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Factors associated with lack of antenatal care uptake among ethnic minority women in rural China: Implications for prevention of mother-to-child HIV transmission

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Abstract

Background: Mother to child transmission (MTCT) is one of the main transmission routes of HIV, and the probability of MTCT can be dramatically reduced with comprehensive interventions. The Liangshan Prefecture started the prevention of MTCT program in 2009. However, the implementation of the program is suboptimal and the coverage of HIV testing is still low. Many Yi women (main local minority nationality) did not take antenatal care (ANC) and gave birth to their babies at home for a variety of reasons.

Methods: Women with pregnancy history in the last five years were recruited in two townships based on cluster sampling and face-to-face interviews were conducted. Descriptive analysis was performed to describe demographic characteristics, history of pregnancy and ANC uptake, knowledge of and attitudes towards ANC. Multivariable analysis was used to identify factors associated with uptake of ANC.

Results: Among 538 women who completed the questionnaires, 77.9% knew that ANC was necessary following pregnancy. However, only 24.2% accessed ANC. Almost all women (94.6%) were willing to use ANC after pregnancy but barriers toward actual uptake of ANC existed including shyness, lack of independence, unavoidable cost. Multivariate analysis showed that, no experience of living outside, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were associated with lack of ANC uptake.

Conclusion: Although ethnic minority women in rural Liangshan expressed strong intention to use ANC, actual uptake of ANC was low. Knowledge of ANC and HIV prevention for mother-to-child transmission (PMTCT) should be improved among this population, and efforts should be made to help them overcome barriers to accessing ANC.

Key words: antenatal care (ANC); ethnic minority; China

Strengths and limitations of this study

- The subjects of this study were selected from health service provider, the recipient, and the hub (the key figure in the family), enriching the research perspective and making information acquisition and research results more comprehensive and closer to the objective.
- We only selected women of child-bearing age and had pregnancy history in the last five years from two towns of Zhaojue. Therefore, our findings may not be generalizable to the entire local women of child-bearing age.
- Due to the mode of survey administration (interviewer-administered face-to-face), social desirability bias might be introduced.
- Our HIV-related questions were not MTCT or PMCT specific. Future studies should consider include HIV-related questions that are more relevant to the concerns and needs of pregnant women.

Introduction

Background

With antiretroviral (ARV) drugs and treatment, is highly effective. Elimination of PMTCT of HIV is now considered a realistic public health goal and an important component of a comprehensive HIV prevention package. In 2014, 73% of the estimated 1.5 million pregnant women living with HIV globally received ARV drugs to effectively avoid transmission to their children [1, 2].

A comprehensive approach to PMTCT programmes is promoted by The World Health Organization (WHO), which includes: 1) precluding new HIV infections among women of reproductive age; 2) avoiding accidental pregnancies among HIV-infected women; 3) preventing HIV vertical transmission from an HIV-infected mother to her child; and 4) providing applicable treatment, care and support to HIV-infected mothers, their children and families [3]. China has been starting on PMTCT since 2003 and achieved similar progress as in other parts of the world [4]. However, in some remote rural areas, especially regions resided by ethnic minority groups, PMTCT still faces significant challenges. For example, Liangshan Yi Autonomous Prefecture in Sichuan Province, which is on a main drug trafficking route in the Golden Triangle, is one of the areas that has the highest HIV infection rate in the past few years [5-9]. A study reported that HIV prevalence was 4.4% among rural residents in two of the most affected counties, Butuo and Zhaojue, in Liangshan prefecture in 2009. [7]. Furthermore, a recent study conducted among HIV-positive pregnant women in the prefecture in 2004 found that 7.0% of their infants were tested positive [9], a figure

significantly higher than the national average. Although overall rate of MTCT dropped from 10.5% in 2008 to 5.5% in 2013 (unpublished data), MTCT of HIV is still a serious public health concern in this area due to lack of HIV testing, barriers to accessing treatment and care, and poverty and illiteracy among the population.

Antenatal care could provide opportunities to identify undiagnosed cases as well as conduct PMTCT among known HIV-positive women. Liangshan Prefecture began to implement PMTCT program at ANC clinics and hospitals since 2009. In addition to providing regular pregnancy-related check-ups, ANC also includes free HIV testing. However, coverage of PMTCT, especially uptake of HIV testing, remained low. One of the reasons for such low coverage was that about a third of local women delivered their babies at home rather than in the hospitals [9]. Furthermore, even fewer pregnant women accessed ANC before delivery. A study reported that 62% of pregnant women in the prefecture had fewer than five ANC visits during pregnancy while 26.0% never utilized any ANC [10]. Therefore, in order to improve the effectiveness of the PMTCT program, access and uptake of ANC need to be improved substantially.

The study area, Zhaojue County, is an underdeveloped county with one of the highest HIV infection rates in Liangshan [7]. In addition to the PMTCT program, the China / United Nations Children's Fund Conditional Cash Transfer (CCT) project, which provides incentives for pregnant women to use ANC and deliver in hospitals, has also been implemented in Zhaojue. However, proportions of women who access ANC and have child delivery in hospitals are still below the average level in the prefecture. In order to encourage more women to access ANC and improve coverag it is

necessary to identify factors that may promote or hinder use of ANC among this vulnerable population.

Objectives

The objectives of this study were to describe knowledge, acceptability and actual uptake of ANC and to identify factors associated with lack of ANC attendence among women of child-bearing age in Zhaojue County, Liangshan, China.

Methods

Setting and participants

The survey was conducted in Zhaojue County of Liangshan Prefecture in December, 2014. The county is located in east-central Liangshan, southwestern Sichuan Province, with an area of 2,700 square kilometers and a population of 308,300. The majority (97.9%) of the population was Yi (the local ethnicity), residing in 47 towns and 269 villages [11].

First, we purposively selected two townships that have both larger populations and hospitals that provide ANC. Then we divided the villages within the two townships into two layers based on the distance between the villages and the township hospital. One village close to the hospital and one far away from the hospital were randomly selected from each township. All eligible women in the selected four villages were invited to participate. Inclusion criteria included: 1) female; 2) aged 49 or under; 3) had a pregnancy history in the last five years; and 4) having resided in Zhaojue County for at least 6 months. The sample size is calculated by the equation N

= Z^2 P(1–P)/d^2, and Z=1.96, P=0.56, d=0.05. N=378, but as cluster sampling was conducted, the sample size should increase by 50%. So, the sample size is 567.

Study instrument and data collection

A structured questionnaire was developed based on literature review, formative research and local health experts' input, and was pilot tested. The information collected included: (1) Demographic and household characteristics of participants, including age, income, education, ethnicity, occupation, marital status, age of the participant's husband, and family size; (2) History of pregnancy, including number of pregnancies, number of births, and whether participants accessed ANC during their pregnancies; (3) Whether they know ANC is necessary, ANC is free, where to get ANC and what ANC includes; (4) Willingness to utilize ANC measured by a series of Yes/No questions, and facilitators of and barriers to accessing ANC; and (5) whether they have heard of AIDS and knew someone who was HIV-positive

Interviewers were local women who were proficient in both Yi (local language) and Mandarin. They were trained to ensure study protocol was followed. On account of the general low educational level of respondents, oral informed consent was obtained from each of them before the face-to-face interview and their names was signed on the informed consent by investigators.

Data management and statistical analysis

All the data were double entered with Epidata 3.1 and discrepancies were checked against the raw data. Data analysis was performed with SPSS 21.0. Descriptive analysis was used to describe demographic characteristics, history of

pregnancies and ANC-related variables. To identify independent correlates of ANC uptake, univariate analysis was first conducted through chi-square tests comparing characteristics of women who accessed ANC during their pregnancy versus those who did not. Variables with a P values < 0.05 in the univariate analysis were eligible for entry into the multivariable logistic regression model, where adjusted OR and 95%CI were calculated accordingly.

Patient and public involvement

No patients were involved in the development of the research question or the outcome measures nor the design of the study. There are no plans to disseminate the results of the research to study participants.

Results

Demographic characteristics

A total of 547 women with pregnancy history in the last five years were approached and 538 valid questionnaires were collected, with a response rate of 98.4%. The mean age of participants was 35.6 years and 7.0% of them were less than 25 years of age. Most participants (86.2%) were illiterate. Almost half (45.1%) had 4-5 family members while 86 (16.4%) had 1-3 and family members. More than half had given birth to a baby (56.2%) 3-4 times. Compared to those who ever used ANC, participants who did not were significantly more likely to be older (39.7% vs. 27.4% between 36 and 45, $p < 0.001$), lack of education (88.2% vs. 79.8% among people who never attended school, $p < 0.05$), had more delivery (16.6% vs. 2.3% in people who have five and more deliveries, $p < 0.001$) (Table 1).

History, knowledge of and attitude towards ANC

Almost all participants (94.6%) reported that they were willing to use ANC during pregnancy. However, just under a quarter (24.2%) had ever received ANC. The majority (77.9%) thought ANC was necessary after pregnancy, 84.5% thought it was necessary to give birth in hospitals, 83% also knew that ANC and delivery in hospitals were free. However, almost half (45.2%) did not know what ANC included. Almost all of the participants (97.4%) heard of AIDS and more than half (54.7%) knew someone who was HIV-infected. Compared to those who ever used ANC, participants who did not were significantly more likely not to have known that ANC was necessary during pregnancy (27% vs. 5.4%, $p < 0.001$), not to have known delivery should be in hospital (17.8% vs. 8.4%, $p < 0.05$), not to have known ANC and delivery in hospitals are all free (19.4% vs. 9.3%, $p < 0.005$), not to have known government encourages ANC (39.1% vs. 24%, $p < 0.005$) (Table 2).

Independent correlates of lack of ANC uptake

In multivariable analysis, women who did not know that ANC during pregnancy was necessary (OR=0.246, 95%CI=0.092-0.658) and those who did not know about government's support policy of ANC (OR=0.561, 95%CI=1.269-0.992) were less likely to use ANC. Women who never lived outside of Zhaojue for more than six months (OR=4.808. 95%CI=2.012-11.494) and those who had five or more deliveries (OR=5.848, 95%CI=1.645-20.833) were more likely to have not used ANC (Table 3).

Facilitators and needs assessment of ANC

When asked about who can influence their decisions of accessing ANC, almost half reported Village Women Federation (47.9%), followed by husbands (43.8%) and parents-in-law (34.7%). The most cited reasons for not using ANC were shyness (33.3%), incapability of going without company (27.3%) and cultural custom (15.2%). In terms of facilitators of ANC, the most popular responses were reimbursement of transportation (73.8%), improved education of ANC among women (64.2%) and linking ANC to issuance of birth certificates (51.9%). About a third of participants (30.9%) thought 50 RMB (about 8 USD) for ANC was acceptable and 23.3% thought 100 RMB was acceptable, however, 22.1% were unwilling to pay anything. (Table 4)

Discussion

In this study, we investigated knowledge about, acceptance and uptake of ANC among women of child-bearing age in an ethnic minority area of China. We also explored factors associated with lack of ANC uptake among these ethnic minority women. We found that majority of participants knew that ANC was free, it was necessary to use antenatal care during pregnancy, and most were willing to use ANC. However, less than a quarter had ever accessed ANC, which is much lower than reported by previous studies. In 1998, The National Health Service Surveys reported that 81% of women used ANC, meanwhile, 76% women in rural areas accessed ANC during 1998 to 2000 [12, 13]. There were a few possible reasons for the low uptake of ANC found in our study. Firstly, the study area is undeveloped, many women do not know about the government's policy and they warry out the spending including transportation issues. Secondly, many women in this area are illiterate and

non-independent (they said they were couldn't go without company). In addition, the cultural custom of not talking about pregnancy and delivering at home also hinder those pregnant women from taking ANC. Thirdly, the strong intention to use ANC reflected current attitudes among participants, while actual uptake of ANC included previous pregnancies. In recent years, due to the implementation of the PMTCT programs in the area, the proportion of Yi women who delivered in hospitals had increased substantially. However, local governments only started to encourage and support ANC access a couple of years before the current survey. There were some informational and educational materials of ANC being distributed, but most women in the rural areas of Zhaojue were illiterate.

Knowing that ANC during pregnancy is necessary and that government's supportive policy of ANC were positively associated with history of using ANC. We also found that having had five or more deliveries was negatively associated history of taking ANC. Women with more pregnancies tended not to take ANC for two possible reasons: 1) These women were older and less educated, thus their knowledge of ANC was relatively poor and they may have limited communication skills with healthcare professionals. 2) They might think that because they had successfully experiences of delivering babies therefore it is not necessary to use ANC. The results of our study were similar to studies in other developing countries. For example, in the systematic review by Simkhada et al., factors associated with the utilization of ANC were: education level of pregnant women and their spouses, health service accessibility, cost, family income, etc. They also found that the attitude towards pregnancy could

impact the utilization of ANC, and there was an inverse correlation between the previous pregnancy and the utilization of ANC [14]. Some studies conducted in China also had or similar findings. For example, Liu and Ceng conducted studies individually in 2007 and 2010, and they found factors associated with the intention and uptake for pregnant women to take ANC could be summarized into three categories: 1) demographic characteristics of pregnant women and their spouses such as low education level, older age and low economic level; 2)number of children ; 3) policies such as birth control leading the worry about being punished even forced abortion [15, 16].

Surprisingly, we found that having ever heard of AIDS and knowing someone who was HIV-infected were not associated with uptake of ANC. A possible reason is that women might not be aware of HIV testing services provided by ANC or that HIV was not one of the top health concerns during their pregnancy and knowledge of HIV and perceived threat of HIV were not sufficient to motivate them get themselves tested during ANC.

Findings from our study suggest that future efforts to increase uptake of ANC and improve PMTCT should focus on the following aspects: 1) improve accessibility of ANC, which may involve infrastructure construction, provision of user-friendly services, etc. In this study, many participates did not know places where offer ANC, and there were also many participants halted because of the long distance and cost in journey. Therefore, making ANC more accessible is urgent. A good service attitude is another approach to attract pregnant women since one who had good experiences with

ANC could put other women in motion; 2) mobilize community and family members to encourage ANC after pregnancy. Women in poor rural area are more likely to be lack of independence. In other words, they are not used to make decisions towards something important. So, the call of community and support of family would give them courage and belief to overcome the psychological barriers. It would make a big difference if their family members and the community encourage them to accept ANC during pregnancy. 3) improve knowledge of ANC among pregnant women, especially among those with low education or illiterate. For example, instead of text-based educational materials, picture-based materials should be distributed. In addition, mini-dramas or plays demonstrating the importance and benefits of ANC could be conducted at community events; 4) HIV screening should continue to be offered at ANC clinics in order to prevent mother-to-child transmission of HIV. The knowledge of the effectiveness and benefits of PMTCT should be improved not only among women, but also among their families and other community members.

