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Current Status and Influencing Factors of Recommending Influenza Vaccination to Pregnant Women by Healthcare Workers in Xiangxi Region

Yi Zhao[a], Weihua Zhou, Jiale Li, Zhi Zeng, Runxia Guo, Liming Tan[b,*]

Jishou University, Yiyang, Hunan, China
[a]2530848681@qq.com, [b]39606605@qq.com
[*]Corresponding author

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Abstract: The Objective of the essay was to investigate the willingness, attitudes, behaviors, influencing factors, and reasons for not recommending influenza vaccines to pregnant women among healthcare workers (mainly obstetricians) in the Xiangxi region, and to provide scientific basis for improving the influenza vaccination rate among pregnant women in Xiangxi. Methods: In August 2022, an anonymous online survey was conducted on healthcare workers in the Xiangxi region using a self-designed questionnaire on the QuestionStar platform. The survey content included the general demographic characteristics of healthcare workers in the Xiangxi region and their willingness, attitudes, and behaviors regarding recommending influenza vaccines to pregnant women. To compare the differences in willingness to recommend influenza vaccines to pregnant women among healthcare workers with different characteristics, a binary logistic regression model was used to analyze the influencing factors of recommending influenza vaccines to pregnant women by healthcare workers in Xiangxi. Results: A total of 102 healthcare workers in Xiangxi were surveyed, aged 20 to 59 years. Conclusion: The willingness of healthcare workers in Xiangxi to recommend influenza vaccines to pregnant women is low. Age, whether they have treated pregnant women with influenza, and occupation are the main influencing factors. The main reason for refusing to recommend influenza vaccines is the safety concerns of pregnant women regarding the vaccine.

1. Introduction

Globally, seasonal influenza is a significant public health issue [1], with the general population being susceptible to influenza. Pregnant women are a high-risk group for influenza, with higher hospitalization rates, severe illness, and death risks compared to non-pregnant women of reproductive age. During previous influenza pandemics, the mortality rate among pregnant women increased, and the mortality rate among women with pneumonia in an influenza environment was close to 50% [2]. Infection with influenza during pregnancy can lead to various diseases in infants, such as neural tube defects, hydrocephalus, congenital heart defects, cleft lip, digestive system defects, limb reduction defects, and congenital renal abnormalities [3,4]. Therefore, influenza infection during pregnancy is

closely related to birth defects.

Multiple studies have shown that influenza vaccination during pregnancy has good immunogenicity [5,6]. Influenza vaccination has no health risks for pregnant women and does not increase the risk of pregnancy complications [7]. Vaccination not only provides effective protection for the mother but also provides passive immune protection for the fetus and infants with immature immune systems (<6 months old) [8].

Although it is recommended that pregnant women receive influenza vaccination, the actual vaccination rate remains low [9-12]. Barriers to vaccination may include a lack of awareness of the risk of influenza infection during pregnancy, concerns about vaccine safety and effectiveness, and difficulties in obtaining information about influenza vaccination. Research has found that recommendations from vaccine providers are one of the most effective motivating factors for pregnant women to receive the vaccine [13-15], and obstetricians play an important role in providing advice and addressing their concerns [16]. As primary healthcare providers for women during pregnancy, they are on the front line of promoting immunization [14]. Therefore, in order to increase the influenza vaccination rate among pregnant women, reduce the incidence of birth defects, and promote the health and quality of the next generation, it is urgently necessary to understand the situation and influencing factors of obstetricians recommending influenza vaccination to pregnant women.

The economic foundation of the ethnic minority settlement areas in western Hunan is weak, medical facilities are backward, and there is a gap between the level of health resource allocation and the national average level [17]. The weak health awareness among residents has led to a poor overall understanding of influenza among pregnant women and a low vaccination rate. In order to understand the attitude and influencing factors of medical workers in the western Hunan region in recommending influenza vaccination to pregnant women, a web-based questionnaire survey was conducted in August 2022 among medical workers in the region. The results are reported below.

