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Effect of knowledge acquisition on gravida's anxiety during COVID-19

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ABSTRACT

Objectives: Pregnant women in China are among those most affected by COVID-19. This article assesses Chinese pregnant women's COVID-19 and pregnancy knowledge levels, including the modality through which such knowledge was acquired, the degree of difficulty in acquiring the knowledge, the means of confirming the accuracy of the knowledge, and difficulties in seeking help from people who possess relevant medical knowledge.
Method: The Mantel-Haenszel chi-square test was used to assess trends in binomial proportions. Multivariable binary logistic regression was performed to identify the association between knowledge acquisition and anxiety among pregnant women.
Results: Low scores on knowledge about pregnancy, acquiring COVID-19 and pregnancy information through communication with others, verifying COVID-19 and pregnancy information either independently or via friends, and experiencing difficulties in seeking professional help regarding COVID-19 and pregnancy significantly increased anxiety among pregnant women.
Conclusions: Pregnant women's anxiety can be effectively reduced through developing and disseminating targeted information, including how to cope in an emergency (such as a major disease outbreak), through popular and social media, along with the provision of convenient consultation services.

Introduction

The emergence and effects of COVID-19

COVID-19, a potentially life-threatening respiratory disease, rapidly spread across the globe since the first case was reported in China in 2019 [1]. Person-to-person transmission has been rampant, and super-spreading events, where large groups of people gather in public places have led to major outbreaks [2]. Chinese authorities responded to the outbreak by treating patients, isolating new cases, tracing contacts, imposing restrictions on travel, restricting outdoor activities, closing workplaces, limiting public transportation, and prohibiting large gatherings [3]. Ensuring public health requires timely diagnosis and strict adherence to universal precautions in healthcare settings, all of which have been critical in reducing the transmission of this disease [4].

Anxiety experienced by pregnant women

Huizink et al. believe that gestational anxiety is primarily state anxiety, which is different from general anxiety [5]. Anxiety among pregnant women tends to be associated with specific pregnancy-related concerns, such as fetal health, childbirth pain, self-image, changes in family structure, and decreased social function. In fact, 23% of Swedish women aged 21–47 and 19.3% of Chinese women aged 17–49 experience a strong fear of childbirth [6–8]. Adverse psychological reactions during pregnancy may have a great impact on women's health and fetal development. Anxiety during pregnancy can increase pain sensitivity, prolong labor, and increase the risk of blood loss and dystocia [6]. When a pregnant woman is in an anxious state, the secretion of adrenocorticosteroid and norepinephrine is accelerated, which causes premature rupture of membranes, preeclampsia, and fetal distress, and increases the probability of a cesarean section birth [9]. Additionally, anxiety and depression are associated with diminutive gestational age and a small head circumference, which is associated with brain dysplasia or impaired cognitive development [10].

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COVID-19's effects on pregnant women

The ongoing pandemic has sparked fear in many people underscoring the increased need for psychiatric support [11]. Mirzadeh and Khedmat noted the risks and complications associated with pregnancy during the COVID-19 pandemic and emphasized pregnant women's need for psychological support during the crisis [12]. Pregnancy is a particularly vulnerable time when psychological distress can have negative consequences for both the mother and the baby. Furthermore, because women tend to report higher symptoms of anxiety and depression during disease outbreaks than men [13], women who are pregnant during the COVID-19 pandemic may be especially affected. Sustained, elevated prenatal anxiety and depression symptoms increase the risk of postpartum depression, as well as prenatal infection and illness rates, which in turn affect maternal mood and fetal development [14]. These long-lasting psychological and neurological effects highlight the importance of mitigating prenatal distress and increasing medical observation during pregnancy; however, this can be difficult to facilitate during the pandemic [15]. Since the outbreak, the Chinese government has taken several unprecedented precautionary measures. Due to the new regulations, many essential services like banking, shopping facilities, hospital services, childcare, schools, sports, and entertainment were unavailable. All citizens avoided going out; traffic was restricted, public places were closed, and public services were halted. In maternal hospitals, all antenatal visits and consultations were canceled or restricted. Thus, it became difficult for pregnant women to find the opportunity to communicate with professional medical staff and obtain appropriate pregnancy care information. Although some hospitals launched relevant public knowledge services on WeChat, they could not alleviate the difficulty of communication between pregnant women and medical staff; neither could they provide timely answers, owing to delays or low pertinence. Consequently, the difficulty in accessing professional medical help may also become a source of anxiety for pregnant women [16].

