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Original Research

A Cross-Sectional Study on Knowledge, Attitudes, and Practices Regarding Fetal Distress Among Pregnant Women

Xia Liu[1], Fangyuan Zheng[2,*], Wanting Zeng[1], Yingying Wu[1]

[1]Department of Outpatient, Hangzhou Women's Hospital, 310008 Hangzhou, Zhejiang, China
[2]Department of Obstetrics, Hangzhou Women's Hospital, 310008 Hangzhou, Zhejiang, China
*Correspondence: oywenru1234@163.com (Fangyuan Zheng)

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Abstract

Background: This study focuses on fetal distress, a condition associated with long-term health risks such as diabetes and heart disease. It highlights the crucial role of early detection and management, particularly through improving the knowledge, attitudes, and practices (KAP) of pregnant women. This research aims to assess the KAP regarding fetal distress among pregnant women at a tertiary care hospital in China, with the goal of informing future prevention programs and health education strategies. **Methods**: This cross-sectional study utilized a custom-designed questionnaire focused on the KAP related to fetal intrauterine distress. The survey targeted pregnant women attending prenatal consultations at a specific hospital in China. Influential factors affecting maternal KAP levels toward preventing fetal intrauterine distress were identified through multiple linear regression analysis. **Results**: Out of the 502 questionnaires distributed, all were effectively retrieved, resulting in a 100% response rate. The average knowledge score for fetal distress prevention was 5.00 (2.00). The average attitude score toward fetal distress was 42.00 (8.00), whereas the average behavioral score for prevention was 34.00 (8.00). Multiple linear regression analysis revealed planned pregnancy, educational attainment, and monthly household income per capita were pivotal determinants influencing pregnant women's KAP toward preventing fetal distress ($p < 0.05$). **Conclusions**: Although pregnant women generally adopt a proactive approach to preventing fetal intrauterine distress, limited knowledge hinders the application of this awareness. Key factors, including pregnancy planning, education, and income, significantly affect KAP related to fetal distress prevention, highlighting the need for targeted perinatal education to reduce its incidence.

Keywords: cross-sectional study; fetal distress; knowledge, attitudes, and practices (KAP); pregnancy

1. Introduction

Fetal distress refers to a condition in which the fetus is in a state of danger due to hypoxia or other factors during pregnancy, particularly during labor. The manifestations of fetal distress can include an abnormal fetal heart rate, abnormal amniotic fluid, and reduced fetal movement [1,2]. Intrauterine distress is typically caused by various factors, including placental dysfunction, fetal developmental abnormalities, and insufficient maternal blood flow [3]. According to the World Health Organization (WHO), approximately 2.6 million neonatal deaths occur annually, with many cases related to preventable causes such as intrauterine distress, birth asphyxia, and prematurity [4]. In addition to the immediate physical risks to the fetus, fetal distress can lead to long-term neurological impairments, developmental delays, and an increased risk of chronic diseases such as diabetes and coronary heart disease [5,6], all of which significantly contribute to the global disease burden. Given these long-term consequences, it is crucial to emphasize the importance of the early detection and management of fetal distress. Knowledge, attitudes, and practices (KAP) research can effectively improve the prevention and management of fetal distress by enhancing the knowledge and behaviors of pregnant women and healthcare providers, ultimately reducing associated risks and burdens.

Currently, awareness of the importance of preventing intrauterine distress remains limited among the majority of individuals of childbearing age. Research has demonstrated that health education on intrauterine distress for pregnant women can significantly reduce the negative consequences associated with this condition [7,8]. Consequently, targeted health education and informed interventions aimed at improving the knowledge, attitudes, and practices of pregnant women are essential components of perinatal care. This study seeks to investigate and assess the knowledge, attitudes, and behaviors of pregnant women regarding fetal distress at a tertiary care hospital in China, as well as the key factors influencing these outcomes. The results will inform the development of future fetal distress prevention programs and contribute to the formulation of more effective, targeted health education strategies.

2. Participants and Methods

2.1 Study Participants

This cross-sectional survey utilized convenience sampling to select participants. Pregnant women undergoing antenatal screenings at a hospital in China from September to November 2023 were included. The inclusion criteria were as follows: (1) local permanent residents without se-

vere pregnancy complications or comorbidities, such as severe heart or lung diseases, cervical insufficiency, or severe diabetes complications; (2) singleton pregnancies; (3) being cognitively capable of understanding and participating in the survey; and (4) providing informed consent for participation in the study. The exclusion criteria were as follows: (1) severe pregnancy complications and (2) unwillingness to participate or withdrawal from the study. All participants signed an informed consent form.