2. Objects and methods

2.1 Research object

Convenient sampling survey was conducted through the internet to distribute electronic questionnaires to obstetricians and gynecologists in a total of 46 hospitals in Xiangxi Tujia and Miao Autonomous Prefecture, including Jishou City, Fenghuang County, and Baojing County. Prior to filling out the questionnaire, participants' consent was obtained, and consenting participants completed an anonymous online questionnaire on their knowledge and attitudes towards influenza and influenza vaccines on their mobile phones.

2.2 Questionnaire

The present study used a cross-sectional self-report questionnaire survey to investigate self-awareness and attitudes. Due to social restrictions during the COVID-19 pandemic, face-to-face interviews with participants were not feasible. To collect as many samples as possible, we sent electronic questionnaires through the Chinese online survey platform "Wenjuanxing" (Changsha Ranxing Information Technology Co., Ltd., Changsha, China) to 46 hospital systems in the Xiangxi region. This platform checked the completeness of the questionnaire before submission, and only fully completed questionnaires were successfully submitted.

The questionnaire included a brief description of the research purpose and informed consent information. In addition, participants who met any of the following exclusion criteria were eliminated: (1) participants who submitted duplicate questionnaires using the same IP address; (2) respondents

who completed the questionnaire in less than 50 seconds; (3) or questionnaires with logical errors. In the end, a total of 102 diabetic patients participated in this study, and missing or illogical questionnaires were excluded. All collected data will be kept confidential and used only for the purposes of this study.

The survey included demographic and clinical practice characteristics, reflecting the views, attitudes, and behaviors of obstetricians in the ethnic minority areas of Xiangxi regarding influenza and influenza vaccination for pregnant women (Supplementary File 1: Table S1). Sociodemographic variables included ethnicity, gender, age, education level (associate degree and below, bachelor's degree, master's degree and above), professional title (primary, intermediate, associate, or full), years of work experience (less than 5 years, 5-10 years, more than 10 years), and whether they had received influenza vaccination or treated pregnant women with influenza. Participants evaluated their cognitive levels and attitudes towards influenza and vaccines using two multiple-choice questions on influenza and six on vaccines (Supplementary File 1: Table S2). Additionally, three multiple-choice questions about vaccine recommendations were used to understand whether obstetricians actually recommended vaccines in their clinical work.

2.3 Statistical analysis

We established a database using Epidata3.1 software and performed data analysis using SPSS26.0 statistical software. For univariate analysis, we used the $\chi 2$ test, and for multivariate analysis, we used multiple logistic regression to calculate the odds ratios with a 95% confidence interval (95% CI) to determine the willingness of healthcare workers to recommend influenza vaccine to pregnant women and the influencing factors. A two-tailed p-value < 0.05 was considered statistically significant. Descriptive statistics such as frequency and percentage were calculated for all categorical variables.

3. Result

3.1 Basic information

A total of 120 survey questionnaires were distributed in this study, and 102 were actually collected, resulting in an effective response rate of 85%. Among the 102 valid questionnaires, 94.1% of the participants were female and 5.9% were male. The majority of the participants were ethnic minorities, with Tujia (56.9%) and Miao (25.5%) being the most prevalent, while Han Chinese accounted for 14.7% of all participants. Among all the participants, 51% had only a college degree or below, 47.1% had a bachelor's degree, and only 2% had a master's degree or higher. There were significant statistical differences in the willingness to recommend influenza vaccines to pregnant women based on age ($P < 0.01$). Obstetricians and gynecologists who had previously treated pregnant women with influenza were more willing to recommend influenza vaccines to pregnant women ($P < 0.05$), as shown in Table 1.

3.2 Relevant knowledge of the participant

3.2.1 Knowledge of influenza

Most participants (89.2%) agreed with the statement "Influenza is a highly susceptible disease," acknowledging the high susceptibility of influenza. Only a small number of participants held a negative attitude (7.8%) or did not know (2.9%). At the same time, most participants (88.2%) also indicated agreement with the statement "Pregnant women are at increased risk of developing severe symptoms after contracting the flu," affirming the severity of the consequences of contracting the flu

during pregnancy. Similarly, only a small number of participants held a negative attitude (6.9%) or did not know (4.9%). A majority of participants (67.6%) believed that influenza can cause complications during pregnancy, with more participants having an uncertain attitude (19.6%) than a negative attitude (12.7%), as shown in Table 1.