The relationship between knowledge and anxiety

Melender observed that the perceived lack of knowledge of pregnant women contributed to their fear; accordingly, some managed their fear by increasing their knowledge about pregnancy [17]. Lam's telephonic survey to determine changes in public perception during the severe acute respiratory syndrome (SARS) pandemic in 2002 showed that an increased understanding of the disease reduced people's anxiety levels [18].

Therefore, knowledge is negatively related to perceived risk. In their survey of 166 senior adults in Las Vegas, Maes and Louis found that the perceived risk of contracting acquired immunodeficiency syndrome (AIDS) was negatively associated with knowledge about AIDS [19]. A similar trend was observed in an online survey conducted with 500 Dutch people during the 2003 SARS outbreak; knowledge about SARS was negatively associated with concerns about SARS as a health problem. [20]. However, it should be noted that these studies were not conducted specifically with pregnant women.

Aim

This study aimed to evaluate the effect of knowledge acquisition on the anxiety levels among pregnant women during the COVID-19 outbreak in China. The objectives were to assess pregnant women's main mode of knowledge acquisition, the accuracy of their knowledge about COVID-19 and pregnancy, their anxiety levels, and the socioeconomic impact of COVID-19 on their daily lives.

Materials and methods

Study design

This study adopted a descriptive cross-sectional design and followed the Strengthening Reporting of Observational Studies in Epidemiology (STROBE) guidelines for observational research.

Setting and study participants

From March 1 to May 1, 2020, we recruited pregnant women from a follow-up antenatal clinic at a hospital in Shanghai, China. This is a general public hospital located neither at the outbreak's epicenter nor in a remote, risk-free area. Further, the hospital provides services to pregnant women through a social welfare program regardless of their family income. We adopted a random sampling method. The pregnant women were divided according to the serial numbers on their medical cards; women with odd serial numbers were selected to be a part of the study on Mondays, Wednesdays, and Fridays, while those with even serial numbers were selected to participate on Tuesdays, Thursdays, and Saturdays. The clinic remained closed on Sundays. The inclusion criteria were Chinese women who were at least 16 weeks pregnant, literate, and could use a mobile phone. The exclusion criteria were those with a gestational period of less than 16 weeks, who were unwilling to participate in the survey, with infrequent mobile phone use, and could not read.

Measures

Descriptive data

The descriptive data form consisted of items about the pregnant women's socio-demographic characteristics, such as age, fetal number, gravida, para, gestational week, level of education, occupation, pregnancy plan, primary pregnancy caregiver, household monthly per capita income, the incidence of vaginal bleeding, vomiting, fever, self-assessment of stress experienced, gestational complications, and abnormal childbearing history.

Knowledge of COVID-19 and impact on pregnancy questionnaire

This questionnaire contains 11 questions—six on knowledge related to COVID-19 and five on knowledge of pregnancy during COVID-19. A score of four or higher in the COVID-19 section indicated sufficient knowledge on this topic (passing), three or more on the pregnancy items indicated that participants passed this section.

Pregnant women's anxiety levels

The participants' anxiety levels were measured using Xiao's Pregnancy-specific Anxiety Questionnaire (PAQ) [21]. In 2010, Xiao used the pregnancy-related anxiety questionnaire (revised) (PRAQ-R) as a reference for creating an anxiety questionnaire for pregnant women in the Chinese context. The researchers used 4,156 Chinese pregnant women as participants to screen the items in the questionnaire and determine the initial supplement framework. Cronbach's alpha coefficient was 0.818; next, they evaluated reliability and validity based on the data of 2,861 pregnant women. After 2–4 weeks, the questionnaire's reliability and validity were re-measured using data from 2,187 pregnant women; the test–retest reliability coefficient and Cronbach's alpha were 0.786 and 0.812, respectively. In 2011, Zhang used this questionnaire to survey 20,308 pregnant women in China. Thus, the questionnaire has good reliability and validity and accurately reflects the anxiety of Chinese pregnant women [8]. Cronbach's alpha coefficient was 0.801 in this study. The PAQ consists of 13 items along three dimensions (anxiety about oneself, fetal health, and childbirth). Each item is scored on a four-point Likert scale (1 = not at all to 4 = very much so). The scale has a total cut-off score of 24; respondents scoring 24 and below were not considered to be anxious, while those scoring 25 or

above were considered as so.

Questionnaire on knowledge acquisition

The questionnaire consisted of four questions to measure the modalities through which pregnant women acquired knowledge, the degree of difficulty experienced during knowledge acquisition, the means used to confirm the accuracy of knowledge, and difficulties experienced in seeking help from people with relevant medical knowledge.