Conclusions

In summary, although the actual uptake of antenatal care among women of childbearing age in this rural minority area is lower than other areas, women in the region have strong intention to ANC. No experience of living outside, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were associated with lack of ANC uptake. ANC targeting PMTCT in China may need to be more comprehensive and

incorporate the cultural, logistic and needs of the population in order to effectively affect this population's utilization of ANC.

Declarations

Ethic

The study protocol was approved by the Ethical Review Committees of the World Health Organization (RPC587) and Shandong University School of Public Health (20130602). Study procedures, voluntary nature of participation, participants' right to withdraw and autonomy of the participants were explained and oral informed consent was obtained from all participants.

Conflict of interest

The authors declare that they have no conflict of interest.

Author's contributions

BL, LN, CW and WM conceived and designed the study. BL, DS, WW, BY, AE, HZ, WW and SW performed the study. BL, and WW analyzed the data. BL, DS, WW and SW contribute to writing the manuscript. CW and WM critically revised the paper. All authors read and approved the final manuscript.

Availability of data and materials

The data supporting our findings have been presented in the main text.

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Key points

- Although the government provides a variety of supportive policies, the progress of prevention of mother to child transmission in Liangshan Prefecture is still not obvious.
- Ethnic minority women in rural Liangshan expressed strong intention to use ANC, but the actual uptake of ANC was low.
- No experience of living outside, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were the obstructive factors of ANC uptake.

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Table 1. Differences in demographic characteristics between participants who used ANC versus those who did not

	Ever took ANC			
	No	**Yes**	**Total**	**P value**
Age				<0.001
≤25	19 (4.7)	18 (14.5)	37 (7.0)	
26-35	165 (40.9)	66 (53.2)	231 (43.8)	
36-45	160 (39.7)	34 (27.4)	194 (36.8)	
>45	59 (14.6)	6 (4.8)	65 (12.3)	

Husband's age				<0.001
≤25	15 (4.2)	12 (10.2)	27 (5.7)	
26-35	143 (39.7)	63 (53.4)	206 (43.2)	
36-45	137 (38.2)	35 (29.7)	172 (36.1)	
>45	64 (17.8)	8 (6.8)	72 (15.1)	
Education				0.04
Never attended school	360 (88.2)	103 (79.8)	463 (86.2)	
Primary	44 (10.8)	24 (18.6)	68 (12.7)	
Secondary or higher	4 (1)	2 (1.6)	6 (1.1)	
Lived out of Zhaojue more than half a year ever				<0.001
Yes	13 (3.7)	23 (18.3)	36 (7.5)	
No	342 (96.3)	103 (81.7)	445 (92.5)	
Household income in the last year(RMB)				0.744
≤1500	93 (24.6)	118 (91.5)	121 (24.1)	
1501-3000	145 (38.4)	55 (44)	200 (39.8)	
3001-4500	39 (10.2)	12 (9.6)	51 (10.1)	
≥4500	101 (26.7)	30 (24)	131 (26)	
Family members				0.008
≤3	57 (14.2)	30 (23.1)	87 (16.4)	
4-5	177 (44)	63 (48.5)	240 (45.1)	
≥6	168 (41.8)	37 (28.5)	205 (38.5)	
Number of pregnancy				0.001
0-2	94 (23)	48 (37.5)	142 (26.5)	
3-4	215 (52.7)	65 (50.8)	280 (52.2)	
≥5	99 (24.3)	15 (11.7)	114 (21.3)	
Number of delivery				<0.001
0-2	106 (27)	54 (42.2)	160 (30.8)	
3-4	221 (56.4)	71 (55.5)	292 (56.2)	
≥5	65 (16.6)	3 (2.3)	68 (13.1)	

Table 2. Differences in knowledge of ANC, HIV, and PMTCT between participants who used ANC versus those who did not

	Ever took ANC			
	No	**Yes**	**Total**	**P value**
Knowing ANC is necessary after pregnant				<0.001
Yes	290 (72.5)	123 (94.6)	413 (77.9)	
No	110 (27)	7 (5.4)	117 (22.1)	
Thinking delivery should be in hospital				0.037

Yes	332 (82.2)	119 (91.5)	451 (84.5)	
No	72 (17.8)	11 (8.4)	83 (15.5)	
Knowing ANC and delivery in hospitals are all free				0.004
Yes	328 (80.6)	117 (90.7)	445 (83)	
No	79 (19.4)	12 (9.3)	91 (17)	
Knowing what ANC includes				<0.001
Yes	225 (55.1)	70 (53.8)	295 (54.8)	
No	183 (44.9)	60 (46.2)	243 (45.2)	
Knowing government encourages ANC				0.003
Yes	235 (60.9)	98 (76)	333 (64.7)	
No	151 (39.1)	31 (24)	182 (35.3)	
Having ever heard AIDS				1
Yes	397 (97.3)	127 (97.7)	524 (97.4)	
No	11 (2.7)	3 (2.3)	14 (2.6)	
Knowing HIV-infected person				0.219
Yes	225 (55.7)	66 (51.6)	291 (54.7)	
No	179 (44.4)	62 (48.4)	241 (45.3)	

Table 3. Multivariable analysis of independent correlates associated with having not used ANC

	Having not used ANC			
	OR	**95%CI**	**AOR**	**95%CI**
Age				
≤25	1			
26-35	4.464	(1.170-4.785)		
36-45	4.464	(2.119-9.346)		
>45	9.346	(3.236-27.027)		

Husband's age				
≤25	1			
26-35	1.815	(0.804-4.098)		
36-45	3.135	(0.137-0.743)		
>45	0.156	(2.227-18.519))		
Education				
Never attended school	1			
Primary	0.525	(0.305-0.903)		
Secondary or higher	0.572	(1.967-3.165)		
Lived out of Zhaojue more than half a year ever				
Yes	1		1	
No	5.882	(2.874-12.048)	4.808	(2.012-11.494)
Number of pregnancies				
0-2	1			
3-4	1.689	(1.082-2.639)		
≥5	3.367	(1.770-6.410)		
Number of delivery				
0-2	1		1	
3-4	1.585	(1.038-2.421)	1.024	(0.601-1.742)
≥5	10.989	(3.311-37.037)	5.848	(1.645-20.833)
Is ANC after pregnancy necessary?				
No	1		1	
Yes	1.504	(0.068-0.331)	0.246	(0.092-0.658)
Is giving birth in hospitals Necessary?				
No	1			
Yes	0.465	(0.191-1.131)		
Do not know	0.833	(0.336-4.292)		
Knowing ANC and delivery in hospitals are all free				
No	1			
Yes	0.426	(0.224-0.810)		
Knowing government Encourages ANC				
No	1		1	
Yes	0.492	(0.313-0.774)	0.561	(0.317-0.992)
Family size				
1-3	1			
4-5	1.479	(0.873-2.506)		
≥6	2.392	(1.355-4.219)		

OR: Univariate Analysis

AOR: Multivariate Analysis

Table 4. Facilitators and needs assessment of ANC among participants

Items	Frequency(%)
People who affect the decision of ANC	

Spouse	232 (43.8)
Parents-in-law	184 (34.7)
Parents	31 (5.8)
Family	5 (0.9)
Village doctor	105 (19.8)
Women's association of village	254 (47.9)
Others	108 (20.4)
No idea	10 (1.9)
Refuse to answer	2 (0.4)
People who support to use ANC	
Spouse	287 (53.9)
Parents-in-law	253 (47.6)
Parents	122 (22.9)
Family	7 (1.3)
Village doctor	236 (44.4)
Women's association of village	382 (71.8)
Others	27 (5.1)
No idea	6 (1.1)
People who oppose to use ANC	
Spouse	9 (1.9)
Parents-in-law	10 (2.1)
Village doctor	18 (3.8)
Women's association of village	25 (5.2)
Others	427 (89)
No idea	12 (2.5)
Refuse to answer	8 (1.7)
Reasons for objecting to using ANC	
Cultural custom	5 (15.2)
Incapability of going for ANC without company	9 (27.3)
Shyness	11 (33.3)
Cost of transportation	2 (6.1)
Others	10 (30.3)
Refuse to answer	5 (15.2)
How to promote the usage of ANC	
Carrying out health education to women	340 (64.2)
Carrying out health education to spouses	100 (18.9)
Getting reimbursement for transportation	391 (73.8)
Issuing birth certificate based on ANC	275 (51.9)
Others	27 (5.1)
No idea	24 (4.5)
Money willing to pay for ANC	
Unwilling to pay anything	110 (22.1)
<50	154 (30.9)
<100	118 (23.7)

<200	99 (19.9)
<500	15 (3.0)
≥500	1 (0.2)
Favorable accompanying person taking ANC	
Husband	162 (39.2)
Mother or mother-in-law	82 (19.9)
Family	16 (3.9)
Women's association of village	140 (33.9)
Village doctor	1 (0.2)
Others	12 (2.9)

The STROBE- statement checklist.

	Item	STROBE- recommendation	Page #
Title and Abstract	1	(a) Indicate that the study was an observational study and, if applicable, use a common study design term	1
		(b) Indicate why the study was conducted, the design, the results, the limitations, and the relevance of the findings	1
Background / rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	(a) State specific objectives, including any primary or secondary prespecified hypotheses or their absence	5
		(b) Ensure that the level of organization[a] is clear for each objective and hypothesis	5
Study design	4	Present key elements of study design early in the paper	
Setting	5	(a) Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
		(b) If applicable, include information at each level of organization	
Participants [b]	6	(a) Describe the eligibility criteria for the owners/managers and for the animals, at each relevant level of organization	5
Variables	7	(a) Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. If applicable, give diagnostic criteria	
Data sources / measurement	8*	(a) For each variable of interest, give sources of data and details of methods of assessment (measurement). If applicable, describe comparability of assessment methods among groups and over time	7
Bias	9	Describe any efforts to address potential sources of bias due to confounding, selection, or information bias	7
Study size	10	(a) Describe how the study size was arrived at for each relevant level of organization	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	7

Statistical methods	12	(a) Describe all statistical methods for each objective, at a level of detail sufficient for a knowledgeable reader to replicate the methods. Include a description of the approaches to variable selection, control of confounding, and methods used to control for non-independence of observations	7
		(b) Describe the rationale for examining subgroups and interactions and the methods used	7
Participants	13*	(a) Report the numbers of owners/managers and animals at each stage of study and at each relevant level of organization - e.g., numbers eligible, included in the study, completing follow-up, and analyzed	8
Descriptive data on exposures and potential confounders	14*	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders by group and level of organization, if applicable	8
Outcome data	15*	(a) Report outcomes as appropriate for the study design and summarize at all relevant levels of organization	8
		(b) For proportions and rates, report the numerator and denominator	8
Main results	16	(a) Give unadjusted estimates and, if applicable, adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders and interactions were adjusted. Report all relevant parameters that were part of the model	9
		(b) Report category boundaries when continuous variables were categorized	9
Strengths and Limitations	19	Discuss strengths and limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
~~Funding~~ Transparency	22	(a) Funding- Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based (b) Conflicts of interest-Describe any conflicts of interest, or lack thereof, for each author (c) Describe the authors' roles- Provision of an authors' declaration of transparency is recommended (d) Ethical approval- Include information on ethical approval for use of animal and human subjects (e) Quality standards-Describe any quality standards used in the conduct of the research	14

[a] Level of organization recognizes that observational studies in veterinary research often deal with repeated measures (within an animal or herd) or animals that are maintained in groups (such as pens and herds); thus, the observations are not statistically independent. This non-independence has profound implications for the design, analysis, and results of these studies.
[b] The word "participant" is used in the STROBE statement. However, for the veterinary version, it is understood that "participant" should be addressed for both the animal owner/manager and for the animals themselves.
*Give such information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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Factors associated with lack of antenatal care uptake among ethnic minority women in rural China

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Keywords:	antenatal care, ethnic minority, Epidemiology < INFECTIOUS DISEASES

Factors associated with lack of antenatal care uptake among ethnic minority women in rural China

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Abstract

Background: Mother to child transmission (MTCT) is one of the main transmission routes of HIV, and the probability of MTCT can be dramatically reduced with comprehensive interventions. In southwest and western regions in China, rural society remains perceived as of a low standard and primitive, which also increases the difficulty of controlling infectious diseases. The Liangshan Prefecture, started the prevention of MTCT program in 2009. However, the implementation of the program is suboptimal and the coverage of HIV testing is still low. Many Yi women (main local minority nationality) did not take antenatal care (ANC) and gave birth to their babies at home for a variety of reasons.

Methods: Women with pregnancy history in the last five years were recruited in two townships based on cluster sampling and face-to-face interviews were conducted. Descriptive analysis was performed to describe demographic characteristics, history of pregnancy and ANC uptake, knowledge of and attitudes towards ANC. Multivariable analysis was used to identify factors associated with uptake of ANC.

Results: Among 538 women who completed the questionnaires, 77.9% knew that ANC was necessary during and after pregnancy. However, only 24.2% accessed ANC. Almost all women (94.6%) were willing to use ANC for pregnancy but barriers toward actual uptake of ANC existed including shyness, lack of independence, unavoidable cost. Multivariate analysis showed that, no experience of living outside of Zhaojue for more than six months, higher number of births, not knowing the

necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were associated with lack of ANC uptake.

Conclusion: Although ethnic minority women in rural Liangshan expressed strong intention to use ANC, actual uptake of ANC was low. Knowledge of ANC and HIV prevention for mother-to-child transmission (PMTCT) should be improved among this population, and efforts should be made to help them overcome barriers to accessing ANC.

Key words: antenatal care (ANC); ethnic minority; China

Strengths and limitations of this study

- The subjects of this study were selected from health service provider, the recipient, and the hub (the key figure in the family), enriching the research perspective and making information acquisition and research results more comprehensive and closer to the objective.
- We only selected women of child-bearing age and had pregnancy history in the last five years from two towns of Zhaojue. Therefore, our findings may not be generalizable to the entire local women of child-bearing age.
- Due to the mode of survey administration (interviewer-administered face-to-face), social desirability bias might be introduced.
- Our HIV-related questions were not MTCT or PMCT specific. Future studies should consider include HIV-related questions that are more relevant to the concerns and needs of pregnant women.

Introduction

Background

HIV can be suppressed by combination antiretroviral therapy (ART) consisting of 3 or more antiretroviral (ARV) drugs. Elimination of PMTCT of HIV is now considered a realistic public health goal and an important component of a comprehensive HIV prevention package. There were 36.9 million people living with HIV at the end of 2017 with 1.8 million people becoming newly infected in 2017 globally. 59% of adults and 52% of children living with HIV were receiving lifelong antiretroviral therapy (ART) in 2017. [1, 2].

