutions with one consistent message and from one source to increase trust.

Strengths and Limitations of the Study

This study involved quite a lot of articles (k=21). However, there is high heterogeneity between studies. In addition, the definition of a variable as a risk factor is also inconsistent between studies. These differences make it challenging to compare age, education level, parity, and trimester from one study to another.

Another limitation of this study is the use of various measuring instruments and differences in the cut-off value of anxiety even with the same measuring instrument. Almost all studies use a self-report questionnaire that can increase the possibility of bias in answering and is not a standard in determining the diagnosis of anxiety. However, this method is still acceptable for use as an initial screening. Another limitation of this study lies in the design of the articles included in the study. All studies used a cross-sectional design, so we can not conclude the causal relationship.

Most studies use online questionnaires with potential selection bias that limits the possibility of subjects with no internet connection being involved in the study. As a result, we must not generalize the findings without caution.[44,45] However, several authors have described the methods used to reduce bias in using this online questionnaire, including telephone contact for willingness to fill out a questionnaire and the use of previously validated questionnaires. However, given that in the context of a pandemic and physical contact restrictions, online questionnaires are the best option to collect data without the risk of contracting the disease.

The strength of this study lies in the size of the combined sample and the comprehensive discussion of anxiety during pregnancy exclusively, which, to the best of our knowledge, is the first systematic review to address anxiety and specific risk factors during pregnancy with a meta-analysis. In addition, the exclusion of low-quality articles also minimizes the possibility of bias towards the study results.

CONCLUSIONS

Our findings from this research can emphasize that pregnant women's services at Public Health Centers, Hospitals, Clinics, Private Practice Midwives, and other service places must consider the anxiety factor. This research can also serve as a guideline to identify pregnant women at risk of experiencing anxiety, which is essential during this pandemic, given the high level of anxiety and the magnitude of the impact. Screening for anxiety is recommended when the mother has an antenatal visit as it was shown a good result in a previous study.46 This study's limited source of articles with only a cross-sectional design indicates the need for a better design, such as a cohort or case-control, to better assess anxiety and conclude causality. Future research designs should also pay attention to and minimize bias when forced to use online questionnaires.

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