Data collection

An e-brochure of the study was sent to participants via WeChat, suggesting that they were not to be interrupted or provided with answers during the process. The first page of the online survey described the purpose of the study and provided instructions. To protect the privacy and confidentiality of the participants, personal information (e.g., names, addresses, and phone numbers) was not collected. Additionally, access to the submitted responses was restricted to the research team and required the user to enter a username and password to log in. Pregnant women were instructed to answer all the questions and were informed that they could withdraw from the study if they felt unwell. The electronic questionnaire could be submitted only once, and all sections needed to be completed before submission. The investigator assessed the validity and integrity of each returned questionnaire, rejecting those with invalid answers (e.g., the same response for all questions or contradictory responses). Of the 227 questionnaires distributed, 198 were returned; 27 were eliminated due to unreasonable answers, and 171 valid questionnaires were considered for analysis. The response rate was 87.2%, and the effective rate was 75.3%.

Data analysis

Descriptive statistics were calculated for participants' demographic characteristics and the results of the knowledge acquisition questionnaire. The Mantel-Haenszel χ^2 test was used for assessing the trend in the binomial proportions. Multivariable logistic regression analysis was performed to assess the association between knowledge acquisition and anxiety among pregnant women. The significance level was set at $P < 0.05$, and data were analyzed using SPSS for Windows (version 23.0; SPSS Inc.)

Ethical approval

Ethical approval was obtained from the local ethics research committee (approval NO.SH9H-2020-T62-2). The researchers explained the objective of the research and obtained verbal consent from the participants before administering the questionnaires. The participants were assured of anonymity and confidentiality and that they could withdraw at any point. They were asked to not write their names on the questionnaire in order to protect their identity.

Results

Respondent characteristics

Among the 171 pregnant women, there was a higher number of primigravida (56.8%) than multigravida (43.2%). Most participants (91.2%) had a high school education, and 72.8% had a college degree. Table 1 shows the significant relationships between the characteristics of the pregnant women and their scores on the knowledge acquisition questionnaire.

Knowledge about COVID-19 and pregnancy

Most of the participants (93.6%) passed the COVID-19 section, while 25.8% passed both the COVID-19 and pregnancy sections. Table S1 shows participants' knowledge about COVID-19 and its impact on pregnancy.

The degree of anxiety was negatively associated with knowledge about pregnancy during COVID-19 ($\chi^2 = 11.48$, $p = 0.03$). Pregnancy-related knowledge was largely obtained (61.4% of pregnant women) through an electronic medium, such as mobile phones or computers. Additionally, communicating with others to obtain information was more likely to increase the level of anxiety among pregnant women ($\chi^2 = 15.48$, $p = 0.00$) compared to obtaining COVID-19 and pregnancy knowledge through television and the Internet ($\chi^2 = 7.26$, $p = 0.03$). The greater the difficulty of acquiring pregnancy-related knowledge, the more likely it was for pregnant women to feel anxious ($\chi^2 = 6.31$, $p = 0.04$). However, this was not reflected in cases of acquiring knowledge about COVID-19. Table 2 shows the results of the questionnaire on knowledge acquisition. The multivariate binary logistic regression analyses showed that pregnant women who found it difficult to get help from a professional regarding COVID-19 pregnancy-related information sought others' opinions to verify COVID-19 and pregnancy information. Furthermore, difficulty in seeking professional help to obtain information about COVID-19 and pregnancy care was significantly associated with a higher risk of anxiety (see Table 3). The results of Omnibus Tests of Model Coefficients revealed that the model's χ^2 value was 6.04 ($df = 1$, $Sig = 0.00$), and the Hosmer–Lemeshow Test revealed a χ^2 value of 6.25 ($df = 8$, $Sig. = 0.62$). This shows that the information in the current data was fully extracted, and the model had a high degree of goodness of fit. Further, the overall success prediction rate was 80.7%.