A comprehensive approach to PMTCT programmes is promoted by The World Health Organization (WHO), which includes: 1) precluding new HIV infections among women of reproductive age; 2) avoiding accidental pregnancies among HIV-infected women; 3) preventing HIV vertical transmission from an HIV-infected mother to her child; and 4) providing applicable treatment, care and support to HIV-infected mothers, their children and families [3]. China has been starting on PMTCT since 2003 and achieved similar progress as in other parts of the world [4]. However, in some remote rural areas, especially regions resided by ethnic minority groups, PMTCT still faces significant challenges. For example, Liangshan Yi Autonomous Prefecture in Sichuan Province, which is on a main drug trafficking route in the Golden Triangle, is one of the areas that has the highest HIV infection rate in the past few years [5-9]. A study reported that HIV prevalence was 4.4% among rural residents in two of the most affected counties, Butuo and Zhaojue, in Liangshan prefecture in 2009. [7].

Furthermore, a early study conducted among HIV-positive pregnant women in the prefecture in 2004 found that 7.0% of their infants were tested positive [9], a figure significantly higher than the national average. Although overall rate of MTCT dropped from 10.5% in 2008 to 5.5% in 2013 (unpublished data), MTCT of HIV is still a serious public health concern in this area due to lack of HIV testing, barriers to accessing treatment and care, and poverty and illiteracy among the population.

Antenatal care could provide opportunities to identify undiagnosed cases as well as conduct PMTCT among known HIV-positive women. Liangshan Prefecture began to implement PMTCT program at ANC clinics and hospitals since 2009. In addition to providing regular pregnancy-related check-ups, ANC also includes free HIV testing. However, coverage of PMTCT, especially uptake of HIV testing, remained low. One of the reasons for such low coverage was that about a third of local women delivered their babies at home rather than in the hospitals [9]. Furthermore, even fewer pregnant women accessed ANC before delivery. A study reported that 62% of pregnant women in the prefecture had fewer than five ANC visits during pregnancy while 26.0% never utilized any ANC [10]. Therefore, in order to improve the effectiveness of the PMTCT program, access and uptake of ANC need to be improved substantially.

The study area, Zhaojue County, is an underdeveloped county with one of the highest HIV infection rates in Liangshan [7]. In addition to the PMTCT program, the China / United Nations Children's Fund Conditional Cash Transfer (CCT) project, which provides incentives for pregnant women to use ANC and deliver in hospitals, has also been implemented in Zhaojue. However, proportions of women who access

ANC and have child delivery in hospitals are still below the average level in the prefecture. In order to encourage more women to access ANC and improve coverag it is necessary to identify factors that may promote or hinder use of ANC among this vulnerable population.

Objectives

The objectives of this study were to describe knowledge, acceptability and actual uptake of ANC and to identify factors associated with lack of ANC attendence among women of child-bearing age in Zhaojue County, Liangshan, China.

Methods

Setting and participants

The survey was conducted in Zhaojue County of Liangshan Prefecture in December, 2014. The county is located in east-central Liangshan, southwestern Sichuan Province, with an area of 2,700 square kilometers and a population of 308,300. The majority (97.9%) of the population was Yi (the local ethnicity), residing in 47 towns and 269 villages [11].

First, we purposively selected two townships that have both larger populations and hospitals that provide ANC. Then we divided the villages within the two townships into two layers based on the distance between the villages and the township hospital. One village close to the hospital (in Layer 1) and one far away from the hospital (in Layer 2) were randomly selected from each township. All eligible women in the selected four villages were invited to participate. Inclusion criteria included: 1) female; 2) aged 49 or under; 3) had a pregnancy history in the last five years; and 4)

having resided in Zhaojue County for at least 6 months. The sample size is calculated by the equation $N = Z^2 P(1-P)/d^2$, and Z=1.96, P=0.56, d=0.05. N=378, but as cluster sampling was conducted, the sample size should increase by 50%. So, the sample size is 567.

Study instrument and data collection

A structured questionnaire was developed based on literature review, formative research and local health experts' input, and was pilot tested. The information collected included: (1) Demographic and household characteristics of participants, including age, income, education, ethnicity, occupation, marital status, age of the participant's husband, and family size; (2) History of pregnancy, including number of pregnancies, number of births, and whether participants accessed ANC during their pregnancies; (3) Whether they know ANC is necessary, ANC is free, where to get ANC and what ANC includes; (4) Willingness to utilize ANC measured by a series of Yes/No questions, and facilitators of and barriers to accessing ANC; and (5) whether they have heard of AIDS and knew someone who was HIV-positive

Interviewers were local women who were proficient in both Yi (local language) and Mandarin. They were trained before investigation by School of Public Health, Shandong University, to ensure study protocol was followed. On account of the general low educational level of respondents, oral informed consent was obtained from each of them before the face-to-face interview and their names was signed on the informed consent by investigators. The trained investigators directly inquired about the participants and explained to them the thoughts involved in the questions.

After confirming that the participants understood the questions, they filled out the questionnaire according to their answers.

Data management and statistical analysis

All the data were double entered with Epidata 3.1 and discrepancies were checked against the raw data. Data analysis was performed with SPSS 21.0. Descriptive analysis was used to describe demographic characteristics, history of pregnancies and ANC-related variables. To identify independent correlates of ANC uptake, univariate analysis was first conducted through chi-square tests comparing characteristics of women who accessed ANC during their pregnancy versus those who did not. Variables with a P values < 0.05 in the univariate analysis were eligible for entry into the multivariable logistic regression model, where adjusted OR and 95%CI were calculated accordingly.

Patient and public involvement

No patients were involved in the development of the research question or the outcome measures nor the design of the study. There are no plans to disseminate the results of the research to study participants.

Results

Demographic characteristics

A total of 547 women with pregnancy history in the last five years were approached and 538 valid questionnaires were collected, with a response rate of 98.4%. The mean age of participants was 35.6 years and 7.0% of them were less than 25 years of age. Most participants (86.2%) were illiterate. Almost half (45.1%) had 4-5 family

members while 86 (16.4%) had 1-3 and family members. More than half had given birth to a baby (56.2%) 3-4 times. The following factors were found to affect the behavior of women of childbearing age using antenatal care (P<0.05). The younger the women of childbearing age, the higher the percentage of antenatal care. Women in the ≤25-year-old group had the highest proportion of antenatal care, at 48.6%. The proportion of participants in the 25-35 age group and the 35-45 age group who participated in antenatal care was 28.6% and 17.5%, respectively. > The 45-year-old group had the lowest proportion of antenatal care, 9.2%. Similarly, the younger the spouse's age group, the higher the percentage of antenatal care, the percentage of participating in prenatal care for each of the above age groups was 44.4%, 30.6%, 20.3%, 11.1%. The higher the level of education, the higher the percentage of prenatal examinations. The percentage of women who attended primary and junior high school examinations (35.3%, 33.3%) was significantly higher than the 22.2% who did not attend school. The percentage of women of childbearing age who had a life experience of more than half a year had a prenatal health care rate of 63.9%, which was significantly higher than the proportion of women who did not have a life experience of 23.1%. The fewer women who live together, the higher the proportion of women who have participated in antenatal care. The proportion of women with 3 or fewer families participating in antenatal care is the highest, at 34.5%, and the family population is 4-5. The proportion of people who participated in antenatal care for 6 or more people decreased in turn, which was 26.3% and 18% respectively. In addition, women who have fewer pregnancies and births have a higher rate of participation in

prenatal care. The proportion of women who had 2-3 pregnancies in prenatal care was 33.8%, the proportion of women who had 3-4 pregnancies before pregnancy was 23.2%, and that of women who had 5 or more pregnancies was 13.2%. The proportion of women who had had antenatal care under the number of births corresponding to the number of births was 33.8%, 24.3%, and 4.4%, respectively. (Table 1).

History, knowledge of and attitude towards ANC

Almost all participants (94.6%) reported that they were willing to use ANC during pregnancy. However, just under a quarter (24.2%) had ever received ANC. The majority (77.9%) thought ANC was necessary during and after pregnancy, 84.5% thought it was necessary to give birth in hospitals, 83% also knew that ANC and delivery in hospitals were free. However, almost half (45.2%) did not know what ANC included. Almost all of the participants (97.4%) heard of AIDS and more than half (54.7%) knew someone who was HIV-infected. Compared to those who ever used ANC, participants who did not were significantly more likely not to have known that ANC was necessary during pregnancy (27% vs. 5.4%, $p < 0.001$), not to have known delivery should be in hospital (17.8% vs. 8.4%, $p < 0.05$), not to have known ANC and delivery in hospitals are all free (19.4% vs. 9.3%, $p < 0.005$), not to have known government encourages ANC (39.1% vs. 24%, $p < 0.005$) (Table 2).

Independent correlates of lack of ANC uptake

Unconditional logistic regression was performed by using the variable of $P < 0.1$ in the univariate analysis as an independent variable and whether it would be willing to participate in antenatal care as a dependent variable. In multivariable analysis, the age,

education level, whether live outside for more than 6 months, times of pregnancies, family size and their knowledge of ANC and policy are associated with that whether they used ANC. The older the maternal age, the greater the risk of not using ANC (For women over the age of 45, OR=9.346, 95%=3.236-27.027). Women who did not know that ANC during pregnancy was necessary (OR=4.056, 95%CI=3.021-14.706) and those who did not know about government's support policy of ANC (OR=2.347, 95%CI=1.234-4.464) were less likely to use ANC. The risk of not using an ANC for an uneducated woman is almost twice that of a woman with secondary or higher education (OR=1.905, 95%CI=1.107-3.279). Women who never lived outside of Zhaojue for more than six months (OR=5.882. 95%CI=2.874-12.048) and those who had five or more pregnancies (OR=3.367, 95%CI=1.770-6.410) were more likely to have not used ANC (Table 3).

Facilitators and needs assessment of ANC

When asked about who can influence their decisions of accessing ANC, almost half reported Village Women Federation (47.9%), followed by husbands (43.8%) and parents-in-law (34.7%). The most cited reasons for not using ANC were shyness (33.3%), incapability of going without company (27.3%) and cultural custom (15.2%). In terms of facilitators of ANC, the most popular responses were reimbursement of transportation (73.8%), improved education of ANC among women (64.2%) and linking ANC to issuance of birth certificates (51.9%). About a third of participants (30.9%) thought 50 RMB (about 8 USD) for ANC was acceptable and 23.3% thought 100 RMB was acceptable, however, 22.1% were unwilling to pay anything. (Table 4)

Discussion

In this study, we investigated knowledge about, acceptance and uptake of ANC among women of child-bearing age in an ethnic minority area of China. We also explored factors associated with lack of ANC uptake among these ethnic minority women. We found that majority of participants knew that ANC was free, it was necessary to use antenatal care during pregnancy, and most were willing to use ANC. However, less than a quarter had ever accessed ANC, which is much lower than reported by previous studies. In 1998, The National Health Service Surveys reported that 81% of women used ANC, meanwhile, 76% women in rural areas accessed ANC during 1998 to 2000 [12, 13]. There were a few possible reasons for the low uptake of ANC found in our study. Firstly, the study area is undeveloped, many women do not know about the government's policy and they warry out the spending including transportation issues. Secondly, many women in this area are illiterate and non-independent (they said they were couldn't go without company). In addition, the cultural custom of not talking about pregnancy and delivering at home also hinder those pregnant women from taking ANC. Thirdly, the strong intention to use ANC reflected current attitudes among participants, while actual uptake of ANC included previous pregnancies. In recent years, due to the implementation of the PMTCT programs in the area, the proportion of Yi women who delivered in hospitals had increased substantially. However, local governments only started to encourage and support ANC access a couple of years before the current survey. There were some

informational and educational materials of ANC being distributed, but most women in the rural areas of Zhaojue were illiterate.

Knowing that ANC during pregnancy is necessary and that government's supportive policy of ANC were positively associated with history of using ANC. We also found that having had five or more deliveries was negatively associated history of taking ANC. Women with more pregnancies tended not to take ANC for two possible reasons: 1) These women were older and less educated, thus their knowledge of ANC was relatively poor and they may have limited communication skills with healthcare professionals. 2) They might think that because they had successfully experiences of delivering babies therefore it is not necessary to use ANC. The results of our study were similar to studies in other developing countries. For example, in the systematic review by Simkhada et al., factors associated with the utilization of ANC were: education level of pregnant women and their spouses, health service accessibility, cost, family income, etc. They also found that the attitude towards pregnancy could impact the utilization of ANC, and there was an inverse correlation between the previous pregnancy and the utilization of ANC [14]. Some studies conducted in China also had or similar findings. For example, Liu and Ceng conducted studies individually in 2007 and 2010, and they found factors associated with the intention and uptake for pregnant women to take ANC could be summarized into three categories: 1) demographic characteristics of pregnant women and their spouses such as low education level, older age and low economic level; 2)number of children ; 3) policies

such as birth control leading the worry about being punished even forced abortion [15, 16].

Surprisingly, we found that having ever heard of AIDS and knowing someone who was HIV-infected were not associated with uptake of ANC. A possible reason is that women might not be aware of HIV testing services provided by ANC or that HIV was not one of the top health concerns during their pregnancy and knowledge of HIV and perceived threat of HIV were not sufficient to motivate them get themselves tested during ANC.

Findings from our study suggest that future efforts to increase uptake of ANC and improve PMTCT should focus on the following aspects: 1) improve accessibility of ANC, which may involve infrastructure construction, provision of user-friendly services, etc. In this study, many participates did not know places where offer ANC, and there were also many participants halted because of the long distance and cost in journey. Therefore, making ANC more accessible is urgent. A good service attitude is another approach to attract pregnant women since one who had good experiences with ANC could put other women in motion; 2) mobilize community and family members to encourage ANC during and after pregnancy. Women in poor rural area are more likely to be lack of independence. In other words, they are not used to make decisions towards something important. So, the call of community and support of family would give them courage and belief to overcome the psychological barriers. It would make a big difference if their family members and the community encourage them to accept ANC during pregnancy. 3) improve knowledge of ANC among pregnant women,

especially among those with low education or illiterate. For example, instead of text-based educational materials, picture-based materials should be distributed. In addition, mini-dramas or plays demonstrating the importance and benefits of ANC could be conducted at community events; 4) HIV screening should continue to be offered at ANC clinics in order to prevent mother-to-child transmission of HIV. The knowledge of the effectiveness and benefits of PMTCT should be improved not only among women, but also among their families and other community members.

Conclusions

In summary, although the actual uptake of antenatal care among women of childbearing age in this rural minority area is lower than other areas, women in the region have strong intention to ANC. No experience of living outside, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were associated with lack of ANC uptake. ANC targeting PMTCT in China may need to be more comprehensive and incorporate the cultural, logistic and needs of the population in order to effectively affect this population's utilization of ANC.

Declarations

Ethic

The study protocol was approved by the Ethical Review Committees of the World Health Organization (RPC587) and Shandong University School of Public Health (20130602). Study procedures, voluntary nature of participation, participants'

right to withdraw and autonomy of the participants were explained and oral informed consent was obtained from all participants.

Conflict of interest

The authors declare that they have no conflict of interest.