Table 1: Single-factor analysis of healthcare workers' willingness to recommend flu vaccination to pregnant women.

			The willingness to recommend a vaccine						*p*	X^2
variable	N	Composition ratio (%)	Yes		No		Unclear			
			n	%	n	%	n	%		
nationality										
the Han nationality	15	14.7	6	40.0	8	53.3	1	6.7	0.054	15.274
the Miao nationality	26	25.5	4	15.4	17	65.4	5	19.2		
the Tujia nationality	58	56.9	15	25.9	31	53.4	12	20.7		
the Bai nationality	1	1.0	1	100.0	0	0.0	0	0.0		
else	2	2.0	0	0.0	0	0.0	2	100.0		
Gender										
Male	6	5.9	2	33.3	2	33.3	2	33.3	0.520	1.307
Female	96	94.1	24	25.0	54	56.3	18	18.8		
Age										
20-29years	6	5.9	0	0.0	1	16.7	5	83.3	**<0.01**	18.012
30-39 years	12	11.8	3	25.0	7	58.3	2	16.7		
40-49 years	70	68.6	20	28.6	38	54.3	12	17.1		
50-59 years	14	13.7	3	21.4	10	71.4	1	7.1		
Educational attainment										
Bachelor degree or below	52	51.0	14	26.9	26	50.0	12	23.1	0.568	2.938
Bachelor	48	47.1	12	25.0	29	60.4	7	14.6		
Master's degree or above	2	2.0	0	0.0	1	50.0	1	50.0		
profession										
Doctor	82	80.4	24	29.3	46	56.1	12	14.6	0.094	7.927
Nurse	18	17.6	2	11.1	9	50.0	7	38.9		
Inspector	2	2.0	0	0.0	1	50.0	1	50.0		
professional title										
Primary title	33	32.4	10	30.3	15	45.5	8	24.2	0.666	4.082
Middle title	41	40.2	11	26.8	24	58.5	6	14.6		
Assistant senior title	26	25.5	5	19.2	15	57.7	6	23.1		
Senior title	2	2.0	0	0.0	2	100.0	0	0.0		
Years of service										
<5years	7	6.9	0	0.0	3	42.9	4	57.1	0.104	7.670
5-10years	10	9.8	3	30.0	5	50.0	2	20.0		
>10 years	85	83.3	23	27.1	48	56.5	14	16.5		
Have you ever treated a pregnant woman with influenza?										

Yes	55	53.9	12	21.8	37	67.3	6	10.9	**<0.05**	8.565
No	47	46.1	14	29.8	19	40.4	14	29.8		
Have you received the flu vaccine before?										
Yes	38	37.3	9	23.7	20	52.6	9	23.7	0.723	0.648
No	64	62.7	17	26.6	36	56.3	11	17.2		
Do you agree with the statement that "influenza is a highly susceptible disease"?										
Yes	91	89.2	23	25.3	51	56.0	17	18.7	0.271	5.164
No	8	7.8	3	37.5	4	50.0	1	12.5		
Unclear	3	2.9	0	0.0	1	33.3	2	66.7		
Do you agree with the statement that "pregnant women are at increased risk of severe illness after getting the flu"?										
Yes	90	88.2	25	27.8	51	56.7	14	15.6	**<0.01**	22.284
No	7	6.9	1	14.3	5	71.4	1	14.3		
Unclear	5	4.9	0	0.0	0	0.0	5	100.0		
Do you think the flu vaccine is safe for pregnant women?										
Yes	37	36.3	18	48.6	15	40.5	4	10.8	**<0.01**	23.947
No	20	19.6	3	15.0	16	80.0	1	5.0		
Unclear	45	44.1	5	11.1	25	55.6	15	33.3		
Do you think it is safe for pregnant women to get the flu vaccine for their fetus?										
Yes	30	29.4	15	50.0	11	36.7	4	13.3	**<0.01**	18.904
No	18	17.6	2	11.1	15	83.3	1	5.6		
Unclear	54	52.9	9	16.7	30	55.6	15	27.8		
Do you agree with the statement that influenza causes a significant burden of disease?										
Yes	50	49.0	13	26.0	29	58.0	8	16.0	0.067	8.763
No	38	37.3	8	21.1	24	63.2	6	15.8		
Unclear	14	13.7	5	35.7	3	21.4	6	42.9		
Do you think the flu causes complications during pregnancy?										
Yes	69	67.6	19	27.5	43	62.3	7	10.1	**<0.01**	17.647
No	13	12.7	5	38.5	5	38.5	3	23.1		
Unclear	20	19.6	2	10.0	8	40.0	10	50.0		
Do you think the flu vaccine is an effective way to prevent pregnant women from getting the flu?										
Yes	59	57.8	25	42.4	27	45.8	7	11.9	**<0.01**	31.444
No	15	14.7	0	0.0	14	93.3	1	6.7		
Unclear	28	27.5	1	3.6	15	53.6	12	42.9		
Do you think pregnant women can get the flu vaccine?*										
Yes	31	30.4	22	71.0	8	25.8	1	3.2	**<0.01**	77.846
No	31	30.4	1	3.2	30	96.8	0	0.0		
Unclear	40	39.2	3	7.5	18	45.0	19	47.5		