Multivariate binary logistic regression analyses also showed that knowledge about pregnancy, acquiring COVID-19 and pregnancy information, verifying COVID-19 and pregnancy information, and seeking help for COVID-19 and pregnancy issues significantly impacted the anxiety experienced by pregnant women. Based on the anxiety scale scores, the number of pregnant women who qualified as being anxious was 0.22 times that of those who did not. Women who acquired COVID-19 knowledge through communication with others experienced 41.84 times more anxiety than those who acquired this knowledge from television. Similarly, women who acquired pregnancy knowledge through communication with others experienced 15.86 times more anxiety than those who used television. Pregnant women who verified their information independently experienced 9.63 and 6.13 times the anxiety related to COVID-19 and pregnancy knowledge, respectively, than those who consulted medical professionals. Those who talked to their friends had 8.96 and 2.85 times more anxiety related to COVID-19 and pregnancy knowledge, respectively, than those who consulted medical professionals. Finally, the anxiety of pregnant women who struggled to access professional help for COVID-19 experienced 4.38 times more anxiety than those who had easier access. Moreover, those who had difficulties accessing professional pregnancy support were 48.90 times more anxious than those who did not.

Discussion

Knowledge acquisition is necessary but difficult

Prenatal care is vital to a healthy pregnancy [22], and even more so during a disease outbreak. In China, as the first country affected by COVID-19, prenatal care was especially important during the pandemic. The present study's findings show that pregnant women experienced difficulty acquiring knowledge on pregnancy during COVID-19, which increased their risk of anxiety. Many homegrown social media platforms, such as WeChat and Weibo, have penetrated the daily lives of Chinese people. As of 2019, WeChat had 654 million users, followed by Weibo with nearly 360 million users [23]. One million doctors have registered with online platforms for diagnosis and treatment, such as Haodaifu. Further, timely health education and counseling can be provided on platforms such as Haodaifu. Future studies should aim to increase hospitals' effective use of information exchange platforms, such as WeChat and other social media, to eliminate the difficulties faced by

Table 1
The significant relation between the characteristics of the pregnant women and approaches for accessing help/degree of difficulty in acquiring COVID-19 and pregnancy information.

No	Content	NO (%)	COVID-19 knowledge									
			Acquire methods COVID-19 knowledge					Seeking professional help				
			Television	Internet (mobile/ computer)	Communication with others	chi-square (df)	P value[b]	Easy	Same as usual	Difficult	chi-square (df)	P value[b]
1	**Para**					0.94(4)	0.92				3.55(4)	0.47
	1	110 (64.3%)	26 (23.6%)	70(63.6%)	14(12.7%)			39(35.5%)	36(32.7%)	35 (31.8%)		
	2	55(32.2%)	16 (29.1%)	32(58.2%)	7(7.1%)			19(34.5%)	22(40.0%)	14 (25.5%)		
	3	6 (3.5%)	2(33.3%)	3(50.03%)	1(0.8%)			1(16.7%)	4(66.7%)	1(16.7%)		
2	**Primary caregiver during pregnancy**					4.90(4)	0.30				2.29(4)	0.68
	Myself	17(9.9%)	3(17.6%)	13(76.5%)	1 (9.9%)			8(47.1%)	5(29.4%)	4(23.5%)		
	Husband	70(40.9%)	19 (27.1%)	45(64.3%)	6(8.6%)			25(35.7%)	23(32.9%)	22 (31.4%)		
	Parents	84(49.1%)	22 (26.2%)	47(56.01%)	15(17.9%)			26(31.0%)	34(40.5%)	24 (28.6%)		
3	**Stress during pregnancy**					7.53(6)	0.27				***19.83(6)***	***0.00***
	None	39(22.8%)	15 (38.5%)	21(533.8%)	3(7.7%)			**23 (59.0%)**	**8(20.5%)**	**8(20.5%)**		
	A little	113 (66.1%)	26 (23.0%)	***72(63.7%)***	15(13.3%)			27(23.9%)	50(44.2%)	36 (31.9%)		
	Relatively high	17(9.9%)	3(17.6%)	11(64.7%)	3(17.6%)			8(47.1%)	3(17.6%)	6(35.3%)		
	Very high	2(1.2%)	0(0.0%)	1 (50.0%)	1 (50.0%)			1(50.0%)	1(50.0%)	0(0.0%)		