Contributorship statement

BL, LN, CW and WM conceived and designed the study. BL, DS, WW, BY, AE, HZ, WW and SW performed the study. BL, and WW analyzed the data. BL, DS, WW and SW contribute to writing the manuscript. CW and WM critically revised the paper. All authors read and approved the final manuscript.

Availability of data and materials

The data supporting our findings have been presented in the main text.

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Data sharing statement

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Key points

- Although the government provides a variety of supportive policies, the progress of prevention of mother to child transmission in Liangshan Prefecture is still not obvious.
- Ethnic minority women in rural Liangshan expressed strong intention to use ANC, but the actual uptake of ANC was low.
- No experience of living outside, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were the obstructive factors of ANC uptake.

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Table 1. Differences in demographic characteristics between participants who used ANC versus those who did not

	Ever took ANC			
	No	**Yes**	**Total**	**P value**
Age				<0.001
≤25	19 (51.4)	18 (48.6)	37 (7.0)	
26-35	165 (71.4)	66 (28.6)	231 (43.8)	
36-45	160 (82.5)	34 (17.5)	194 (36.8)	
>45	59 (90.8)	6 (9.2)	65 (12.3)	
Husband's age				<0.001
≤25	15 (55.6)	12 (44.4)	27 (5.7)	
26-35	143 (69.4)	63 (30.6)	206 (43.2)	
36-45	137 (79.7)	35 (20.3)	172 (36.1)	
>45	64 (88.9)	8 (11.1)	72 (15.1)	
Education				0.04
Never attended school	360 (77.8)	103 (22.2)	463 (86.2)	
Primary	44 (64.7)	24 (35.3)	68 (12.7)	
Secondary or higher	4 (76.0)	2 (24.0)	6 (1.1)	
Lived out of Zhaojue more than half a year ever				<0.001
Yes	13 (36.1)	23 (63.9)	36 (7.5)	
No	342 (76.9)	103 (23.1)	445 (92.5)	
Household income in the last year(RMB)				0.744
≤1500	93 (44.1)	118 (55.9)	121 (24.1)	
1501-3000	145 (72.5)	55 (27.5)	200 (39.8)	
3001-4500	39 (76.5)	12 (23.5)	51 (10.1)	
≥4500	101 (77.1)	30 (22.9)	131 (26)	
Family members				0.008
≤3	57 (65.5)	30 (34.5)	87 (16.4)	
4-5	177 (73.8)	63 (26.3)	240 (45.1)	
≥6	168 (82.0)	37 (18.0)	205 (38.5)	
Number of pregnancy				0.001
0-2	94 (66.2)	48 (33.8)	142 (26.5)	
3-4	215 (73.8)	65 (26.3)	280 (52.2)	
≥5	99 (86.8)	15 (13.2)	114 (21.3)	
Number of delivery				<0.001
0-2	106 (66.3)	54 (33.7)	160 (30.8)	
3-4	221 (75.7)	71 (24.3)	292 (56.2)	
≥5	65 (95.6)	3 (4.4)	68 (13.1)	

Table 2. Differences in knowledge of ANC, HIV, and PMTCT between participants who used ANC versus those who did not

	Ever took ANC			
	No	**Yes**	**Total**	**P value**
Knowing ANC is necessary for pregnant				<0.001
Yes	290 (72.5)	123 (94.6)	413 (77.9)	
No	110 (27)	7 (5.4)	117 (22.1)	
Thinking delivery should be in hospital				0.037
Yes	332 (82.2)	119 (91.5)	451 (84.5)	
No	72 (17.8)	11 (8.4)	83 (15.5)	
Knowing ANC and delivery in hospitals are all free				0.004
Yes	328 (80.6)	117 (90.7)	445 (83)	
No	79 (19.4)	12 (9.3)	91 (17)	
Knowing what ANC includes				<0.001
Yes	225 (55.1)	70 (53.8)	295 (54.8)	
No	183 (44.9)	60 (46.2)	243 (45.2)	
Knowing government encourages ANC				0.003
Yes	235 (60.9)	98 (76)	333 (64.7)	
No	151 (39.1)	31 (24)	182 (35.3)	
Having ever heard AIDS				1
Yes	397 (97.3)	127 (97.7)	524 (97.4)	
No	11 (2.7)	3 (2.3)	14 (2.6)	
Knowing HIV-infected person				0.219
Yes	225 (55.7)	66 (51.6)	291 (54.7)	
No	179 (44.4)	62 (48.4)	241 (45.3)	

Table 3. Multivariable analysis of independent correlates associated with having not used ANC

	Having not used ANC	
	OR	**95% CI**
Age		
≤25	1	
26-35	4.464	(1.170-4.785)
36-45	4.464	(2.119-9.346)
>45	9.346	(3.236-27.027)
Husband's age		
≤25	1	
26-35	1.815	(0.804-4.098)
36-45	3.135	(0.137-0.743)
>45	0.156	(2.227-18.519))
Education		
Never attended school	1	
Primary	0.525	(0.305-0.903)
Secondary or higher	0.572	(1.967-3.165)
Lived out of Zhaojue more than half a year ever		
Yes	1	
No	5.882	(2.874-12.048)
Number of pregnancies		
0-2	1	
3-4	1.689	(1.082-2.639)
≥5	3.367	(1.770-6.410)
Number of delivery		
0-2	1	
3-4	1.585	(1.038-2.421)
≥5	10.989	(3.311-37.037)
Is ANC for pregnancy necessary?		
Yes	1	
No	4.056	(3.021-14.706)
Is giving birth in hospitals necessary?		
No	1	
Yes	0.465	(0.191-1.131)
Do not know	0.833	(0.336-4.292)
Knowing ANC and delivery in hospitals are all free		
No	1	
Yes	0.426	(0.224-0.810)
Knowing government encourages ANC		
Yes	1	
No	2.033	(1.292-3.195)
Family size		
1-3	1	
4-5	1.479	(0.873-2.506)
≥6	2.392	(1.355-4.219)

Table 4. Facilitators and needs assessment of ANC among participants

Items	Frequency(%)
People who affect the decision of ANC	
Spouse	232 (43.8)
Parents-in-law	184 (34.7)
Parents	31 (5.8)
Family	5 (0.9)
Village doctor	105 (19.8)
Women's association of village	254 (47.9)
Others	108 (20.4)
No idea	10 (1.9)
Refuse to answer	2 (0.4)
People who support to use ANC	
Spouse	287 (53.9)
Parents-in-law	253 (47.6)
Parents	122 (22.9)
Family	7 (1.3)
Village doctor	236 (44.4)
Women's association of village	382 (71.8)
Others	27 (5.1)
No idea	6 (1.1)
People who oppose to use ANC	
Spouse	9 (1.9)
Parents-in-law	10 (2.1)
Village doctor	18 (3.8)
Women's association of village	25 (5.2)
Others	427 (89)
No idea	12 (2.5)
Refuse to answer	8 (1.7)
Reasons for objecting to using ANC	
Cultural custom	5 (15.2)
Incapability of going for ANC without company	9 (27.3)
Shyness	11 (33.3)
Cost of transportation	2 (6.1)
Others	10 (30.3)
Refuse to answer	5 (15.2)
How to promote the usage of ANC	
Carrying out health education to women	340 (64.2)
Carrying out health education to spouses	100 (18.9)
Getting reimbursement for transportation	391 (73.8)
Issuing birth certificate based on ANC	275 (51.9)
Others	27 (5.1)
No idea	24 (4.5)
Money willing to pay for ANC	

Unwilling to pay anything	110 (22.1)
<50	154 (30.9)
<100	118 (23.7)
<200	99 (19.9)
<500	15 (3.0)
≥500	1 (0.2)
Favorable accompanying person taking ANC	
Husband	162 (39.2)
Mother or mother-in-law	82 (19.9)
Family	16 (3.9)
Women's association of village	140 (33.9)
Village doctor	1 (0.2)
Others	12 (2.9)

The STROBE- statement checklist.

	Item	STROBE- recommendation	Page #
Title and Abstract	1	(a) Indicate that the study was an observational study and, if applicable, use a common study design term	1
		(b) Indicate why the study was conducted, the design, the results, the limitations, and the relevance of the findings	1
Background / rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	(a) State specific objectives, including any primary or secondary prespecified hypotheses or their absence	5
		(b) Ensure that the level of organization[a] is clear for each objective and hypothesis	5
Study design	4	Present key elements of study design early in the paper	
Setting	5	(a) Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
		(b) If applicable, include information at each level of organization	
Participants [b]	6	(a) Describe the eligibility criteria for the owners/managers and for the animals, at each relevant level of organization	5
Variables	7	(a) Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. If applicable, give diagnostic criteria	
Data sources / measurement	8*	(a) For each variable of interest, give sources of data and details of methods of assessment (measurement). If applicable, describe comparability of assessment methods among groups and over time	7
Bias	9	Describe any efforts to address potential sources of bias due to confounding, selection, or information bias	7
Study size	10	(a) Describe how the study size was arrived at for each relevant level of organization	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	7

Statistical methods	12	(a) Describe all statistical methods for each objective, at a level of detail sufficient for a knowledgeable reader to replicate the methods. Include a description of the approaches to variable selection, control of confounding, and methods used to control for non-independence of observations	7
		(b) Describe the rationale for examining subgroups and interactions and the methods used	7
Participants	13*	(a) Report the numbers of owners/managers and animals at each stage of study and at each relevant level of organization - e.g., numbers eligible, included in the study, completing follow-up, and analyzed	8
Descriptive data on exposures and potential confounders	14*	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders by group and level of organization, if applicable	8
Outcome data	15*	(a) Report outcomes as appropriate for the study design and summarize at all relevant levels of organization	8
		(b) For proportions and rates, report the numerator and denominator	8
Main results	16	(a) Give unadjusted estimates and, if applicable, adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders and interactions were adjusted. Report all relevant parameters that were part of the model	9
		(b) Report category boundaries when continuous variables were categorized	9
Strengths and Limitations	19	Discuss strengths and limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
~~Funding~~ Transparency	22	(a) Funding- Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based (b) Conflicts of interest-Describe any conflicts of interest, or lack thereof, for each author (c) Describe the authors' roles- Provision of an authors' declaration of transparency is recommended (d) Ethical approval- Include information on ethical approval for use of animal and human subjects (e) Quality standards-Describe any quality standards used in the conduct of the research	14

[a] Level of organization recognizes that observational studies in veterinary research often deal with repeated measures (within an animal or herd) or animals that are maintained in groups (such as pens and herds); thus, the observations are not statistically independent. This non-independence has profound implications for the design, analysis, and results of these studies.
[b] The word "participant" is used in the STROBE statement. However, for the veterinary version, it is understood that "participant" should be addressed for both the animal owner/manager and for the animals themselves.
*Give such information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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Factors associated with lack of antenatal care uptake among ethnic minority women in rural China: Implications for prevention of mother-to-child HIV transmission

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Keywords:	antenatal care, ethnic minority, Epidemiology < INFECTIOUS DISEASES

Factors associated with lack of antenatal care uptake among ethnic minority women in rural China: Implications for prevention of mother-to-child HIV transmission

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Abstract

Background: Mother to child transmission (MTCT) is one of the main transmission routes of HIV, and the probability of MTCT can be dramatically reduced with comprehensive interventions. In southwest and western regions in China, rural society remains perceived as of as of a low standard and primitive, which also increases the difficulty of controlling infectious diseases. The Liangshan Prefecture, started the prevention of MTCT program in 2009. However, the implementation of the program is suboptimal and the coverage of HIV testing is still low. Many Yi women (main local minority nationality) did not take antenatal care (ANC) and gave birth to their babies at home for a variety of reasons.

Methods: Women with pregnancy history in the last five years were recruited in two townships based on cluster sampling and face-to-face interviews were conducted. Descriptive analysis was performed to describe demographic characteristics, history of pregnancy and ANC uptake, knowledge of and attitudes towards ANC. Multivariable analysis was used to identify factors associated with uptake of ANC.

Results: Among 538 women who completed the questionnaires, 77.9% knew that ANC was necessary during and after pregnancy. However, only 24.2% accessed ANC. Almost all women (94.6%) were willing to use ANC for pregnancy but barriers toward actual uptake of ANC existed including shyness, lack of independence, unavoidable cost. Multivariate analysis showed that, no experience of living outside of Zhaojue for more than six months, higher number of births, not knowing the

necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were associated with lack of ANC uptake.

Conclusion: Although ethnic minority women in rural Liangshan expressed strong intention to use ANC, actual uptake of ANC was low. Knowledge of ANC and HIV prevention for mother-to-child transmission (PMTCT) should be improved among this population, and efforts should be made to help them overcome barriers to accessing ANC.

Key words: antenatal care (ANC); ethnic minority; China

Strengths and limitations of this study

- The subjects of this study were selected from health service provider, the recipient, and the hub (the key figure in the family), enriching the research perspective and making information acquisition and research results more comprehensive and closer to the objective.
- We only selected women of child-bearing age and had pregnancy history in the last five years from two towns of Zhaojue. Therefore, our findings may not be generalizable to the entire local women of child-bearing age.
- Due to the mode of survey administration (interviewer-administered face-to-face), social desirability bias might be introduced.

- Our HIV-related questions were not MTCT or PMCT specific. Future studies should consider include HIV-related questions that are more relevant to the concerns and needs of pregnant women.

Introduction

Background

HIV can be suppressed by combination antiretroviral therapy (ART) consisting of 3 or more antiretroviral (ARV) drugs. Elimination of PMTCT of HIV is now considered a realistic public health goal and an important component of a comprehensive HIV prevention package. There were approximately 36.9 million people living with HIV at the end of 2017 with 1.8 million people becoming newly infected in 2017 globally. 59% of adults and 52% of children living with HIV were receiving lifelong antiretroviral therapy (ART) in 2017. [1, 2].

A comprehensive approach to PMTCT programmes is promoted by The World Health Organization (WHO), which includes: 1) precluding new HIV infections among women of reproductive age; 2) avoiding accidental pregnancies among HIV-infected women; 3) preventing HIV vertical transmission from an HIV-infected mother to her child; and 4) providing applicable treatment, care and support to HIV-infected mothers, their children and families [3]. China has been starting on PMTCT since 2003 and achieved similar progress as in other parts of the world [4]. However, in some remote rural areas, especially regions resided by ethnic minority groups, PMTCT still faces significant challenges. For example, Liangshan Yi Autonomous

Prefecture in Sichuan Province, which is on a main drug trafficking route in the Golden Triangle, is one of the areas that has the highest HIV infection rate in the past few years [5-9]. A study reported that HIV prevalence was 4.4% among rural residents in two of the most affected counties, Butuo and Zhaojue, in Liangshan prefecture in 2009. [7]. Furthermore, a early study conducted among HIV-positive pregnant women in the prefecture in 2004 found that 7.0% of their infants were tested positive [9], a figure significantly higher than the national average. Although overall rate of MTCT dropped from 10.5% in 2008 to 5.5% in 2013 (unpublished data), MTCT of HIV is still a serious public health concern in this area due to lack of HIV testing, barriers to accessing treatment and care, and poverty and illiteracy among the population.

