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Examining the relative importance of factors influencing perinatal anxiety in different perinatal periods during the Covid-19 pandemic: a random forest-based approach

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1. INTRODUCTION AND RESEARCH QUESTIONS

Since December 2019, Covid-19 has spread rapidly and widely around the world and quickly became a global pandemic. In a high-risk and stressful environment caused by infectious disease outbreaks, people tend to feel fear and uncertainty and are prone to a range of psychological problems and physical symptoms [1]. During the Covid-19 pandemic, the public was found to have more severe mental health problems than before, with a relatively high prevalence [2]. Due to changes in the level and function of the endocrine system during pregnancy, pregnant women are prone to physical and psychological stress reactions, and psychological stress reactions will lead to different degrees of fear, tension, and other emotions, and these negative emotions will make pregnant women more psychological disorders such as stress, anxiety, and depression are prone to occur, which have a great impact on the physical and mental health of pregnant women and fetuses. Mei et al. [3] found a higher prevalence of anxiety and depression in pregnant women during the Covid-19 epidemic than before the epidemic. In contrast, a cross-sectional study of 156 participants showed that pregnant women had the same rates of anxiety as before the pandemic and significantly higher rates of depression; Pregnant women living in Wuhan have no higher levels of depression or anxiety than those in other areas [4]. The impact of the COVID-19 pandemic on maternal mental health outcomes has not been fully elucidated.

Therefore, after the outbreak of the new coronavirus, we conducted a survey of maternal mental health in different provinces in China, including Wuhan (the first city of the outbreak, with the largest number of confirmed cases), Beijing (the number of confirmed cases was moderate), Lanzhou (the number of confirmed cases was relatively less). Demographic and COVID-19-related characteristics, such as age, degree of education, and economic loss, were also collected to analyze the mental health status of pregnant women during the Covid-19 pandemic.

2. THEORY AND RESEARCH FRAMEWORK

In this study, four random forest models were established for samples of different gestational periods to identify the influencing factors of maternal anxiety. Use the open-source sci-kit-learn library in Python to implement the random forest algorithm and train the model. Random forests can automatically generate relatively important scores for features, but this score can only be used for variable interpretation, and the extent and direction of the impact of features cannot be known. Therefore, an interpretable machine learning SHAP method is introduced to further explain random forest results.

3. RESULTS AND MAJOR FINDINGS

The study shows that the total anxiety rate of pregnant women is 21.23%, and the anxiety rates of the four pregnancy periods are 21.5%, 19.2%, 21.6%, and 27.2%, respectively. Anxiety prevalence was lowest in the second trimester and highest in postpartum women. For different pregnancy periods, depression and insomnia are the most important factors affecting maternal anxiety, and they all have a positive impact on anxiety, that is,

the higher the scores of depression and insomnia, the higher the risk of maternal anxiety. The study found that the feature importance of maternal anxiety is different in different gestational periods. In addition to depression, insomnia, and any worries or fears during childbirth, attention needs to be paid to women in the first trimester who live in areas with relatively backward economic development (such as Lanzhou) and whose pregnancy status has a greater impact on their actions. For women in the second trimester, special attention needs to be paid to women who have suffered greater economic losses due to the epidemic, live in areas with severe epidemics (such as Wuhan), and younger women who have drinking habits. For women in the third trimester, it is also necessary to pay attention to the impact of pregnancy on the action, greater losses due to the epidemic, and increased frequency of contractions have a greater risk of anxiety. Among postpartum women, the more worries or fears of childbirth, the greater the economic loss, and the older they are, the more likely they are to suffer from anxiety disorders. The results of the study show that there are similarities and differences in the feature importance of maternal anxiety during different pregnancy periods, and more attention should be paid to important factors (such as depression, insomnia, and worries or fears during childbirth) for intervention.

4. CONTRIBUTIONS

Unlike previous studies on a certain period of pregnancy, our study analyzes maternal anxiety throughout the prenatal and postpartum periods, which has stronger integrity and generalization. Second, this study uses a random forest model to analyze maternal anxiety, which enriches the research in this field. Our study also introduced the SHAP method to further explain the precise impact of each factor on maternal anxiety at different gestational trimesters. This study has some limitations. First of all, this study adopts a cross-sectional design, which makes it difficult to compare the changes in the incidence of anxiety before and after the outbreak of Covid-19. At the same time, the cross-sectional design can only explore relevant factors, but it is difficult to draw causal conclusions. Secondly, this study uses Chinese multi-center data samples, which can provide some references for related research in China, but cannot provide sufficient reference significance for other regions. Finally, the postpartum data collected in this study are relatively small, and there may be insufficient research on postpartum anxiety.

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