2.2 Methods

2.2.1 Survey Instrument

The questionnaire was developed by the researchers after reviewing relevant domestic and international literature [9,10], followed by a pilot survey and subsequent revisions. It consists of two parts: general information about the participant and a questionnaire on KAP regarding fetal intrauterine distress. The questionnaire does not involve any invasion of privacy. (1) The general information included gestational age, first-time pregnancy, planned pregnancy, educational level, occupation, average monthly family income, and concurrent diseases. (2) The KAP questionnaire on fetal intrauterine distress: in accordance with KAP theory and the ACOG guidelines for diagnosing fetal distress [11], this questionnaire was formalized after a preliminary survey. It encompasses three dimensions, namely, knowledge about fetal distress, attitudes toward its prevention, and behaviors for its prevention, with a total of 43 items. The scoring principles for each dimension are as follows: (1) The knowledge assessment on preventing fetal distress consisted of 18 items, with each correct response awarded 1 point, yielding a maximum possible score of 18. Given the limited sample size from a single-center study, and to ensure an accurate evaluation of participants' knowledge and comprehension, a full-correct scoring method was employed. This method helps mitigate the risks of guessing or incomplete understanding among the pregnant women, thereby reducing subjective bias and providing a more reliable measure of their overall mastery of the key knowledge points. (2) Attitudes toward preventing fetal distress includes 13 items, which are scored on a 5-point Likert scale ranging from "strongly disagree" (0 points) to "strongly agree" (4 points), with Items 36, 37, 38, and 39 scored inversely. The total score ranges from 0 to 52 points, with higher scores indicating more proactive attitudes toward prevention. (3) Behaviors for preventing fetal distress consists of 12 items, which are also scored on a 5-point Likert scale, with total scores ranging from 0 to 48 points; higher scores indicate better correctness of behaviors for prevention. The total score of the KAP questionnaire for fetal intrauterine distress ranges from 0 to 118 points, with higher scores indicating better levels of knowledge, attitudes, and practices. The questionnaire has been uploaded as a **Supplementary File**.

2.2.2 Survey Methodology

This study utilized the "Questionnaire Star" platform to create the survey, incorporating automatic logic checks and generating a quick response (QR) code for the questionnaire. This code was displayed at the obstetrics outpatient nurse station and doctor's office. Participation was voluntary, with pregnant women scanning the QR code to fill out the questionnaire. To prevent duplicate responses, internet protocol (IP) restrictions were set, disallowing multiple submissions from the same IP address. Trained investigators used standardized guidance language to assist participants in completing the survey.

2.2.3 Quality Control

(1) Questionnaire design phase: researchers consulted the latest literature to design a paper-based survey, which was reviewed by obstetrics experts. Following approval, a pilot survey was conducted, and the questionnaire was revised, deleted, and supplemented under expert guidance on the basis of the pilot findings, ensuring the questionnaire's comprehensiveness and scientific validity. The final electronic version was created using the "Questionnaire Star" software (Ranxing Information Technology Co., Ltd., Changsha, Hunan, China). (2) Survey phase: investigators were trained prior to the official survey, using a uniform method to introduce the study's purpose, significance, electronic questionnaire completion methods, and precautions. The respondents participated voluntarily to ensure authenticity, and the investigators guaranteed the absolute confidentiality of personal information. Investigators promptly reviewed each submitted electronic questionnaire, addressing any queries or corrections to ensure completeness and accuracy. (3) Data processing and quality control: at the end of each day, the data were exported to an Excel spreadsheet using the "Questionnaire Star" software's export function. Two individuals cross-checked the exported data against the original submissions. After the survey's conclusion, a final cross-check was conducted to ensure the accuracy and authenticity of the exported data.

2.3 Statistical Methods

The data were analyzed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA). The Kolmogorov-Smirnov test was used for the normality test. Quantitative data conforming to a normal distribution are presented as the means $\pm$ standard deviations, and t tests were used for comparisons between two groups. Nonnormally distributed quantitative data are represented by median (interquartile range) values. Count data are presented as frequencies or percentages, and Chi-square tests were used for comparisons. The F test or independent sample t test was used to compare the KAP scores for preventing fetal intrauterine distress among pregnant women with different characteristics. Multiple linear regression analysis identified factors influencing maternal

Table 1. General information about pregnant women.