Antenatal care could provide opportunities to identify undiagnosed cases as well as conduct PMTCT among known HIV-positive women. Liangshan Prefecture began to implement PMTCT program at ANC clinics and hospitals since 2009. In addition to providing regular pregnancy-related check-ups, ANC also includes free HIV testing. However, coverage of PMTCT, especially uptake of HIV testing, remained low. One of the reasons for such low coverage was that about a third of local women delivered their babies at home rather than in the hospitals [9]. Furthermore, even fewer pregnant women accessed ANC before delivery. A study reported that 62% of pregnant women in the prefecture had fewer than five ANC visits during pregnancy while 26.0% never utilized any ANC [10]. Therefore, in order to improve the

effectiveness of the PMTCT program, access and uptake of ANC need to be improved substantially.

The study area, Zhaojue County, is an underdeveloped county with one of the highest HIV infection rates in Liangshan [7]. In addition to the PMTCT program, the China / United Nations Children's Fund Conditional Cash Transfer (CCT) project, which provides incentives for pregnant women to use ANC and deliver in hospitals, has also been implemented in Zhaojue. However, proportions of women who access ANC and have child delivery in hospitals are still below the average level in the prefecture. In order to encourage more women to access ANC and improve coverag it is necessary to identify factors that may promote or hinder use of ANC among this vulnerable population.

Objectives

The objectives of this study were to describe knowledge, acceptability and actual uptake of ANC and to identify factors associated with lack of ANC attendence among women of child-bearing age in Zhaojue County, Liangshan, China.

Methods

Setting and participants

The survey was conducted in Zhaojue County of Liangshan Prefecture in December, 2014. The county is located in east-central Liangshan, southwestern Sichuan Province, with an area of 2,700 square kilometers and a population of

308,300. The majority (97.9%) of the population was Yi (the local ethnicity), residing in 47 towns and 269 villages [11].

First, we purposively selected two townships that have both larger populations and hospitals that provide ANC. Then we divided the villages within the two townships into two layers based on the distance between the villages and the township hospital. The average distance from the villages in the two floors to the township hospitals is 8km and 15km respectively. One village close to the hospital and one far away from the hospital were randomly selected from each township. All eligible women in the selected four villages were invited to participate. Inclusion criteria included: 1) female; 2) aged 49 or under; 3) had a pregnancy history in the last five years; and 4) having resided in Zhaojue County for at least 6 months. The sample size is calculated by the equation $N = Z^2 P(1-P)/d^2$, and Z=1.96, d=0.05. The hospital delivery rate in Liangshan Yi Autonomous Region in 2013 was about 56%, so P=0.56. N=378, but as cluster sampling was conducted, in order to reduce sampling error, we increased the sample size by 50%. So, the sample size is 567.

Study instrument and data collection

A structured questionnaire was developed based on literature review, formative research and local health experts' input, and was pilot tested. The information collected included: (1) Demographic and household characteristics of participants, including age, income, education, ethnicity, occupation, marital status, age of the participant's husband, and family size; (2) History of pregnancy, including number of

pregnancies, number of births, and whether participants accessed ANC during their pregnancies; (3) Whether they know ANC is necessary, ANC is free, where to get ANC and what ANC includes; (4) Willingness to utilize ANC measured by a series of Yes/No questions, and facilitators of and barriers to accessing ANC; and (5) whether they have heard of AIDS and knew someone who was HIV-positive

Interviewers were 5 local women who were proficient in both Yi (local language) and Mandarin. They were trained before investigation by School of Public Health, Shandong University, to ensure study protocol was followed. On account of the general low educational level of some respondents, oral informed consent was obtained from each of them before the face-to-face interview and their names was signed on the informed consent. For respondents who can not write their own names, the investigator fills in on their behalf with their consent.The trained investigators directly inquired about the participants and explained to them the thoughts involved in the questions. After confirming that the participants understood the questions, they filled out the questionnaire according to their answers. Investigators conduct investigations at the village committee, and then fill in the leaks by means of household surveys, and use the “Prenatal Health Survey Form for Women of Childbearing Age” to conduct investigations.

Data management and statistical analysis

All the data were double entered with Epidata 3.1 and discrepancies were checked against the raw data. Data analysis was performed with SPSS 21.0.

Descriptive analysis was used to describe demographic characteristics, history of pregnancies and ANC-related variables. To identify independent correlates of ANC uptake, univariate analysis was first conducted through chi-square tests comparing characteristics of women who accessed ANC during their pregnancy versus those who did not. Variables with a P values < 0.05 in the univariate analysis were eligible for entry into the multivariable logistic regression model, where adjusted OR and 95%CI were calculated accordingly.

Patient and public involvement

No patients were involved in the development of the research question or the outcome measures nor the design of the study. There are no plans to disseminate the results of the research to study participants.

Results

Demographic characteristics

A total of 547 women with pregnancy history in the last five years were approached and 538 valid questionnaires were collected, with a response rate of 98.4%. The mean age of participants was 35.6 years and 7.0% of them were less than 25 years of age. Most participants (86.2%) were illiterate. Almost half (45.1%) had 4-5 family members while 86 (16.4%) had 1-3 and family members. More than half had given birth to a baby (56.2%) 3-4 times. The following factors were found to affect the behavior of women of childbearing age using antenatal care (P<0.05). The younger the women of childbearing age, the higher the percentage of antenatal care.

Women in the ≤25-year-old group had the highest proportion of antenatal care, at 48.6%. The proportion of participants in the 25-35 age group and the 35-45 age group who participated in antenatal care was 28.6% and 17.5%, respectively. > The 45-year-old group had the lowest proportion of antenatal care, 9.2%. Similarly, the younger the spouse's age group, the higher the percentage of antenatal care, the percentage of participating in prenatal care for each of the above age groups was 44.4%, 30.6%, 20.3%, 11.1%. The higher the level of education, the higher the percentage of prenatal examinations. The percentage of women who attended primary and junior high school examinations (35.3%, 33.3%) was significantly higher than the 22.2% who did not attend school. Among women of childbearing age who have lived for more than half a year outside of Zhaojue, the proportion of people who have had antenatal care is 63.9%, which is significantly higher than that of women who have not lived in other places (23.1%). The fewer women who live together, the higher the proportion of women who have participated in antenatal care. The proportion of women with 3 or fewer families participating in antenatal care is the highest, at 34.5%, and the family population is 4-5. The proportion of people who participated in antenatal care for 6 or more people decreased in turn, which was 26.3% and 18% respectively. In addition, women who have fewer pregnancies and births have a higher rate of participation in prenatal care. The proportion of women who had 2-3 pregnancies in prenatal care was 33.8%, the proportion of women who had 3-4 pregnancies before pregnancy was 23.2%, and that of women who had 5 or more pregnancies was 13.2%. The proportion

of women who had had antenatal care under the number of births corresponding to the number of births was 33.8%, 24.3%, and 4.4%, respectively. (Table 1).

History, knowledge of and attitude towards ANC

Almost all participants (94.6%) reported that they were willing to use ANC during pregnancy. However, just under a quarter (24.2%) had ever received ANC. The majority (77.9%) thought ANC was necessary during and after pregnancy, 84.5% thought it was necessary to give birth in hospitals, 83% also knew that ANC and delivery in hospitals were free. However, almost half (45.2%) did not know what ANC included. Almost all of the participants (97.4%) heard of AIDS and more than half (54.7%) knew someone who was HIV-infected. Compared to those who ever used ANC, participants who did not were significantly more likely not to have known that ANC was necessary during pregnancy (27% vs. 5.4%, $p < 0.001$), not to have known delivery should be in hospital (17.8% vs. 8.4%, $p < 0.05$), not to have known ANC and delivery in hospitals are all free (19.4% vs. 9.3%, $p < 0.005$), not to have known government encourages ANC (39.1% vs. 24%, $p < 0.005$) (Table 2).

Independent correlation of lack of ANC uptake

In multivariable analysis, women who did not know that ANC during pregnancy was necessary (OR=, 95%CI=0.092-0.658) and those who did not know about government's support policy of ANC (OR=0.561, 95%CI=1.269-0.992) were less likely to use ANC. Women who never lived outside of Zhaojue for more than six

months (OR=4.808. 95%CI=2.012-11.494) and those who had five or more deliveries (OR=5.848, 95%CI=1.645-20.833) were more likely to have not used ANC (Table 3).

Facilitators and needs assessment of ANC

When asked about who can influence their decisions of accessing ANC, almost half reported Village Women Federation (47.9%), followed by husbands (43.8%) and parents-in-law (34.7%). The most cited reasons for not using ANC were shyness (33.3%), incapability of going without company (27.3%) and cultural custom (15.2%). In terms of facilitators of ANC, the most popular responses were reimbursement of transportation (73.8%), improved education of ANC among women (64.2%) and linking ANC to issuance of birth certificates (51.9%). About a third of participants (30.9%) thought 50 RMB (about 8 USD) for ANC was acceptable and 23.3% thought 100 RMB was acceptable, however, 22.1% were unwilling to pay anything. (Table 4)

Discussion

In this study, we investigated knowledge about, acceptance and uptake of ANC among women of child-bearing age in an ethnic minority area of China. We also explored factors associated with lack of ANC uptake among these ethnic minority women. We found that majority of participants knew that ANC was free, it was necessary to use antenatal care during pregnancy, and most were willing to use ANC. However, less than a quarter had ever accessed ANC, which is much lower than reported by previous studies. In 1998, The National Health Service Surveys reported

that 81% of women used ANC, meanwhile, 76% women in rural areas accessed ANC during 1998 to 2000 [12, 13]. There were a few possible reasons for the low uptake of ANC found in our study. Firstly, the study area is undeveloped, many women do not know about the government's policy and they warry out the spending including transportation issues. Secondly, many women in this area are illiterate and non-independent (they said they were couldn't go without company). In addition, the cultural custom of not talking about pregnancy and delivering at home also hinder those pregnant women from taking ANC. Thirdly, the strong intention to use ANC reflected current attitudes among participants, while actual uptake of ANC included previous pregnancies. In recent years, due to the implementation of the PMTCT programs in the area, the proportion of Yi women who delivered in hospitals had increased substantially. However, local governments only started to encourage and support ANC access a couple of years before the current survey. There were some informational and educational materials of ANC being distributed, but most women in the rural areas of Zhaojue were illiterate.

Knowing that ANC during pregnancy is necessary and that government's supportive policy of ANC were positively associated with history of using ANC. We also found that having had five or more deliveries was negatively associated history of taking ANC. Women with more pregnancies tended not to take ANC for two possible reasons: 1) These women were older and less educated, thus their knowledge of ANC was relatively poor and they may have limited communication skills with healthcare professionals. 2) They might think that because they had successfully

experiences of delivering babies therefore it is not necessary to use ANC. The results of our study were similar to studies in other developing countries. For example, in the systematic review by Simkhada et al., factors associated with the utilization of ANC were: education level of pregnant women and their spouses, health service accessibility, cost, family income, etc. They also found that the attitude towards pregnancy could impact the utilization of ANC, and there was an inverse correlation between the previous pregnancy and the utilization of ANC [14]. Some studies conducted in China also had or similar findings. For example, Liu and Ceng conducted studies individually in 2007 and 2010, and they found factors associated with the intention and uptake for pregnant women to take ANC could be summarized into three categories: 1) demographic characteristics of pregnant women and their spouses such as low education level, older age and low economic level; 2)number of children ; 3) policies such as birth control leading the worry about being punished even forced abortion [15, 16].

Surprisingly, we found that having ever heard of AIDS and knowing someone who was HIV-infected were not associated with uptake of ANC. A possible reason is that women might not be aware of HIV testing services provided by ANC or that HIV was not one of the top health concerns during their pregnancy and knowledge of HIV and perceived threat of HIV were not sufficient to motivate them get themselves tested during ANC.

Findings from our study suggest that future efforts to increase uptake of ANC and improve PMTCT should focus on the following aspects: 1) improve accessibility

of ANC, which may involve infrastructure construction, provision of user-friendly services, etc. In this study, many participates did not know places where offer ANC, and there were also many participants halted because of the long distance and cost in journey. Therefore, making ANC more accessible is urgent. A good service attitude is another approach to attract pregnant women since one who had good experiences with ANC could put other women in motion; 2) mobilize community and family members to encourage ANC during and after pregnancy. Women in poor rural area are more likely to be lack of independence. In other words, they are not used to make decisions towards something important. So, the call of community and support of family would give them courage and belief to overcome the psychological barriers. It would make a big difference if their family members and the community encourage them to accept ANC during pregnancy. 3) improve knowledge of ANC among pregnant women, especially among those with low education or illiterate. For example, instead of text-based educational materials, picture-based materials should be distributed. In addition, mini-dramas or plays demonstrating the importance and benefits of ANC could be conducted at community events; 4) HIV screening should continue to be offered at ANC clinics in order to prevent mother-to-child transmission of HIV. The knowledge of the effectiveness and benefits of PMTCT should be improved not only among women, but also among their families and other community members.

As a result, the villagers of the Zhaojue County Maternal and Child Health Hospital, Aomu, gave a publicity to the villagers, and therefore targeted measures were taken to encourage the villagers to conduct prenatal examinations.

Conclusions

In summary, although the actual uptake of antenatal care among women of childbearing age in this rural minority area is lower than other areas, women in the region have strong intention to ANC. No experience of living outside, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were associated with lack of ANC uptake. ANC targeting PMTCT in China may need to be more comprehensive and incorporate the cultural, logistic and needs of the population in order to effectively affect this population's utilization of ANC.

Declarations

Ethic

The study protocol was approved by the Ethical Review Committees of the World Health Organization (RPC587) and Shandong University School of Public Health (20130602). Study procedures, voluntary nature of participation, participants' right to withdraw and autonomy of the participants were explained and oral informed consent was obtained from all participants.

Conflict of interest

The authors declare that they have no conflict of interest.

Author's contributions

BL, LN, CW and WM conceived and designed the study. BL, DS and WW trained interviewers, BY, AE, HZ, WW and SW assisted respondents to fill out the questionnaire. BL, and WW analyzed the data. BL, DS and SW contribute to writing the manuscript. CW, JM and WM critically revised the paper. All authors read and approved the final manuscript.

Data availability statement

All data relevant to the study are included in the article or uploaded as supplementary information. The data supporting our findings have been presented in the main text.

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Key points

- Although the government provides a variety of supportive policies, the progress of prevention of mother to child transmission in Liangshan Prefecture is still not obvious.

- Ethnic minority women in rural Liangshan expressed strong intention to use ANC, but the actual uptake of ANC was low.
- No experience of living outside, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were the obstructive factors of ANC uptake.