No	**Content**	**NO (%)**	COVID-19 knowledge														
			Acquire methods pregnancy-related knowledge					Seeking professional help for pregnancy knowledge					Degree of difficulty in acquiring COVID-19 pregnancy-related knowledge				
			Television	Internet (mobile/ computer)	Communication with others	chi-square (df)	P value[b]	Easy	Same as usual	Difficult	chi-square (df)	P value[b]	Easy	same as usual	difficult	chi-square (df)	P value[b]
1	**Para**					***12.465 (4)***	***0.01***				3.55(4)	0.47				3.84 (4)	0.43
	1	110 (64.3%)	8(7.3%)	97(88.2%)	5(4.5%)			39 (35.5%)	36 (32.7%)	35 (31.8%)			5(4.5%)	11 (10.0%)	94 (85.5%)		
	2	55 (32.2%)	9(16.4%)	43(78.2%)	3(5.5%)			19 (34.5%)	22 (40.0%)	14 (25.5%)			2(2.3%)	9 (16.4%)	44 (80.0%)		
	3	6 (3.5%)	1(16.7%)	2(50.0%)	2(33.3%)			1 (16.7%)	4 (66.7%)	1 (16.7%)			0(0.0%)	2 (33.3%)	4 (66.7%)		
2	**Primary caregiver during pregnancy**					***9.97(4)***	***0.04***				2.29(4)	0.68				2.91 (4)	0.57
	Myself	17 (9.9%)	5(29.4%)	11(64.7%)	1 (5.9%)			8 (47.1%)	5 (29.4%)	4 (23.5%)			1(5.9%)	4 (23.5%)	12 (70.6%)		
	Husband	70 (40.9%)	9(12.9%)	55(78.6%)	6(8.6%)			25 (35.7%)	23 (32.9%)	22 (31.4%)			2(2.9%)	7 (10.0%)	61 (87.1%)		
	Parents	84 (49.1%)	12 (14.3%)	53(63.1%)	19(22.6%)			26 (31.0%)	34 (40.5%)	24 (28.6%)			4(4.8%)	11 (13.1%)	69 (82.1%)		
3	**Stress during pregnancy**					***13.06 (6)***	***0.04***				***19.83 (6)***	***0.00***				***19.43 (6)***	***0.00***
	None	39 (22.8%)	10 (25.6%)	28(32.6%)	**1(2.6%)**			**23 (59.0%)**	**8 (20.5%)**	**8 (20.5%)**			6 (15.4%)	3(7.7%)	30 (76.9%)		
	A little	113 (66.1%)	7(6.2%)	98(86.7%)	8(7.1%)			27 (23.9%)	50 (44.2%)	36 (31.9%)			1(0.9%)	16 (14.2%)	96 (85.0%)		
	Relatively high	17 (9.9%)	1(5.9%)	15(88.2%)	1(5.9%)			8 (47.1%)	3 (17.6%)	6 (35.3%)			0(0.0%)	2 (11.8%)	15 (88.2%)		
	Very high	2(1.2%)	0(0.0%)	2(100.0%)	0(0.0%)			1 (50.0%)	1 (50.0%)	0(0.0%)			0(0.0%)	1 (50.0%)	1 (50.0%)		

Table 2
Results for the questionnaire on knowledge acquisition.