Factor	Number (%)
Gestational age	
<28 weeks	39 (7.8)
≥28 weeks	463 (92.2)
First pregnancy	
Yes	284 (56.6)
No	218 (43.4)
Planned pregnancy	
Yes	333 (66.3)
No	169 (33.7)
Education level	
Junior high school or below	21 (4.2)
High school or technical secondary school	52 (10.4)
Diploma or undergraduate degree	354 (70.5)
Master's degree or above	75 (14.9)
Occupation	
Civil servant or similar	31 (6.2)
Corporate employee	213 (42.4)
Others	258 (51.4)
Per capita monthly household income	
<687.745 dollars	50 (9.9)
687.745~1375.49 dollars	166 (33.1)
≥1375.49 dollars	286 (57.0)
Pregnancy-related complications	
Yes	132 (26.3)
No	370 (73.7)

KAP levels in preventing fetal intrauterine distress. A p value < 0.05 was considered to indicate statistical significance.

3. Results

3.1 General Information About the Pregnant Women

A total of 502 questionnaires were distributed and effectively collected, yielding a 100% response rate. The study surveyed 502 pregnant women, whose gestational ages ranged from 18 to 40 weeks (34.06 $\pm$ 4.00). The majority (92.2%) were ≥28 weeks pregnant. A significant proportion were experiencing their first pregnancy (56.6%). The majority of participants had planned pregnancies (66.3%), held a diploma or undergraduate degree (70.5%), and had a monthly per capita household income of ≥1375.49 dollars (57.0%). There were 132 pregnant women (26.3%) with pregnancy-related complications, including gestational diabetes, gestational hypertension, subclinical hypothyroidism, and iron deficiency anemia. The detailed distribution of the general information about the pregnant women is shown in Table 1.

3.2 Pregnant Women's Knowledge Scores on Fetal Intrauterine Distress

The score for pregnant women's knowledge of the prevention of fetal intrauterine distress was an average of 5.00 (2.00) points. The highest correct response rates for knowledge about fetal distress were for the questions about the best sleeping position in late pregnancy, awareness of fetal distress, and the normal fetal heart rate range, with correct response rates of 86.3%, 65.3%, and 52.0%, respectively. The lowest correct response rates were for questions about abnormal contractions, signs of fetal distress in fetal movements, and the simplest and most accurate method for assessing fetal distress, with correct response rates of 5.0%, 6.6%, and 20.9%, respectively. The correct response rates for knowledge about fetal intrauterine distress are detailed in Table 2.

3.3 Attitude Scores of Pregnant Women Toward Fetal Intrauterine Distress

The total attitude scores of pregnant women toward fetal intrauterine distress was 42.00 (8.00) points. The top three scoring attitudes were willingness to maintain good rest and lifestyle habits, willingness to manage diet and nutrition, and willingness to proactively learn relevant knowledge. The three lowest scoring attitudes were as follows: reluctance to use medication even with pregnancy complications, belief that regular prenatal check-ups negate the need for remote fetal heart monitoring, and the perception that vaginal delivery is more likely to result in fetal distress. The specific scoring details are provided in Table 3.

3.4 Behavior Scores of Pregnant Women towards Fetal Intrauterine Distress

The total score for pregnant women's behaviors in preventing fetal intrauterine distress was 34.00 (8.00) points on average. The top three scoring behaviors were as follows: attending prenatal check-ups on time, high-risk pregnant women following doctors' advice for active treatment, and strictly adhering to medical prescriptions for medication use. The three lowest scoring behaviors were: using remote fetal heart rate monitoring, regularly acquiring knowledge about fetal distress from various sources, and counting fetal movements daily as advised by doctors. The specific scoring details are provided in Table 4.

3.5 Comparison of the KAP Scores for the Prevention of Fetal Intrauterine Distress Among Pregnant Women with Different Demographic Characteristics

There were statistically significant differences in the KAP scores for the prevention of fetal intrauterine distress among pregnant women with varying demographic characteristics, such as planned pregnancy status, educational level, occupation, and monthly per capita household income ($p < 0.05$). The details are provided in Table 5.

3.6 Multiple Linear Regression Analysis of Factors Affecting the KAP Scores of Pregnant Women in Preventing Fetal Intrauterine Distress

Multiple linear regression analysis was performed with the total KAP score of pregnant women in preventing fetal intrauterine distress as the dependent variable and the

Table 2. Correct response rates for knowledge on fetal intrauterine distress among pregnant women (n = 502).