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Table 1. Differences in demographic characteristics between participants who used ANC versus those who did not

	Ever took ANC			
	No	**Yes**	**Total**	**P value**
Age				<0.001
≤25	19 (51.4)	18 (48.6)	37 (7.0)	
26-35	165 (71.4)	66 (28.6)	231 (43.8)	
36-45	160 (82.5)	34 (17.5)	194 (36.8)	
>45	59 (90.8)	6 (9.2)	65 (12.3)	
Husband's age				<0.001
≤25	15 (55.6)	12 (44.4)	27 (5.7)	

26-35	143 (69.4)	63 (30.6)	206 (43.2)	
36-45	137 (79.7)	35 (20.3)	172 (36.1)	
>45	64 (88.9)	8 (11.1)	72 (15.1)	
Education				0.04
Never attended school	360 (77.8)	103 (22.2)	463 (86.2)	
Primary	44 (64.7)	24 (35.3)	68 (12.7)	
Secondary or higher	4 (76.0)	2 (24.0)	6 (1.1)	
Lived out of Zhaojue more than half a year ever				<0.001
Yes	13 (36.1)	23 (63.9)	36 (7.5)	
No	342 (76.9)	103 (23.1)	445 (92.5)	
Household income in the last year(RMB)				0.744
≤1500	93 (44.1)	118 (55.9)	121 (24.1)	
1501-3000	145 (72.5)	55 (27.5)	200 (39.8)	
3001-4500	39 (76.5)	12 (23.5)	51 (10.1)	
≥4500	101 (77.1)	30 (22.9)	131 (26)	
Family members				0.008
≤3	57 (65.5)	30 (34.5)	87 (16.4)	
4-5	177 (73.8)	63 (26.3)	240 (45.1)	
≥6	168 (82.0)	37 (18.0)	205 (38.5)	
Number of delivery				<0.001
0-2	106 (66.3)	54 (33.7)	160 (30.8)	
3-4	221 (75.7)	71 (24.3)	292 (56.2)	
≥5	65 (95.6)	3 (4.4)	68 (13.1)	

Table 2. Differences in knowledge of ANC, HIV, and PMTCT between participants who used ANC versus those who did not

	Ever took ANC			
	No	**Yes**	**Total**	**P value**
Knowing ANC is necessary for pregnant				<0.001
Yes	290 (72.5)	123 (94.6)	413 (77.9)	
No	110 (27)	7 (5.4)	117 (22.1)	
Thinking delivery should be in hospital				0.037
Yes	332 (82.2)	119 (91.5)	451 (84.5)	
No	72 (17.8)	11 (8.4)	83 (15.5)	
Knowing ANC and delivery in hospitals are all free				0.004
Yes	328 (80.6)	117 (90.7)	445 (83)	
No	79 (19.4)	12 (9.3)	91 (17)	
Knowing what ANC includes				0.436
Yes	225 (55.1)	70 (53.8)	295 (54.8)	
No	183 (44.9)	60 (46.2)	243 (45.2)	
Knowing government encourages ANC				0.003
Yes	235 (60.9)	98 (76)	333 (64.7)	
No	151 (39.1)	31 (24)	182 (35.3)	
Having ever heard AIDS				1
Yes	397 (97.3)	127 (97.7)	524 (97.4)	

No	11 (2.7)	3 (2.3)	14 (2.6)	
Knowing HIV-infected person				0.219
Yes	225 (55.7)	66 (51.6)	291 (54.7)	
No	179 (44.4)	62 (48.4)	241 (45.3)	

Table 3. Multivariable analysis of independent correlates associated with having not used ANC

	Having not used ANC	
	OR	**95%CI**
Age		
≤25	1	
26-35	4.464	(1.170-4.785)
36-45	4.464	(2.119-9.346)
>45	9.346	(3.236-27.027)
Husband's age		
≤25	1	
26-35	1.815	(0.804-4.098)
36-45	3.135	(0.137-0.743)
>45	0.156	(2.227-18.519))
Education		
Secondary or higher school	1	
Primary or lower	1.748	(1.967-3.165)
Lived out of Zhaojue more than half a year ever		
Yes	1	
No	5.882	(2.874-12.048)
Number of deliveries		
0-2	1	
3-4	1.585	(1.038-2.421)
≥5	10.989	(3.311-37.037)
Is ANC for pregnancy necessary?		

Yes	1	
No	4.056	(3.021-14.706)
Is giving birth in hospitals necessary?		
Yes	1	
No	2.151	(0.884-5.235)
Knowing ANC and delivery in hospitals are all free		
Yes	1	
No	2.347	(1.235-4.464)
Knowing government encourages ANC		
Yes	1	
No	2.033	(1.292-3.195)
Family size		
1-3	1	
4-5	1.479	(0.873-2.506)
≥6	2.392	(1.355-4.219)

Table 4. Facilitators and needs assessment of ANC among participants

Items	**Frequency(%)**
People who affect the decision of ANC	
Spouse	232 (43.8)
Parents-in-law	184 (34.7)
Parents	31 (5.8)
Family	5 (0.9)
Village doctor	105 (19.8)
Women's association of village	254 (47.9)
Others	108 (20.4)

No idea	10 (1.9)
Refuse to answer	2 (0.4)
People who support to use ANC	
Spouse	287 (53.9)
Parents-in-law	253 (47.6)
Parents	122 (22.9)
Family	7 (1.3)
Village doctor	236 (44.4)
Women's association of village	382 (71.8)
Others	27 (5.1)
No idea	6 (1.1)
People who oppose to use ANC	
Spouse	9 (1.9)
Parents-in-law	10 (2.1)
Village doctor	18 (3.8)
Women's association of village	25 (5.2)
Others	427 (89)
No idea	12 (2.5)
Refuse to answer	8 (1.7)
Reasons for objecting to using ANC	
Cultural custom	5 (15.2)
Incapability of going for ANC without company	9 (27.3)
Shyness	11 (33.3)
Cost of transportation	2 (6.1)

Others	10 (30.3)
Refuse to answer	5 (15.2)
How to promote the usage of ANC	
Carrying out health education to women	340 (64.2)
Carrying out health education to spouses	100 (18.9)
Getting reimbursement for transportation	391 (73.8)
Issuing birth certificate based on ANC	275 (51.9)
Others	27 (5.1)
No idea	24 (4.5)
Money willing to pay for ANC	
Unwilling to pay anything	110 (22.1)
<50	154 (30.9)
<100	118 (23.7)
<200	99 (19.9)
<500	15 (3.0)
≥500	1 (0.2)
Favorable accompanying person taking ANC	
Husband	162 (39.2)
Mother or mother-in-law	82 (19.9)
Family	16 (3.9)
Women's association of village	140 (33.9)
Village doctor	1 (0.2)
Others	12 (2.9)

The STROBE- statement checklist.

	Item	STROBE- recommendation	Page #
Title and Abstract	1	(a) Indicate that the study was an observational study and, if applicable, use a common study design term	1
		(b) Indicate why the study was conducted, the design, the results, the limitations, and the relevance of the findings	1
Background / rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	(a) State specific objectives, including any primary or secondary prespecified hypotheses or their absence	5
		(b) Ensure that the level of organization[a] is clear for each objective and hypothesis	5
Study design	4	Present key elements of study design early in the paper	
Setting	5	(a) Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
		(b) If applicable, include information at each level of organization	
Participants [b]	6	(a) Describe the eligibility criteria for the owners/managers and for the animals, at each relevant level of organization	5
Variables	7	(a) Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. If applicable, give diagnostic criteria	
Data sources / measurement	8*	(a) For each variable of interest, give sources of data and details of methods of assessment (measurement). If applicable, describe comparability of assessment methods among groups and over time	7
Bias	9	Describe any efforts to address potential sources of bias due to confounding, selection, or information bias	7
Study size	10	(a) Describe how the study size was arrived at for each relevant level of organization	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	7

Statistical methods	12	(a) Describe all statistical methods for each objective, at a level of detail sufficient for a knowledgeable reader to replicate the methods. Include a description of the approaches to variable selection, control of confounding, and methods used to control for non-independence of observations	7
		(b) Describe the rationale for examining subgroups and interactions and the methods used	7
Participants	13*	(a) Report the numbers of owners/managers and animals at each stage of study and at each relevant level of organization - e.g., numbers eligible, included in the study, completing follow-up, and analyzed	8
Descriptive data on exposures and potential confounders	14*	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders by group and level of organization, if applicable	8
Outcome data	15*	(a) Report outcomes as appropriate for the study design and summarize at all relevant levels of organization	8
		(b) For proportions and rates, report the numerator and denominator	8
Main results	16	(a) Give unadjusted estimates and, if applicable, adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders and interactions were adjusted. Report all relevant parameters that were part of the model	9
		(b) Report category boundaries when continuous variables were categorized	9
Strengths and Limitations	19	Discuss strengths and limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
~~Funding~~ Transparency	22	(a) Funding- Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based (b) Conflicts of interest-Describe any conflicts of interest, or lack thereof, for each author (c) Describe the authors' roles- Provision of an authors' declaration of transparency is recommended (d) Ethical approval- Include information on ethical approval for use of animal and human subjects (e) Quality standards-Describe any quality standards used in the conduct of the research	14

[a] Level of organization recognizes that observational studies in veterinary research often deal with repeated measures (within an animal or herd) or animals that are maintained in groups (such as pens and herds); thus, the observations are not statistically independent. This non-independence has profound implications for the design, analysis, and results of these studies.
[b] The word "participant" is used in the STROBE statement. However, for the veterinary version, it is understood that "participant" should be addressed for both the animal owner/manager and for the animals themselves.
*Give such information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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Factors associated with lack of antenatal care uptake among ethnic minority women in rural China: Implications for prevention of mother-to-child HIV transmission

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Factors associated with lack of antenatal care uptake among ethnic minority women in rural China: Implications for prevention of mother-to-child HIV transmission

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Abstract

Background: Mother to child transmission (MTCT) is one of the main transmission routes of HIV, and the probability of MTCT can be dramatically reduced with comprehensive interventions. In southwest and western regions in China,The level of development in rural areas is relatively backward and retains some original features, which also increases the difficulty of controlling infectious diseases. The Liangshan Prefecture started the prevention of MTCT program in 2009. However, the implementation of the program is not ideal and the coverage of HIV testing is still low. Many Yi (local major ethnicity) women did not take antenatal care (ANC) and just gave birth to their babies at home for a variety of reasons.

Methods: Women with pregnancy history in the last five years were recruited from two townships based on cluster sampling. Face-to-face interviews were conducted to collect data. Descriptive analysis was performed to describe demographic characteristics, history of pregnancy and ANC uptake, knowledge of and attitudes towards ANC. Multivariable analysis was used to identify factors associated with uptake of ANC.

Results: Among 538 women who completed the questionnaires, 77.9% knew that ANC was necessary during and after pregnancy. However, only 24.2% actually accessed ANC. Almost all women (94.6%) expressed their willingness to receive ANC for pregnancy but barriers toward actual uptake of ANC existed including shyness, lack of independence, unavoidable cost. Multivariate analysis showed that,

no experience of living outside of Zhaojue for more than six months, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were associated with lack of ANC uptake.

Conclusion: Although ethnic minority women in rural Liangshan expressed strong intention to use ANC, actual uptake of ANC was low. Knowledge of ANC and HIV prevention for mother-to-child transmission (PMTCT) should be improved among this population, and efforts should be made to help them overcome barriers to accessing ANC.

Key words: antenatal care (ANC); ethnic minority; China

Strengths and limitations of this study

- The subjects of this study were selected from health service provider, the recipient, and the hub of them (the key figure in a family), which enriched the research perspective and made information acquisition and research results more comprehensive and objective.
- We only selected women of child-bearing age who had pregnancy history in the last five years from two towns of Zhaojue. Therefore, our findings may not be generalizable to all the women of child-bearing age in the rural area.
- Due to the mode of survey administration (interviewer-administered face-to-face), social desirability bias might be introduced.

- When collecting information, we only focused on the uptake of ANC of the respondents within the whole five years, and ignored whether or not they accepted ANC during the most recent pregnancy. Therefore, it may overestimate the uptake of ANC.

- Our HIV-related questions were not MTCT or PMCT specific. Future studies should consider HIV-related questions which are more relevant to the concerns and needs of pregnant women.

Introduction

Background

HIV can be suppressed by combination antiretroviral therapy (ART) consisting of 3 or more antiretroviral (ARV) drugs. Elimination of PMTCT of HIV is now considered a realistic public health goal and an important component of a comprehensive HIV prevention package. There were approximately 36.9 million people living with HIV at the end of 2017 with 1.8 million people becoming newly infected in 2017 globally. 59% of adults and 52% of children living with HIV were receiving lifelong antiretroviral therapy (ART) in 2017. [1, 2].

A comprehensive approach to PMTCT programmes is promoted by The World Health Organization (WHO), which includes: 1) precluding new HIV infections among women of reproductive age; 2) avoiding accidental pregnancies among HIV-infected women; 3) preventing HIV vertical transmission from an HIV-infected mother to her child; and 4) providing applicable treatment, care and support to HIV-

infected mothers, their children and families [3]. China has been starting on PMTCT since 2003 and achieved similar progress as other parts of the world [4]. However, in some remote rural areas, especially regions resided by ethnic minority groups, PMTCT still faces significant challenges. For example, Liangshan Yi Autonomous Prefecture in Sichuan Province, which is situated on a major drug trafficking route of the Golden Triangle, is one of the areas that has the highest HIV infection rate in the past few years [5-9]. A study reported that HIV prevalence was 4.4% among rural residents in two of the most affected counties in Liangshan prefecture in 2009, Butuo and Zhaojue. [7]. Furthermore, a early study conducted among HIV-positive pregnant women in the prefecture in 2004 found that 7.0% of their infants were tested HIV positive [9], which is significantly higher than the national average. Although overall rate of MTCT dropped from 10.5% in 2008 to 5.5% in 2013 (unpublished data), MTCT of HIV is still a serious public health concern in this area due to lack of HIV testing, barriers to accessing treatment and care, and poverty and illiteracy among the population.

Antenatal care could provide opportunities to identify undiagnosed cases as well as conduct PMTCT among HIV-positive women. Liangshan Prefecture began to execute PMTCT program at ANC clinics and hospitals since 2009. In addition to providing regular pregnancy-related check-ups, ANC also includes free HIV testing. However, coverage of PMTCT especially uptake of HIV testing remained low. One of the reasons for such low coverage was that about one third of local women delivered their babies at home rather than in the hospitals [9]. Furthermore, even

fewer pregnant women accessed ANC before delivery. A study reported that 62% of pregnant women in the prefecture had fewer than five ANC visits during pregnancy while 26.0% never utilized any ANC [10]. Therefore, in order to improve the effectiveness of the PMTCT program, access and uptake of ANC need to be improved substantially.