No	Content	NO (%)	Pregnancy-specific anxiety				"Concern about oneself" anxiety				"Concern about the fetus" anxiety				"Concern about the parturition program" anxiety			
			No. %	Yes %	Chi-square (df)	P value[b]	No.%	Yes %	Chi-square (df)	P value[b]	No. %	Yes%	Chi-square (df)	P value[b]	No.%	Yes. %	Chi-square (df)	P value[b]
1	Score for knowledge about pregnancy				***3.32(1)***	***0.04***			1.82(1)	0.12			0.88(1)	0.23			1.65 (14)	0.14
	Qualified	38 (22.2%)	30 (78.9%)	8 (21.1%)			29 (25.2%)	9(16.1%)			29 (24.2%)	9 (17.6%)			28 (25.2%)	10 (16.7%)		
	Unqualified	133 (36.8%)	84 (63.2%)	49 (36.8%)			86 (74.8%)	47 (83.9%)			91 (75.8%)	42 (82.4%)			83 (74.8%)	50 (83.3%)		
2	Methods used to acquire COVID-19 knowledge				***15.48 (2)***	***0.00***			***9.02(2)***	***0.01***			0.53(2)	0.77			***14.75 (2)***	***0.00***
	Television	44 (25.7%)	35 (79.5%)	9 (20.5%)			34 (77.3%)	10 (22.7%)			31 (703.5%)	13 (29.5%)			35 (79.5%)	9 (20.5%)		
	Internet (mobile/ computer)	105 (61.4%)	72 (68.6%)	33 (31.4%)			72 (68.6%)	33 (31.4%)			75 (71.4%)	30 (28.6%)			69 (65.7%)	36 (34.3%)		
	Communication with others	22 (12.9%)	7(31.8%)	15 (68.2%)			9(40.9%)	13 (59.1%)			14 (63.6%)	8 (36.4%)			7 (31.8%)	15 (68.2%)		
3	Methods used to acquire COVID-19 pregnancy-related knowledge				8.23(2)	0.2			4.25(2)	0.122			***30.54 (2)***	***0.00***			3.41(2)	0.18
	Television	26 (15.2%)	18 (69.2%)	8 (30.8%)			19 (16.5%)	7(12.5%)			24 (20.0%)	2(7.8%)			19 (17.1%)	7 (11.7%)		
	Internet (mobile/ computer)	119 (69.6%)	85 (71.4%)	34 (28.6%)			83 (72.2%)	36 (64.3%)			89 (74.2%)	30 (35.5%)			79 (71.2%)	40 (66.7%)		
	Communication with others	26 (15.2%)	11 (42.3%)	15 (57.7%)			13 (11.3%)	13 (23.20%)			7(5.8%)	19 (7.8%)			13 (11.7%)	13 (21.7%)		
4	Degree of difficulty in acquiring COVID-19 knowledge				0.00(1)	1.00			0.13(1)	0.83			3.17(1)	0.08			0.39(1)	0.54
	"Easy; I can obtain it if I want to."	141 (82.5%)	94 (66.7%)	47 (33.3%)			94 (66.7%)	47 (33.3%)			103 (73.0%)	38 (27.0%)			93 (66.0%)	48 (34.0%)		
	"In general, same as usual"	30 (17.5%)	20 (66.7%)	10 (333%)			21 (70.0%)	9(30.0%)			17 (56.7%)	13 (43.3%)			18 (60.0%)	12 (40.0%)		
	"Difficult; hard to find or obtain help from a professional"	0(0.0%)	0(00.0%)	0 (00.0%)			0(00.0%)	0(00.0%)			0(00.0%)	0 (00.0%)			0 (00.0%)	0 (00.0%)		
5	Degree of difficulty in acquiring COVID-19 pregnancy-related knowledge				***6.31(2)***	***0.04***			***6.45(2)***	***0.04***			***8.98(2)***	***0.01***			0.15(2)	0.93
	"Easy; I can obtain it if I want to."	7(4.1%)	7 (100.0%)	0 (0.00%)			7 (100.0%)	0(0.00%)			7 (100.0%)	0 (0.00%)			5 (71.4%)	2 (28.6%)		
	"In general, same as usual"	22 (12.9%)	11 (50.0%)	11 (50.0%)			11 (50.0%)	11 (50.0%)			20 (90.9%)	2(9.1%)			14 (63.6%)	8 (36.4%)		
	"Difficult; hard to find or obtain help from a professional"	142 (83.0%)	96 (67.6%)	46 (32.4%)			97 (68.3%)	45 (31.7%)			93 (65.5%)	49 (34.5%)			92 (64.8%)	50 (35.2%)		
6	Methods for verifying COVID-19 information				***6.90(2)***	***0.03***			4.83(2)	0.09			4.55(2)	0.10			0.35(2)	0.84
								9(20.0%)										

(*continued on next page*)

Table 2 (*continued*)