3.2.2 Knowledge of influenza vaccines

Among the 102 participants, a majority (57.8%) believed that the flu vaccine is an effective method to prevent pregnant women from contracting the flu. Participants who were uncertain (27.5%) about the effectiveness of the flu vaccine in preventing flu in pregnant women were more than those who held a negative attitude (14.7%). A majority of participants (44.1%) indicated that they were unsure whether the flu vaccine is safe for pregnant women, while 36.3% of all participants believed that the flu vaccine is safe for pregnant women, and 19.6% believed it to be unsafe. More than half (52.9%) of the participants were uncertain about whether the flu vaccine is safe for the fetus when administered to pregnant women. 29.4% of participants believed that it is safe for pregnant women to receive the flu vaccine, while 18% believed it to be unsafe for the fetus.

3.3 Willingness and behavior of healthcare workers to recommend influenza vaccine to pregnant women.

3.3.1 Recommended intentions and behaviors

Among 102 participants, 25.5% expressed willingness to recommend influenza vaccine to pregnant women. However, only 14.7% of participants indicated that they frequently recommend influenza vaccination for pregnant women in their clinical practice.

3.3.2 Results of a univariate analysis of healthcare workers' willingness to recommend influenza vaccine to pregnant women

By analyzing the demographic characteristics of 102 participants, it was found that there were statistically significant differences (P<0.05) in different age groups and whether they had treated pregnant women with influenza. Significant differences were also found in the choices regarding influenza and influenza vaccine-related knowledge, such as whether participants agreed with the statement "pregnant women are at increased risk of severe illness after contracting influenza," whether they believed that influenza vaccine is safe for pregnant women and their fetuses, whether they believed that influenza causes pregnancy complications, whether they believed that influenza vaccine is an effective way to prevent pregnant women from getting the flu, and whether they believed that pregnant women can receive influenza vaccination. The results of the six related questions showed statistically significant differences (P<0.01), as shown in Table 1.

3.3.3 Multivariate analysis of healthcare workers' willingness to recommend influenza vaccine to pregnant women

The variable of interest is whether or not one is willing to recommend the flu vaccine to pregnant women. Single-factor analysis includes indicators with statistical significance as independent variables. Multiple-factor analysis was conducted using binomial logistic regression, as shown in Table 2.

Table 2 displays the results of the multivariable logistic regression model. According to the table, the belief that pregnant women can receive the flu vaccine (OR=47.569, 95% CI: 1.465 to 1544.497) significantly affects healthcare workers' willingness to recommend the flu vaccine to pregnant women. In addition, a larger OR value indicates a stronger tendency to recommend the flu vaccine to pregnant women, compared to the reference value (the last option in each group of data).