The study area, Zhaojue County, is an underdeveloped county with one of the highest HIV infection rates in Liangshan [7]. In addition to the PMTCT program, the China / United Nations Children's Fund Conditional Cash Transfer (CCT) project, which provides incentives for pregnant women to use ANC and deliver in hospitals, has also been implemented in Zhaojue. However, proportions of women who access ANC and have child delivery in hospitals are still below the average level in the prefecture. In order to encourage more women to access ANC and improve coverage, it is necessary to identify factors that may promote or hinder use of ANC among this vulnerable population.

Objectives

The objectives of this study were to describe knowledge, acceptability, actual uptake of ANC and to identify factors associated with lack of ANC attendence among women of child-bearing age in Zhaojue County, Liangshan, China.

Methods

Setting and participants

The survey was conducted in Zhaojue County of Liangshan Prefecture in December, 2014. The county is located in east-central Liangshan, southwestern Sichuan Province, with an area of 2,700 square kilometers and a population of 308,300. The main (97.9%) local population is the Yi, residing in 47 towns and 269 villages [11].

First, we purposively selected two townships that both have larger population and hospitals that provide ANC. Then we divided the villages within the two townships into two layers based on the distance between the villages and the township hospital. The average distance from the villages in the two layers to the township hospitals is 8km and 15km respectively. One village close to the hospital and one far away from the hospital were randomly selected from each township. All eligible women in the selected four villages were invited to participate in the study. Inclusion criteria included: 1) female; 2) aged 49 or under; 3) had a pregnancy history in the last five years; and 4) having resided in Zhaojue County for at least 6 months. The sample size is calculated by the equation $N = Z^2 P(1-P)/d^2$, and Z=1.96, d=0.05. The hospital delivery rate in Liangshan Yi Autonomous Region in 2013 was about 56%, so P=0.56. N=378, but as cluster sampling was conducted, in order to reduce sampling error, we increased the sample size by 50%. So, the sample size is 567.

Study instrument and data collection

A structured questionnaire was developed by local health experts based on literature review, formative research and pilot test. The information collected

included: (1) Demographic and household characteristics of participants, including age, income, education, ethnicity, occupation, marital status, age of the participant's husband, and family size; (2) History of pregnancy, including number of pregnancies, number of births, and whether participants accessed ANC during their pregnancies; (3) Whether they know ANC is necessary, ANC is free, where to get ANC and what ANC includes; (4) Willingness to utilize ANC measured by a series of Yes/No questions, and facilitators of and barriers to accessing ANC; and (5) whether they have heard of AIDS and knew someone who was HIV-positive

Interviewers were 5 local women who were proficient in both Yi (local language) and Mandarin. They were trained by School of Public Health, Shandong University before investigation to ensure study protocol was followed. On account of the general low educational level of some respondents, oral informed consent was obtained from each of them before the face-to-face interview. For respondents who don't know how to write their own names, the investigator signed on their behalf with their consent. This study is a cross-sectional study that does not involve clinical trials. In consideration of that most of the respondents are illiterate, the ethics committee approved this procedure. The trained investigators directly inquired about the participants and explained to them the thoughts involved in the questions. After confirming that the participants understood the questions, interviewers filled out the questionnaire according to interviewees' answers. Investigators conduct investigations at the village committee, using the "Prenatal Health Survey Form for Women of Childbearing Age" to conduct investigations. Some respondents may not

be present, so researchers need to go to their home for face-to-face investigation until we collect enough data.

Data management and statistical analysis

All the data were double entered with Epidata 3.1 and discrepancies were checked against the raw data. Data analysis was performed with SPSS 21.0. Descriptive analysis was used to describe demographic characteristics, history of pregnancies and ANC-related variables. To identify independent correlates of ANC uptake, univariate analysis was first conducted through chi-square tests comparing characteristics of women who accessed ANC during their pregnancy versus those who did not. Variables with a P values < 0.05 in the univariate analysis were eligible for entry into the multivariable logistic regression model, where adjusted OR and 95%CI were calculated accordingly.

Patient and public involvement

No patients were involved in the development of the research question nor the design of the study. The Zhaojue County Maternal and Child Health Hospital has processed the research results into science knowledge and informed local villagers through several publicity in 2018. In this process, the staff informed the villagers that both men and women should pay attention to antenatal care, and the government will bear most of the costs.

Results

Demographic characteristics

A total of 547 women with pregnancy history in the past five years (1/1/2010~12/31/2014) were approached and 538 valid questionnaires were collected, with a response rate of 98.4%. The mean age of participants was 35.6 years and 7.0% of them were less than 25 years of age. Most participants (86.2%) were illiterate. Almost half (45.1%) had 4-5 family members while 86 (16.4%) had 1-3 and family members. More than half (56.2%) had 3-4 births. Women in the ≤25-year-old group had the highest proportion of antenatal care, at 48.6%. The proportion of participants in the 25-35 age group and the 35-45 age group who participated in antenatal care was 28.6% and 17.5%, respectively. > The 45-year-old group had the lowest proportion of antenatal care, 9.2%. Similarly, the younger the spouse's age group, the higher the percentage of antenatal care, the percentage of participating in prenatal care for each of the above age groups was 44.4%, 30.6%, 20.3%, 11.1%. The higher the level of education, the higher the percentage of prenatal examinations. The percentage of women who attended primary and junior high school examinations (35.3%, 33.3%) was significantly higher than the 22.2% who did not attend school. Among women of childbearing age who have lived for more than half a year outside of Zhaojue, the proportion of people who have had antenatal care is 63.9%, which is significantly higher than that of women who have not lived outside of Zhaojue (23.1%). 34.5% of women with 3 or fewer family members ever took ANC, and the proportion of people who too ANC for 4-5 and ≥6 was 26.3% and 18% respectively. In addition, women who give fewer births have a higher rate of participation in prenatal care. Among

those with 0 to 2 births, 33.7% have received ANC, but in those with 4 to 5 births and 6 or more, this proportion is only 24.3% and 4.4%. (Table 1).

History, knowledge of and attitude towards ANC

Almost all participants (94.6%) reported that they were willing to use ANC during pregnancy. However, just under a quarter (24.2%) had ever received it. The majority (77.9%) thought ANC was necessary during and after pregnancy, 84.5% thought it was necessary to give birth in hospitals, 83% also knew that ANC and delivery in hospitals were free. However, almost half (45.2%) did not know what ANC included. Almost all of the participants (97.4%) heard of AIDS and more than half (54.7%) knew someone who was HIV-infected. Compared to those who ever used ANC, participants who did not were significantly more likely not to have known that ANC was necessary during pregnancy (27% vs. 5.4%, $p < 0.001$), not to have known delivery should be in hospital (17.8% vs. 8.4%, $p < 0.05$), not to have known ANC and delivery in hospitals are all free (19.4% vs. 9.3%, $p < 0.005$), not to have known government encourages ANC (39.1% vs. 24%, $p < 0.005$) (Table 2).

Independent correlates of lack of ANC uptake

In multivariable analysis, women who did not know that ANC during pregnancy was necessary (OR=, 95%CI=0.092-0.658) and those who did not know about government's support policy of ANC (OR=0.561, 95%CI=1.269-0.992) were less likely to use ANC. Women who never lived outside of Zhaojue for more than six

months (OR=4.808. 95%CI=2.012-11.494) and those who had five or more deliveries (OR=5.848, 95%CI=1.645-20.833) were more likely to have not used ANC (Table 3).

Facilitators and needs assessment of ANC

When asked about who can influence their decisions of accessing ANC, almost half reported Village Women Federation (47.9%), followed by husbands (43.8%) and parents-in-law (34.7%). The most cited reasons for not using ANC were shyness (33.3%), incapability of going without company (27.3%) and cultural custom (15.2%). In terms of facilitators of ANC, the most popular responses were reimbursement of transportation (73.8%), improved education of ANC among women (64.2%) and linking ANC to issuance of birth certificates (51.9%). About a third of participants (30.9%) thought 50 RMB (about 8 USD) for ANC was acceptable and 23.3% thought 100 RMB was acceptable, however, 22.1% were unwilling to pay anything. (Table 4)

Discussion

In this study, we investigated knowledge about, acceptance and uptake of ANC among women of child-bearing age in an ethnic minority area of China. We also explored factors associated with lack of ANC uptake among these ethnic minority women. We found that majority of participants knew that ANC was free and that it was necessary to use antenatal care during pregnancy, and most of them were willing to use ANC. However, less than a quarter had ever accessed ANC, which is much lower than reported by previous studies. In 1998, The National Health Service

Surveys reported that 81% of women used ANC, meanwhile, 76% women in rural areas accessed ANC during 1998 to 2000 [12, 13]. There were a few possible reasons for the low uptake of ANC found in our study. Firstly, the study area is undeveloped, many women do not know about the government's policy and they worry about the spending as well as transportation issues. Secondly, many women in this area are illiterate and non-independent (they said they were not able to go without company). In addition, the cultural custom of not talking about pregnancy and just delivering at home also hinder those pregnant women from taking ANC. Thirdly, the strong intention to use ANC reflected current attitudes among participants, while the actual uptake of ANC covered many previous pregnancies. In recent years, due to the implementation of the PMTCT programs in the area, the proportion of Yi women who delivered in hospitals had increased substantially. However, local governments only started to encourage and support ANC access a couple of years before the current survey. There were some informational and educational materials of ANC being distributed, but most women in the rural areas of Zhaojue were illiterate.

Knowing that ANC during pregnancy is necessary and that government's supportive policy of ANC were positively associated with history of using ANC. We also found that having had five or more deliveries was negatively associated history of taking ANC. Women with more pregnancies tended not to take ANC for two possible reasons: 1) These women were older and less educated, thus their knowledge of ANC was relatively poor and they may have no ability to communicate with health care professionals. 2) They might think that they had successfully experiences of

delivering babies therefore it is no need to care about ANC. The results of our study were similar to studies in other developing countries. For example, in the systematic review by Simkhada et al., factors associated with the utilization of ANC were: education level of pregnant women and their spouses, health service accessibility, cost, family income, etc. They also found that the attitude towards pregnancy could impact the utilization of ANC, and there was an inverse correlate between the previous pregnancy and the utilization of ANC [14]. Some studies conducted in China also had similar findings. For example, Liu and Ceng conducted studies individually in 2007 and 2010, and they found factors associated with the intention and uptake for pregnant women to take ANC could be summarized into three categories: 1) demographic characteristics of pregnant women and their spouses such as low education level, older age and low economic level; 2)number of children ; 3) policies such as birth control leading the worry about being punished even forced abortion [15, 16].

Surprisingly, we found that having ever heard of AIDS and knowing someone who was HIV-infected were not associated with uptake of ANC. A possible reason is that women might not be aware of HIV testing services provided by ANC or that HIV was not one of the top health concerns during their pregnancy and knowledge of HIV and perceived threat of HIV were not sufficient to motivate them to get themselves tested during ANC.

Findings from our study suggest that future efforts to increase uptake of ANC and improve PMTCT should focus on the following aspects: 1) improve knowledge

of ANC among pregnant women, especially among those with low education or illiterate. For example, instead of text-based educational materials, picture-based materials should be distributed. In addition, mini-dramas or plays demonstrating the importance and benefits of ANC could be conducted at community events; 2) improve accessibility of ANC, which may involve infrastructure construction, provision of user-friendly services, etc. In this study, many participates did not know places where offer ANC, and there were also many participants halted because of the long distance and cost in journey. Therefore, making ANC more accessible is urgent. A good service attitude is another approach to attract pregnant women since one who had good experiences with ANC could put other women in motion; 3) mobilize community and family members to encourage ANC during and after pregnancy. Women in poor rural area are more likely to be lack of independence. In other words, they are not used to make decisions towards something important. So, the call of community and support of family would give them courage and belief to overcome the psychological barriers. It would make a big difference if their family members and the community encourage them to accept ANC during pregnancy. 4) HIV screening should continue to be offered at ANC clinics in order to prevent mother-to-child transmission of HIV. The knowledge of the effectiveness and benefits of PMTCT should be improved not only among women, but also among their families and other community members.

As a result, the Zhaojue County Maternal and Child Health Hospital gave a publicity to the villagers, therefore, targeted measures were taken to encourage the villagers to conduct ANC.

Conclusions

In summary, although the actual uptake of antenatal care among women of childbearing age in this rural minority area is lower than other areas, women in the region have strong intention to ANC. No experience of living outside, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were associated with lack of ANC uptake. ANC targeting PMTCT in China may need to be more comprehensive and incorporate the cultural, logistic and needs of the population in order to effectively affect this population's utilization of ANC.

Declarations

Ethic

The study protocol was approved by the Ethical Review Committees of the World Health Organization (RPC587) and Shandong University School of Public Health (20130602). Study procedures, voluntary nature of participation, participants' right to withdraw and autonomy of the participants were explained and oral informed consent was obtained from all participants.

Conflict of interest

The authors declare that they have no conflict of interest.

Author's contributions

BL, LN, CW and WM conceived and designed the study. BL, DS and WW trained interviewers, BY, AE, HZ, WW and SW assisted respondents to fill out the questionnaire. BL, and WW analyzed the data. BL, DS and SW contribute to writing the manuscript. CW, JM and WM critically revised the paper. All authors read and approved the final manuscript.

Data availability statement

All data relevant to the study are included in the article or uploaded as supplementary information.

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Key points

- Although the government provides a variety of supportive policies, the progress of prevention of mother to child transmission in Liangshan Prefecture is still not obvious.
- Ethnic minority women in rural Liangshan expressed strong intention to use ANC, but the actual uptake of ANC was low.
- No experience of living outside, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were the obstructive factors of ANC uptake.