No	Content	NO (%)	Pregnancy-specific anxiety				"Concern about oneself" anxiety				"Concern about the fetus" anxiety				"Concern about the parturition program" anxiety			
			No. %	Yes %	Chi-square (df)	P value[b]	No.%	Yes %	Chi-square (df)	P value[b]	No. %	Yes%	Chi-square (df)	P value[b]	No.%	Yes. %	Chi-square (df)	P value[b]
	Seek confirmation from medical professionals	45 (26.3%)	37 (82.2%)	8 (17.8%)			36 (80.0%)				37 (82.2%)	8 (17.8%)			30 (66.7%)	15 (33.3%)		
	Ask family and friends for their opinions	93 (54.4%)	58 (62.4%)	35 (37.6%)			57 (61.3%)	36 (38.7%)			60 (64.5%)	33 (35.5%)			61 (65.6%)	32 (34.4%)		
	Seek answers autonomously	33 (19.3%)	19 (57.6%)	14 (42.4%)			22 (66.7%)	11 (33.3%)			23 (69.7%)	10 (30.3%)			20 (60.6%)	13 (39.4%)		
7	Method for verifying COVID-19 pregnancy-related information				***7.67(2)***	***0.02***			5.17(2)	0.08			4.45(2)	0.11			2.34(2)	0.31
	Seek confirmation from medical professionals	50 (29.2%)	41 (82.0%)	9 (18.0%)			39 (78.0%)	11 (22.0%)			38 (76.0%)	12 (24.0%)			35 (70.0%)	15 (30.0%)		
	Ask family and friends for their opinions	98 (57.3%)	60 (61.2%)	38 (38.8%)			64 (65.3%)	34 (34.7%)			70 (71.4%)	28 (28.6%)			59 (60.2%)	39 (39.8%)		
	Seek answers autonomously	23 (13.5%)	13 (56.5%)	10 (43.5%)			12 (52.2%)	11 (47.8%)			12 (52.2%)	11 (47.8%)			17 (73.9%)	6 (26.1%)		
8	Seeking professional help regarding COVID-19 care				***9.33(2)***	***0.01***			***8.33(2)***	***0.02***			1.98(2)	0.37			***6.12(2)***	***0.04***
	"Easy; I can obtain it if I want to."	59 (34.5%)	47 (79.7%)	12 (20.3%)			48 (81.4%)	11 (18.6%)			45 (76.3%)	14 (23.7%)			44 (74.6%)	15 (25.4%)		
	"In general, same as usual"	62 (36.3%)	41 (66.1%)	21 (33.9%)			36 (58.1%)	26 (41.9%)			43 (69.4%)	19 (30.6%)			41 (66.1%)	21 (33.9%)		
	"Difficult; hard to find or obtain help from a professional"	50 (29.2%)	26 (52.0%)	24 (48.0%)			31 (62.0%)	19 (38.0%)			32 (64.0%)	18 (36.0%)			26 (52.0%)	24 (48.0%)		
9	Seeking professional help regarding pregnancy care				***16.4(2)***	***0.00***			***6.98(2)***	***0.03***			***735(2)***	***0.02***			5.45(2)	0.07
	"Easy; I can obtain it if I want to."	31 (18.1%)	30 (96.8%)	1(3.2%)			27 (87.1%)	4(12.9%)			28 (90.3%)	3(9.7%)			24 (77.4%)	7 (22.6%)		
	"In general, same as usual"	49 (28.7%)	32 (65.3%)	17 (34.7%)			32 (65.3%)	17 (34.7%)			32 (65.3%)	17 (34.7%)			35 (71.4%)	14 (28.6%)		
	"Difficult; hard to find or obtain help from a professional"	91 (53.2%)	52 (57.1%)	39 (42.9%)			56 (61.5%)	35 (38.5%)			60 (65.9%)	31 (34.1%)			52 (57.1%)	39 (42.9%)		

Table 3
Variables in the equation and steps is take forward.

No	Content	B	Sig.	Adjusted odds ratio	95% C.I.	
					Lower	Upper
1	The score for knowledge about pregnancy is qualified.	−1.52	0.02	0.22	0.06	0.81
1	Methods used to acquire COVID-19 knowledge through television		0.00			
	Methods used to acquire COVID-19 knowledge through Internet	0.85	0.18	2.34	0.67	8.12
	Methods used to acquire COVID-19 knowledge through communication with others	3.73	0.00	41.84	5.82	301.02
2	Methods used to acquire COVID-19 pregnancy-related knowledge through television		0.00			
	Methods used to acquire COVID-19 pregnancy-related knowledge through Internet	1.12	0.11	3.06	0.77	12.14
	Methods used to acquire COVID-19 pregnancy-related knowledge through communication with others	2.76	0.00	15.86	2.57	97.69
3	It is easy to acquire COVID-19 knowledge.		0.86			
	The situation is the same as usual for acquiring COVID-19 knowledge.	−0.33	0.58	0.72	0.222	2.32
	It is difficult to acquire COVID-19 knowledge.	22.46	0.99	5679	0.00	–
4	It is easy to acquire COVID-19 pregnancy-related knowledge.		0.01			
	The situation is the same as usual for acquiring COVID-19 pregnancy-related knowledge.	21.65	0.99	2514	0.00	–
	It is difficult to acquire COVID-19 pregnancy-related knowledge.	19.17	0.99	2114	0.00	–
5	Methods for verifying COVID-19 information from medical professionals		0.02			
	Methods for verifying COVID-19 information from family and friends	1.94	0.01	6.93	1.82	26.43
	Methods for verifying COVID-19 information autonomously	1.81	0.02	6.13	1.31	28.65
5	Methods for verifying pregnancy information from medical professionals		***0.01***			
	Methods for verifying pregnancy information from family and friends	2.19	0.00	8.96	2.38	33.75
	Methods for verifying pregnancy information autonomously	1.05	0.18	2.85	0.62	13.21
6	Seeking professional help for COVID-19 care is easy.		0.02			
	Seeking professional help for COVID-19 care is the same as usual.	1.57	0.01	4.82	1.47	15.83
	Seeking professional help for COVID-19 care is difficult.	1.48	0.02	4.38	1.30	14.80
7	Seeking professional help for pregnancy care is easy.		0.00			
	Seeking professional help for pregnancy care is the same as usual.	3.17	0.01	23.90	2.24	255.0.22
	Seeking professional help for pregnancy care is difficult.	3.89	0.00	48.90	4.64	515.00

pregnant women while accessing professional support.