Question	Number correct (%)
Are you aware of fetal intrauterine distress?	328 (65.3)
What is fetal intrauterine distress?	216 (43.0)
What are the causative factors of fetal distress?	182 (36.3)
Which maternal diseases increase the risk of fetal distress?	165 (32.9)
Which umbilical cord conditions lead to fetal distress?	176 (35.1)
Which placental conditions lead to fetal distress?	155 (30.9)
Which poor lifestyle habits during pregnancy cause distress?	241 (48.0)
What are the signs of acute fetal distress?	139 (27.7)
What are the causes of acute fetal distress?	170 (33.9)
What are the signs of chronic fetal distress?	158 (31.5)
What are the causes of chronic fetal distress?	175 (34.9)
What is the simplest and most accurate method of assessment?	105 (20.9)
What is the normal range for fetal heart rate?	261 (52.0)
What are the signs of abnormal contractions?	25 (5.0)
What is the best sleeping position in late pregnancy?	433 (86.3)
Do you know how to self-monitor fetal movement?	195 (38.8)
What fetal movements indicate distress?	33 (6.6)
What are the possible consequences of fetal distress?	185 (36.9)

Table 3. Attitude scores of pregnant women toward fetal intrauterine distress (n = 502).

Question	Score
	Median (interquartile range)
Do you think fetal intrauterine distress is a common condition in late pregnancy that needs attention?	4.00 (1.00)
Do you think proactive learning about fetal distress prevention is necessary?	4.00 (1.00)
Do you believe personalized guidance from medical personnel is more reliable than other media sources?	4.00 (1.00)
Should good lifestyle habits and regular rest be maintained regardless of complications?	4.00 (0.00)
Should dietary and nutritional management be practiced regardless of complications?	4.00 (0.00)
Should exercise be practiced during pregnancy, barring any contraindications?	4.00 (1.00)
Should personalized management be provided for pregnant women with high-risk factors (such as diabetes, hypertension, heart disease, etc.)?	4.00 (1.00)
Do you think regular prenatal check-ups play an important role in preventing fetal distress?	4.00 (1.00)
Do you think daily self-monitoring of fetal movement can promptly detect distress?	4.00 (1.00)
Should medication be avoided during pregnancy even with complications like hypertension or diabetes?	2.00 (2.00)
Is it hard to accept repeated fetal heart monitoring?	3.00 (1.00)
Is it unnecessary to rent remote fetal heart monitoring if prenatal check-ups are normal?	2.00 (1.00)
Do you think vaginal delivery increases the risk of fetal distress compared to cesarean section?	2.00 (1.00)
Total score	42.00 (8.00)

factors that were statistically significant in the univariate analysis as the independent variables. The results indicated that planned pregnancy, educational level, and per capita monthly household income are significant factors affecting the KAP scores of pregnant women in preventing fetal intrauterine distress ($p < 0.05$). See Table 6 for details.

4. Discussion

This survey indicated that pregnant women's knowledge scores concerning fetal intrauterine distress was only 5 points on average. This suggests limited awareness among the surveyed pregnant women about the prevention of fetal distress, potentially due to restricted access to information, which is influenced by regional economic and healthcare disparities. Crucially, the accuracy of understanding key aspects such as abnormal contraction patterns, indicators of fetal distress in movements, and the most straightforward and accurate assessment methods for fetal distress was notably low. This emphasizes the need for healthcare professionals to intensify education on these topics to improve pregnant women's grasp of related knowledge.

The study also found that the total score for attitudes toward preventing fetal intrauterine distress was 42.00 (8.00) points, and for behaviors, it was 34.00 (8.00) points. These findings demonstrate a generally proactive attitude and behavior among pregnant women in preventing fetal distress. However, lower scores were noted in areas such as the use of remote fetal heart monitoring and seeking information through various channels. This highlights the importance of clinicians raising awareness about remote

Table 4. Behavior scores of pregnant women towards fetal intrauterine distress (n = 502).