Table 2: A multivariate analysis of healthcare workers' willingness to recommend influenza vaccines to pregnant women

Whether pregnant women are willing to be recommended for influenza vaccination during the admission process		B	standard error	Wald	DOF	Salience	Exp(B)	95% confidence interval for Exp(B).	
								floor level	upper limit
Yes	intercept	-37.872	2496.122	.000	1	.988			
	[age=1]	-43.911	10959.746	.000	1	.997	8.503E-20	.000	.[b]
	[age=2]	.373	2.401	.024	1	.876	1.453	.013	160.780
	[age=3]	.639	1.671	.146	1	.702	1.894	.072	50.112
	[age=4]	0[c]	.	.	0	.	.	.	.
	[Have you received the flu vaccine? =1]	-.297	1.079	.076	1	.783	.743	.090	6.162
	[Have you received the flu vaccine? =2]	0[c]	.	.	0	.	.	.	.
	[Do you agree that "pregnant women are at increased risk of severe illness after influenza"=1]	33.949	2496.121	.000	1	.989	554549570125922.700	.000	.[b]

	[Do you agree that "pregnant women are at increased risk of severe illness after influenza"=2]	49.113	.000	.	1	.	2135776686335978400000.000	213577668633597840000000.000	213577668633597840000000.000
	[Do you agree that "pregnant women are at increased risk of severe illness after influenza"=3]	0[c]	.	.	0	.	.	.	.
	[Whether the flu vaccine is considered safe for pregnant women =1]	1.180	1.991	.351	1	.553	3.255	.066	161.002
	[Whether the flu vaccine is considered safe for pregnant women =2]	17.946	2976.175	.000	1	.995	62190376.870	.000	.[b]
	[Whether the flu vaccine is considered safe for pregnant women =3]	0[c]	.	.	0	.	.	.	.
	[Influenza vaccine is an effective way to prevent influenza infection in pregnant women =1]	2.618	1.640	2.548	1	.110	13.702	.551	340.792
	[Influenza vaccine is an effective way to prevent influenza infection in pregnant women =2]	2.145	6494.348	.000	1	1.000	8.545	.000	.[b]
	[Influenza vaccine is an effective way to prevent influenza infection in pregnant women =3]	0[c]	.	.	0	.	.	.	.
	[Whether influenza is thought to cause pregnancy complications in pregnant women =1]	.331	1.476	.050	1	.823	1.393	.077	25.141
	[Whether influenza is thought to cause pregnancy complications in pregnant women =2]	-.092	1.908	.002	1	.962	.912	.022	38.393
	[Whether influenza is thought to cause pregnancy complications in pregnant women =3]	0[c]	.	.	0	.	.	.	.
	[Whether influenza vaccination for pregnant women is considered safe for the fetus =1]	-1.142	2.058	.308	1	.579	.319	.006	18.017
	[Whether influenza vaccination for pregnant women is considered safe for the fetus =2]	44.735	4944.244	.000	1	.993	26799044755885190000.000	.000	.[b]
	[Whether influenza vaccination for pregnant women is considered safe for the fetus =3]	0[c]	.	.	0	.	.	.	.
	[Whether you think pregnant women can get the flu vaccine =1]	3.862	1.776	4.731	1	**.030**	47.569	1.465	1544.497
	[Whether you think pregnant women can get the flu vaccine =2]	15.839	2934.129	.000	1	.996	7566117.719	.000	.[b]
	[Whether you think pregnant women can get the flu vaccine =3]	0[c]	.	.	0	.	.	.	.
	[Have you seen any pregnant women with influenza? =1]	-.221	1.124	.039	1	.844	.802	.089	7.256
	[Have you seen any pregnant women with influenza? =2]	0[c]	.	.	0	.	.	.	.
no	intercept	-51.147	10970.853	.000	1	.996			
	[age=1]	-29.672	3693.574	.000	1	.994	1.299E-13	.000	.[b]
	[age =2]	-.250	2.253	.012	1	.912	.779	.009	64.373
	[age =3]	-.526	1.510	.122	1	.727	.591	.031	11.385
	[age =4]	0[c]	.	.	0	.	.	.	.
	[Have you received the flu vaccine?=1]	-.326	.912	.128	1	.721	.722	.121	4.313
	[Have you received the flu vaccine?=2]	0[c]	.	.	0	.	.	.	.
	[Do you agree that "pregnant women are at increased risk of severe illness after influenza"=1]	51.335	10970.853	.000	1	.996	19708912392248607000000.000	.000	.[b]
	[Do you agree that "pregnant women are at increased risk of severe illness after influenza"=2]	65.231	11222.836	.000	1	.995	21343360891771254000000000000.000	.000	.[b]
	[Do you agree that "pregnant women are at increased risk of	0[c]	.	.	0	.	.	.	.