Methods used to acquire information are important

Our study shows that pregnant women were more likely to acquire COVID-19 information from friends and family as they were often cared for by their parents or their partners' parents. However, acquiring COVID-19 and pregnancy-related knowledge through others also led to pregnant women experiencing a higher degree of stress and a higher risk for anxiety than when they acquired such knowledge through television or the Internet. This result is consistent with that of the study by Jiang et al. [24], which indicated that pregnant women who obtained antenatal care information via friends and family members were at a higher risk for depression. Friends and families tend to provide inaccurate information and show excessive concern, which can increase pregnant women's anxiety. Nevertheless, this finding suggests the need to actively disseminate maternal health service information and involve family members in antenatal health education. The ability to access health-related information from a reliable and credible source has always been a primary service need of new and expecting mothers [25]. Due to the popularization of the Internet, the content published using WeChat and Weibo is supervised and controlled; it is also written, reviewed, and published by medical personnel with professional knowledge. For example, a statement at the end of an article published on the WeChat account "Mother Parenting," with 300,000 readers, indicated that a doctor reviewed the article before publication, implying that the information is authentic and reliable. Accordingly, communication of authoritative information by health service providers via social media platforms can be one component of epidemic preparedness and response in the future.

Verification of information and assistance by medical staff influence the anxiety of pregnant women

The participants of this study obtained information about COVID-19 from various sources. Thus, the accuracy of this information needed to be confirmed. According to Chuang, it is important to ensure the

credibility and accessibility of information about COVID-19 [26]. Reliable open communication channels can help the public detect spurious or misleading information [26]; failure to do so can amplify risk perceptions amid an evolving pandemic [27–29]. Chuang further noted that healthcare professionals play a key role in risk communication by providing accurate information [26]. In line with this, our study findings also suggest that verifying COVID-19 and pregnancy-related information or getting professional help effectively reduces pregnant women's anxiety. This research was conducted at the beginning of the pandemic. Gradually, much misinformation and several rumors about COVID-19 were clarified by professional medical personnel and removed from the platforms. For example, Zhang Wenhong, an infectious disease expert, exemplified the need for medical staff to provide reliable information to the public. Therefore, during a pandemic, healthcare professionals should actively disseminate meaningful, relevant, and accurate information.

This study differs from other studies, in that we used the PAQ while others used a general anxiety questionnaire that was not designed for pregnant women [21] and did not reflect their concerns. That is, general anxiety scales, such as the General Health Questionnaire-30, State-Trait Anxiety Inventory, and the Manifest Anxiety Scale, are not designed to assess pregnancy-related anxiety [30].

Conclusion

During public health emergencies such as the COVID-19 pandemic, mental health care services should be strengthened to reassure and support pregnant women. Specific information targeted at pregnant women, including information on coping in an emergency (such as a major disease outbreak), should be made more convenient and reliable, along with timely consultation and professional help. Focus should be directed toward ensuring the accuracy of information in popular media and disseminating information developed by health care institutions via social media platforms; this could be an effective way of mitigating mental health challenges and ensuring epidemic preparedness and responses in the future.

Limitations

During the pandemic, many hospital outpatient clinics restricted the flow of patients, thereby limiting the number of potential survey participants. An insufficient number of questionnaires were collected, and the influence of confounding factors on the results could not be controlled. However, according to the general information and correlation presented in Table 1, there were few significant confounding factors. As shown in Table 3, multivariate binary logistic regression was used to exclude these factors and achieve the adjusted odds ratio/95% confidence interval, thereby reducing the influence of confounding factors on the results. In future research, the sample size and number of participating research centers should be increased.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Unblinded ethics statement

Ethics approval was obtained from the Research Ethics Committee of the Ninth People's Hospital, Shanghai Jiaotong University School of Medicine. Medical Academy Ethical Board/SHJY20200331 (Date of approval: June 23, 2020).

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.srhc.2021.100667.

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