Question	Score
	Median (interquartile range)
Do you count fetal movements daily at home as advised by your doctor?	2.00 (1.00)
Do you use remote fetal heart monitoring?	0.00 (1.00)
Do you attend hospital prenatal check-ups on time?	4.00 (0.00)
Do you regularly acquire knowledge about fetal distress through doctors, books, internet, or apps?	1.00 (2.00)
Do you follow doctor's advice to recheck fetal heart monitoring during prenatal check-ups?	4.00 (0.00)
Do you maintain regular rest and stable emotions?	3.00 (0.00)
Do you follow doctor's advice for dietary and nutritional management during pregnancy?	3.00 (1.00)
Do you exercise during pregnancy as advised by your doctor?	3.00 (1.00)
Do you immediately go to the hospital for check-ups when you feel abnormal fetal movements?	4.00 (1.00)
Do you strictly follow doctor's advice for proper medication use?	4.00 (0.00)
If you are a high-risk pregnant woman, do you follow doctor's advice for active cooperation in treatment?	4.00 (0.00)
Do you actively seek help from community health services for pregnancy management?	3.00 (3.00)
Total score	34.00 (8.00)

Table 5. Comparison of KAP scores on prevention of fetal intrauterine distress among pregnant women with different demographic characteristics.

Factor	Number (%)	KAP score (Points), $\bar{x} \pm s$	*t*/F	*p*
Gestational age				
<28 weeks	39 (7.8)	81.64 ± 13.43	0.521	0.602
≥28 weeks	463 (92.2)	80.55 ± 12.45		
First pregnancy				
Yes	284 (56.6)	80.27 ± 12.81	–0.748	0.455
No	218 (43.4)	81.11 ± 12.13		
Planned pregnancy				
Yes	333 (66.3)	81.80 ± 12.80	2.934	0.004
No	169 (33.7)	78.36 ± 11.63		
Education level				
Junior high school or below	21 (4.2)	69.76 ± 11.71	8.073	<0.001
High school or technical secondary school	52 (10.4)	77.96 ± 11.12		
Diploma or undergraduate degree	354 (70.5)	81.01 ± 12.44		
Master's degree or above	75 (14.9)	83.76 ± 12.28		
Occupation				
Civil servant or similar	31 (6.2)	83.71 ± 13.27	5.121	0.006
Corporate employee	213 (42.4)	82.24 ± 11.39		
Others	258 (51.4)	78.95 ± 13.09		
Monthly per capita household income				
<687.745 dollars	50 (9.9)	74.70 ± 11.86	11.716	<0.001
687.745~1375.49 dollars	166 (33.1)	78.86 ± 11.89		
≥1375.49 dollars	286 (57.0)	82.71 ± 12.53		
Concurrent diseases				
Yes	132 (26.3)	81.74 ± 12.15	1.182	0.238
No	370 (73.7)	80.24 ± 12.63		

KAP, knowledge, attitudes, and practices.

fetal monitoring and encouraging information acquisition through diverse platforms, including WeChat, hospital websites, prenatal classes, and outpatient brochures.

Further analysis to identify the factors influencing pregnant women's KAP levels in preventing fetal intrauterine distress revealed that planned pregnancy, educational level, and monthly per capita household income are significant determinants ($p < 0.05$).

These factors create a cycle where limited resources not only hinder educational attainment but also impact overall well-being, further exacerbating the challenges faced by low-income women. Women with lower income often have less access to educational resources, such as tutoring, books, extracurricular programs, and even stable home environments that foster learning. Financial constraints can affect not only their educational opportunities but also

Table 6. Multiple linear regression analysis of factors affecting KAP of pregnant women in preventing fetal intrauterine distress.

Variable	Partial regression coefficient	Standard error	Standard regression coefficient	*t*	*p*
Constant	73.152	4.550	-	16.078	0.000
Planned pregnancy	–2.587	1.145	–0.098	–2.260	0.024
Education level	2.570	0.892	0.133	2.881	0.004
Occupation	–1.597	0.920	–0.078	–1.735	0.083
Per capita monthly household income	2.934	0.835	0.157	3.515	0.000

Note: Adopt effect coding method (this method creates n – 1 variables, but the reference group is coded as –1, while the other groups are coded as 1 for the corresponding variable and 0 otherwise).

$R^2 = 0.084$, adjusted $R^2 = 0.077$, $F = 11.396$, $p < 0.001$.

their mental and physical well-being, leading to poorer outcomes. Financial instability can be a significant source of stress, leading to mental fatigue, which affects cognitive function and overall performance. Women in low-income households often bear the brunt of caregiving responsibilities, which may divert their focus and energy from other pursuits such as education or career advancement. Women with lower levels of formal education are likely to have been educated in schools that have fewer resources, lower-quality teaching, and limited opportunities for academic enrichment. This can result in gaps in foundational knowledge, critical thinking skills, and academic confidence.

This could be attributed to women with planned pregnancies being more mindful of maternal and infant health issues [12], those with higher educational levels possessing broader knowledge and understanding [13], and those with higher household incomes having more resources for proactive learning [14,15].