	severe illness after influenza"=3]								
	[Whether the flu vaccine is considered safe for pregnant women =1]	-1.137	1.751	.421	1	.516	.321	.010	9.927
	[Whether the flu vaccine is considered safe for pregnant women =2]	16.264	2976.175	.000	1	.996	11569890.537	.000	.[b]
	[Whether the flu vaccine is considered safe for pregnant women =3]	0[c]	.	.	0	.	.	.	.
	[Influenza vaccine is an effective way to prevent influenza infection in pregnant women =1]	.582	1.142	.260	1	.610	1.790	.191	16.794
	[Influenza vaccine is an effective way to prevent influenza infection in pregnant women =2]	16.956	4234.932	.000	1	.997	23115848.720	.000	.[b]
	[Influenza vaccine is an effective way to prevent influenza infection in pregnant women =3]	0[c]	.	.	0	.	.	.	.
	[Whether influenza is thought to cause pregnancy complications in pregnant women =1]	-.386	1.093	.125	1	.724	.680	.080	5.788
	[Whether influenza is thought to cause pregnancy complications in pregnant women =2]	-1.640	1.759	.870	1	.351	.194	.006	6.089
	[Whether influenza is thought to cause pregnancy complications in pregnant women =3]	0[c]	.	.	0	.	.	.	.
	[Whether influenza vaccination for pregnant women is considered safe for the fetus =1]	.567	1.834	.095	1	.757	1.763	.048	64.163
	[Whether influenza vaccination for pregnant women is considered safe for the fetus =2]	46.126	4944.243	.000	1	.993	1077454947333102100 00.000	.000	.[b]
	[Whether influenza vaccination for pregnant women is considered safe for the fetus =3]	0[c]	.	.	0	.	.	.	.
	[Whether you think pregnant women can get the flu vaccine =1]	2.088	1.678	1.548	1	.213	8.069	.301	216.292
	[Whether you think pregnant women can get the flu vaccine =2]	18.877	2934.129	.000	1	.995	157839257.462	.000	.[b]
	[Whether you think pregnant women can get the flu vaccine =3]	0[c]	.	.	0	.	.	.	.
	[Have you seen any pregnant women with influenza? =1]	1.233	.916	1.810	1	.179	3.431	.569	20.678

a. The reference category is: ^1.

b. A floating point overflow occurred while calculating this statistic. Therefore, its value is set to the system missing value.

c. This parameter is redundant and is therefore set to zero.

4. Discussion

Despite a large body of research indicating that administering influenza vaccines to pregnant women can provide immune protection to both the mother and fetus, reducing the incidence of pregnancy complications, severe illness, mortality, and incidence of birth defects caused by influenza infection during pregnancy, the vaccination rate for pregnant women in China remains low. In major cities such as Beijing and Shenzhen, the vaccination rate for influenza during pregnancy is less than 20%. Medical staff recommendations have consistently been identified as one of the most important factors in increasing vaccination rates. Receiving advice from medical personnel during pregnancy can increase the vaccination rate by 6-7 times. A study on the barriers to influenza vaccination for pregnant women in Chaoyang Maternity and Child Healthcare Hospital in Beijing showed that 93.94% of doctors were unwilling to recommend influenza vaccines, with the main reasons being concerns about the safety of the vaccine for the fetus (20.87%) and for pregnant women (18.26%). The results of this study indicate that the main reason why medical staff in Xiangxi District are unwilling to recommend influenza vaccines to pregnant women is still due to safety concerns for pregnant women

(80.39%). Compared to developed cities such as Beijing, the Xiangxi region has low levels of health literacy among the population, including medical staff, due to its special geographic location, poor transportation, and economic backwardness. In addition, the lack of government and obstetrician recommendations (65.69%) has added to the hesitation of medical staff in recommending influenza vaccines to pregnant women, which undoubtedly creates barriers to increasing the influenza vaccination rate for pregnant women in Xiangxi.