First, planned pregnancies are often associated with better health outcomes, as women with planned pregnancies typically receive preconception counseling and early prenatal care. This proactive approach makes them more likely to seek information and adhere to recommended guidelines for preventing fetal intrauterine distress. In terms of interventions, public health campaigns targeting unplanned pregnancies could improve KAP levels by providing early education and resources to at-risk populations. Emphasizing the importance of planning pregnancies, especially in low-income and less-educated communities, could help prevent complications such as fetal intrauterine distress. However, in our study, the negative correlation between planned pregnancy and KAP scores raises some questions. One possible explanation is that women with planned pregnancies might not fully understand the specific aspects measured by the KAP score, despite their generally proactive approach. Additionally, other confounding factors could be influencing this relationship, such as the stress experienced by individuals with planned pregnancies or the varying quality and sources of information they rely on. These factors may contribute to the unexpected negative correlation observed in the data.

Second, education plays a crucial role in shaping health behaviors. Higher educational attainment allows women to better understand medical advice, improve their health literacy, and gain better access to resources. Educated women are more likely to comprehend the risks associated with fetal intrauterine distress and take preventive measures accordingly, resulting in higher KAP scores.

Therefore, health education programs should be customized according to the educational level of the target population [16]. For women with higher educational levels, more complex scientific explanations may be needed, whereas simpler, visual, or interactive tools may be more effective for women with lower educational attainment. Family planning and prenatal care programs should also include targeted educational interventions to bridge the KAP gap across different educational backgrounds.

Finally, household income plays a significant role in shaping health behaviors. Higher-income households have better access to healthcare, prenatal vitamins, regular check-ups, and the ability to act on health advice. In contrast, lower-income households may struggle with transportation, affording necessary supplements, or taking time off work to attend medical appointments, which can negatively impact their KAP levels.

To address this, policies should ensure access to free or subsidized prenatal care for lower-income families, which is vital in improving KAP levels. Financial support programs, such as subsidized transportation or free nutritional supplements, could help address the socioeconomic barriers that hinder effective fetal care.

These factors do not operate in isolation but interact in complex ways. For example, women with higher educational levels are more likely to plan their pregnancies, which in turn positively influences their KAP levels. Additionally, women from higher-income households often have the resources to act on the knowledge they gain through education, leading to better health outcomes [17]. Therefore, integrated interventions that address all three factors simultaneously could be more effective. For example, combining pregnancy planning education with resources for low-income families (e.g., financial aid or healthcare access) could lead to better outcomes. Collaborative efforts between healthcare providers, educators, and policymakers are needed to ensure that all determinants are addressed, particularly in marginalized or vulnerable communities.

Limitations

This study used a convenience sampling method, which, while providing easy access to participants, may have introduced biases that limit the representativeness and randomness of the sample. As a result, the findings may not be fully generalizable to the broader population.

5. Conclusions

In conclusion, the study indicates that although pregnant women generally adopt a proactive approach to preventing fetal intrauterine distress, their limited knowledge impedes the full application of this awareness. Factors such as lower education, income, and unplanned pregnancies appear to impact KAP levels, highlighting the need for targeted perinatal healthcare education. However, given the sample's limitations, the conclusions should be interpreted with caution. Future research should involve more diverse and randomized samples to validate and generalize these findings.

Availability of Data and Materials

The minimal anonymized dataset necessary to replicate these study findings was kept as a Supporting Information file. An English language version of the questionnaire has been uploaded as a **Supplementary File**.

Author Contributions

Conception and design of study: XL, FZ. Acquisition of data: WZ, YW. Analysis and/or interpretation of data: XL, WZ, YW. Drafting the manuscript: XL. Revising the manuscript critically for important intellectual content: FZ. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This study was conducted in accordance with the International Code of Ethics for Biomedical Research Involving Humans and the Declaration of Helsinki. Written informed consent was obtained from the parturient herself for the clinical assessment and testing on a consent form approved by the Ethics Review Committee of Hangzhou Women's Hospital in China, approval number [2023YLS A128]. The identity of the participants was kept anonymous and the information in this study was kept strictly confidential.

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Conflict of Interest

The authors declare no conflict of interest.

Declaration of AI and AI-assisted Technologies in the Writing Process

During the preparation of this work the authors used ChatGpt-3.5 in order to check spell and grammar. After using this tool, the authors reviewed and edited the content as needed and takes full responsibility for the content of the publication.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.31083/CEOG31368.

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