Results of a univariate analysis of medical staff recommending influenza vaccines to pregnant women showed that participants with more than 10 years of work experience accounted for 83.3% of all participants, and most participants were between 40 and 49 years old (68.6%). However, the survey results showed that medical staff aged 20-29 years old chose "unclear" in response to the question of whether they would recommend influenza vaccines to pregnant women, indicating that contemporary young medical staff may lack sufficient knowledge about influenza vaccination during pregnancy. With the development of the times and the updating of information, the traditional belief that no vaccines should be administered during pregnancy should be gradually replaced. This suggests that local governments should conduct long-term knowledge promotion campaigns on influenza vaccination during pregnancy, especially for young medical staff, and local health authorities should use modern network media technology to provide targeted solutions to the safety concerns of Xiangxi residents regarding influenza vaccination during pregnancy. They can also leverage the credibility of local governments and obstetric experts to help improve the health literacy of Xiangxi residents, and increase the knowledge of medical staff on influenza vaccination during pregnancy through information and promotion activities, thereby improving education for pregnant women.

At the same time, the analysis results show that doctors who have had experience treating pregnant women with influenza ($P < 0.05$), doctors who are more susceptible to and aware of the severity of influenza during pregnancy, and those who have a higher awareness of the safety of influenza vaccines for pregnant women and fetuses are more willing to recommend influenza vaccines to pregnant women, as shown in Table 1. This may be related to the increased risk perception of doctors for influenza during pregnancy due to their experience in treating such cases. Perception of risk can change doctors' attitudes towards recommending influenza vaccination during pregnancy, and may also enrich their knowledge about vaccination during pregnancy, further influencing their behavior in recommending influenza vaccines to pregnant women during clinical practice, as shown in Figure 1.

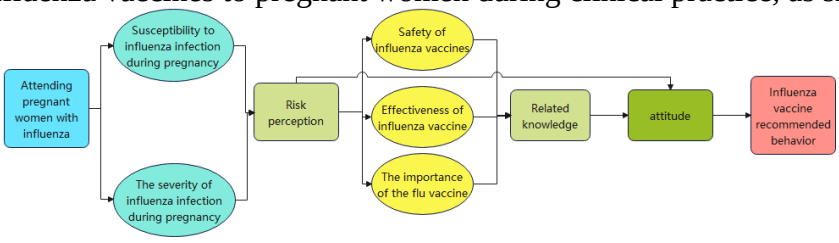

Figure 1: The impact of attending pregnant women with influenza on the recommendation of influenza vaccines by healthcare workers to pregnant women

In addition, the results of the univariate analysis of medical workers' willingness to recommend influenza vaccine to pregnant women and the univariate analysis of medical workers' actual recommendation of influenza vaccine to pregnant women during the diagnosis and treatment process show that doctors are more likely to recommend influenza vaccine to pregnant women than nurses and laboratory technicians. Previous studies by Dube et al. (23) have shown that compared to doctors, other medical workers including nurses and midwives are less willing to recommend influenza vaccine to pregnant women due to lack of knowledge, concerns about vaccine safety, not considering vaccine administration as part of routine maternal and child health care, and concerns about medical liability. This can explain why the results of this study suggest that doctors are more inclined to

provide recommendations for influenza vaccine to pregnant women than other medical workers.

This study has certain limitations. First, the target population of the study is medical workers (mainly obstetricians) in the Xiangxi area, and cannot be generalized to all medical workers. Second, recall bias is an unavoidable factor because some indicators reflect memory information from one year or earlier, which may affect the percentage of factors affecting medical workers' willingness to recommend influenza vaccine to pregnant women in this study.

In conclusion, there is a certain gap in the willingness of medical workers in the Xiangxi area to recommend influenza vaccine to pregnant women compared to developed areas. Factors such as age, experience of receiving pregnant women with influenza, and knowledge related to influenza infection during pregnancy and influenza vaccine are important factors affecting medical workers' recommendations. This study aims to explore the willingness of medical personnel to recommend influenza vaccine to pregnant women and the factors influencing their recommendations during the actual diagnosis and treatment process, which can help to improve the influenza vaccination rate among pregnant women in the Xiangxi area and improve the adverse outcomes of influenza infection during pregnancy. Our research results will provide more insights for public health authorities to plan and implement targeted strategies to improve the vaccination rate of pregnant women.

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