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Table 1. Differences in demographic characteristics between participants who used ANC versus those who did not

	Ever took ANC			
	No	**Yes**	**Total**	**P value**
Age				<0.001
≤25	19 (51.4)	18 (48.6)	37 (7.0)	
26-35	165 (71.4)	66 (28.6)	231 (43.8)	

36-45	160 (82.5)	34 (17.5)	194 (36.8)	
>45	59 (90.8)	6 (9.2)	65 (12.3)	
Husband's age				<0.001
≤25	15 (55.6)	12 (44.4)	27 (5.7)	
26-35	143 (69.4)	63 (30.6)	206 (43.2)	
36-45	137 (79.7)	35 (20.3)	172 (36.1)	
>45	64 (88.9)	8 (11.1)	72 (15.1)	
Education				0.04
Never attended school	360 (77.8)	103 (22.2)	463 (86.2)	
Primary	44 (64.7)	24 (35.3)	68 (12.7)	
Secondary or higher	4 (76.0)	2 (24.0)	6 (1.1)	
Lived out of Zhaojue more than half a year ever				<0.001
Yes	13 (36.1)	23 (63.9)	36 (7.5)	
No	342 (76.9)	103 (23.1)	445 (92.5)	
Household income in the last year(RMB)				0.744
≤1500	93 (44.1)	118 (55.9)	121 (24.1)	
1501-3000	145 (72.5)	55 (27.5)	200 (39.8)	
3001-4500	39 (76.5)	12 (23.5)	51 (10.1)	
≥4500	101 (77.1)	30 (22.9)	131 (26)	
Family members				0.008
≤3	57 (65.5)	30 (34.5)	87 (16.4)	
4-5	177 (73.8)	63 (26.3)	240 (45.1)	
≥6	168 (82.0)	37 (18.0)	205 (38.5)	
Number of delivery				<0.001
0-2	106 (66.3)	54 (33.7)	160 (30.8)	
3-4	221 (75.7)	71 (24.3)	292 (56.2)	
≥5	65 (95.6)	3 (4.4)	68 (13.1)	

Table 2. Differences in knowledge of ANC, HIV, and PMTCT between participants who used ANC versus those who did not

	Ever took ANC			
	No	**Yes**	**Total**	**P value**
Knowing ANC is necessary for pregnant				<0.001
Yes	290 (72.5)	123 (94.6)	413 (77.9)	
No	110 (27)	7 (5.4)	117 (22.1)	
Thinking delivery should be in hospital				0.037
Yes	332 (82.2)	119 (91.5)	451 (84.5)	
No	72 (17.8)	11 (8.4)	83 (15.5)	
Knowing ANC and delivery in hospitals are all free				0.004
Yes	328 (80.6)	117 (90.7)	445 (83)	
No	79 (19.4)	12 (9.3)	91 (17)	
Knowing what ANC includes				0.436
Yes	225 (55.1)	70 (53.8)	295 (54.8)	
No	183 (44.9)	60 (46.2)	243 (45.2)	
Knowing government encourages ANC				0.003

Yes	235 (60.9)	98 (76)	333 (64.7)	
No	151 (39.1)	31 (24)	182 (35.3)	
Having ever heard AIDS				1
Yes	397 (97.3)	127 (97.7)	524 (97.4)	
No	11 (2.7)	3 (2.3)	14 (2.6)	
Knowing HIV-infected person				0.219
Yes	225 (55.7)	66 (51.6)	291 (54.7)	
No	179 (44.4)	62 (48.4)	241 (45.3)	

Table 3. Multivariable analysis of independent correlates associated with having not used ANC

	Having not used ANC	
	OR	**95%CI**
Age		
≤25	1	
26-35	4.464	(1.170-4.785)
36-45	4.464	(2.119-9.346)
>45	9.346	(3.236-27.027)
Husband's age		
≤25	1	
26-35	1.815	(0.804-4.098)
36-45	3.135	(1.346-7.299)
>45	6.410	(2.227-18.519))
Education		
Secondary or higher school	1	
Primary or lower	2.748	(1.967-3.165)
Lived out of Zhaojue more than half a year ever		
Yes	1	
No	5.882	(2.874-12.048)
Number of deliveries		

0-2	1	
3-4	1.585	(1.038-2.421)
≥5	10.989	(3.311-37.037)
Is ANC for pregnancy necessary?		
Yes	1	
No	4.056	(3.021-14.706)
Is giving birth in hospitals necessary?		
Yes	1	
No	2.151	(0.884-5.235)
Knowing ANC and delivery in hospitals are all free		
Yes	1	
No	2.347	(1.235-4.464)
Knowing government encourages ANC		
Yes	1	
No	2.033	(1.292-3.195)
Family size		
1-3	1	
≥4	2.062	(1.290-3.745)

Table 4. Facilitators and needs assessment of ANC among participants

Items	Frequency(%)
People who affect the decision of ANC	
Spouse	232 (43.8)
Parents-in-law	184 (34.7)
Parents	31 (5.8)
Family	5 (0.9)

Village doctor	105 (19.8)
Women's association of village	254 (47.9)
Others	108 (20.4)
No idea	10 (1.9)
Refuse to answer	2 (0.4)
People who support to use ANC	
Spouse	287 (53.9)
Parents-in-law	253 (47.6)
Parents	122 (22.9)
Family	7 (1.3)
Village doctor	236 (44.4)
Women's association of village	382 (71.8)
Others	27 (5.1)
No idea	6 (1.1)
People who oppose to use ANC	
Spouse	9 (1.9)
Parents-in-law	10 (2.1)
Village doctor	18 (3.8)
Women's association of village	25 (5.2)
Others	427 (89)
No idea	12 (2.5)
Refuse to answer	8 (1.7)
Reasons for objecting to using ANC	
Cultural custom	5 (15.2)

Incapability of going for ANC without company	9 (27.3)
Shyness	11 (33.3)
Cost of transportation	2 (6.1)
Others	10 (30.3)
Refuse to answer	5 (15.2)
How to promote the usage of ANC	
Carrying out health education to women	340 (64.2)
Carrying out health education to spouses	100 (18.9)
Getting reimbursement for transportation	391 (73.8)
Issuing birth certificate based on ANC	275 (51.9)
Others	27 (5.1)
No idea	24 (4.5)
Money willing to pay for ANC	
Unwilling to pay anything	110 (22.1)
<50	154 (30.9)
<100	118 (23.7)
<200	99 (19.9)
<500	15 (3.0)
≥500	1 (0.2)
Favorable accompanying person taking ANC	
Husband	162 (39.2)
Mother or mother-in-law	82 (19.9)
Family	16 (3.9)
Women's association of village	140 (33.9)

Village doctor	1 (0.2)
Others	12 (2.9)

The STROBE- statement checklist.

	Item	STROBE- recommendation	Page #
Title and Abstract	1	(a) Indicate that the study was an observational study and, if applicable, use a common study design term	1
		(b) Indicate why the study was conducted, the design, the results, the limitations, and the relevance of the findings	1
Background / rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	(a) State specific objectives, including any primary or secondary prespecified hypotheses or their absence	5
		(b) Ensure that the level of organization[a] is clear for each objective and hypothesis	5
Study design	4	Present key elements of study design early in the paper	
Setting	5	(a) Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
		(b) If applicable, include information at each level of organization	
Participants [b]	6	(a) Describe the eligibility criteria for the owners/managers and for the animals, at each relevant level of organization	5
Variables	7	(a) Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. If applicable, give diagnostic criteria	
Data sources / measurement	8*	(a) For each variable of interest, give sources of data and details of methods of assessment (measurement). If applicable, describe comparability of assessment methods among groups and over time	7
Bias	9	Describe any efforts to address potential sources of bias due to confounding, selection, or information bias	7
Study size	10	(a) Describe how the study size was arrived at for each relevant level of organization	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	7

Statistical methods	12	(a) Describe all statistical methods for each objective, at a level of detail sufficient for a knowledgeable reader to replicate the methods. Include a description of the approaches to variable selection, control of confounding, and methods used to control for non-independence of observations	7
		(b) Describe the rationale for examining subgroups and interactions and the methods used	7
Participants	13*	(a) Report the numbers of owners/managers and animals at each stage of study and at each relevant level of organization - e.g., numbers eligible, included in the study, completing follow-up, and analyzed	8
Descriptive data on exposures and potential confounders	14*	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders by group and level of organization, if applicable	8
Outcome data	15*	(a) Report outcomes as appropriate for the study design and summarize at all relevant levels of organization	8
		(b) For proportions and rates, report the numerator and denominator	8
Main results	16	(a) Give unadjusted estimates and, if applicable, adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders and interactions were adjusted. Report all relevant parameters that were part of the model	9
		(b) Report category boundaries when continuous variables were categorized	9
Strengths and Limitations	19	Discuss strengths and limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
~~Funding~~ Transparency	22	(a) Funding- Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based (b) Conflicts of interest-Describe any conflicts of interest, or lack thereof, for each author (c) Describe the authors' roles- Provision of an authors' declaration of transparency is recommended (d) Ethical approval- Include information on ethical approval for use of animal and human subjects (e) Quality standards-Describe any quality standards used in the conduct of the research	14

[a] Level of organization recognizes that observational studies in veterinary research often deal with repeated measures (within an animal or herd) or animals that are maintained in groups (such as pens and herds); thus, the observations are not statistically independent. This non-independence has profound implications for the design, analysis, and results of these studies.
[b] The word "participant" is used in the STROBE statement. However, for the veterinary version, it is understood that "participant" should be addressed for both the animal owner/manager and for the animals themselves.
*Give such information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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What factors hinder ethnic minority women in rural China from getting antenatal care? A retrospective data analysis

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Keywords:	antenatal care, ethnic minority, Epidemiology < INFECTIOUS DISEASES

What factors hinder ethnic minority women in rural China from getting antenatal care? A retrospective data analysis

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Abstract

Background: Mother to child transmission (MTCT) is one of the main transmission routes of HIV, and the probability of MTCT can be dramatically reduced with comprehensive interventions. In southwest and western regions in China,The level of development in rural areas is relatively backward and retains some original features, which also increases the difficulty of controlling infectious diseases. The Liangshan Prefecture started the prevention of MTCT program in 2009. However, the implementation of the program is not ideal and the coverage of HIV testing is still low. Many Yi (local major ethnicity) women did not take antenatal care (ANC) and just gave birth to their babies at home for a variety of reasons.

Methods: Women with pregnancy history in the last five years were recruited from two townships based on cluster sampling. Face-to-face interviews were conducted to collect data. Descriptive analysis was performed to describe demographic characteristics, history of pregnancy and ANC uptake, knowledge of and attitudes towards ANC. Multivariable analysis was used to identify factors associated with uptake of ANC.

Results: Among 538 women who completed the questionnaires, 77.9% knew that ANC was necessary during and after pregnancy. However, only 24.2% actually accessed ANC. Almost all women (94.6%) expressed their willingness to receive ANC for pregnancy but barriers toward actual uptake of ANC existed including shyness, lack of independence, unavoidable cost. Multivariate analysis showed that,

no experience of living outside of Zhaojue for more than six months, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were associated with lack of ANC uptake.

Conclusion: Although ethnic minority women in rural Liangshan expressed strong intention to use ANC, actual uptake of ANC was low. Knowledge of ANC and HIV prevention for mother-to-child transmission (PMTCT) should be improved among this population, and efforts should be made to help them overcome barriers to accessing ANC.

Key words: antenatal care (ANC); ethnic minority; China

Strengths and limitations of this study

- The subjects of this study were selected from health service provider, the recipient, and the hub of them (the key figure in a family), which enriched the research perspective and made information acquisition and research results more comprehensive and objective.
- We only selected women of child-bearing age who had pregnancy history in the last five years from two towns of Zhaojue, so maybe the findings are not generalizable to all the women of child-bearing age in the rural area.
- Due to the mode of survey administration (interviewer-administered face-to-face), social desirability bias might be introduced.

- It may overestimate the uptake of ANC because this study only focused on the uptake of ANC of the respondents within the whole five years, and ignored whether or not they accepted ANC during the most recent pregnancy.

- Our HIV-related questions were not MTCT or PMCT specific, so future studies should consider HIV-related questions which are more relevant to the concerns and needs of pregnant women.

Introduction

Background

HIV can be suppressed by combination antiretroviral therapy (ART) consisting of 3 or more antiretroviral (ARV) drugs. Elimination of PMTCT of HIV is now considered a realistic public health goal and an important component of a comprehensive HIV prevention package. There were approximately 36.9 million people living with HIV at the end of 2017 with 1.8 million people becoming newly infected in 2017 globally. 59% of adults and 52% of children living with HIV were receiving lifelong antiretroviral therapy (ART) in 2017. [1, 2].

A comprehensive approach to PMTCT programmes is promoted by The World Health Organization (WHO), which includes: 1) precluding new HIV infections among women of reproductive age; 2) avoiding accidental pregnancies among HIV-infected women; 3) preventing HIV vertical transmission from an HIV-infected mother to her child; and 4) providing applicable treatment, care and support to HIV-infected mothers, their children and families [3]. China has been starting on PMTCT

since 2003 and achieved similar progress as other parts of the world [4]. However, in some remote rural areas, especially regions resided by ethnic minority groups, PMTCT still faces significant challenges. For example, Liangshan Yi Autonomous Prefecture in Sichuan Province, which is situated on a major drug trafficking route of the Golden Triangle, is one of the areas that has the highest HIV infection rate in the past few years [5-9]. A study reported that HIV prevalence was 4.4% among rural residents in two of the most affected counties in Liangshan prefecture in 2009, Butuo and Zhaojue. [7]. Furthermore, a early study conducted among HIV-positive pregnant women in the prefecture in 2004 found that 7.0% of their infants were tested HIV positive [9], which is significantly higher than the national average. Although overall rate of MTCT dropped from 10.5% in 2008 to 5.5% in 2013 (unpublished data), MTCT of HIV is still a serious public health concern in this area due to lack of HIV testing, barriers to accessing treatment and care, and poverty and illiteracy among the population.

Antenatal care could provide opportunities to identify undiagnosed cases as well as conduct PMTCT among HIV-positive women. Liangshan Prefecture began to execute PMTCT program at ANC clinics and hospitals since 2009. In addition to providing regular pregnancy-related check-ups, ANC also includes free HIV testing. However, coverage of PMTCT especially uptake of HIV testing remained low. One of the reasons for such low coverage was that about one third of local women delivered their babies at home rather than in the hospitals [9]. Furthermore, even fewer pregnant women accessed ANC before delivery. A study reported that 62% of

pregnant women in the prefecture had fewer than five ANC visits during pregnancy while 26.0% never utilized any ANC [10]. Therefore, in order to improve the effectiveness of the PMTCT program, access and uptake of ANC need to be improved substantially.

The study area, Zhaojue County, is an underdeveloped county with one of the highest HIV infection rates in Liangshan [7]. In addition to the PMTCT program, the China / United Nations Children's Fund Conditional Cash Transfer (CCT) project, which provides incentives for pregnant women to use ANC and deliver in hospitals, has also been implemented in Zhaojue. However, proportions of women who access ANC and have child delivery in hospitals are still below the average level in the prefecture. In order to encourage more women to access ANC and improve coverage, it is necessary to identify factors that may promote or hinder use of ANC among this vulnerable population.

Objectives

The objectives of this study were to describe knowledge, acceptability, actual uptake of ANC and to identify factors associated with lack of ANC attendence among women of child-bearing age in Zhaojue County, Liangshan, China.

Methods

Setting and participants

The survey was conducted in Zhaojue County of Liangshan Prefecture in December, 2014. The county is located in east-central Liangshan, southwestern Sichuan Province, with an area of 2,700 square kilometers and a population of 308,300. The main (97.9%) local population is the Yi, residing in 47 towns and 269 villages [11].

First, we purposively selected two townships that both have larger population and hospitals that provide ANC. Then we divided the villages within the two townships into two layers based on the distance between the villages and the township hospital. The average distance from the villages in the two layers to the township hospitals is 8km and 15km respectively. One village close to the hospital and one far away from the hospital were randomly selected from each township. All eligible women in the selected four villages were invited to participate in the study. Inclusion criteria included: 1) female; 2) aged 49 or under; 3) had a pregnancy history in the last five years; and 4) having resided in Zhaojue County for at least 6 months. The sample size is calculated by the equation $N = Z^2 P(1-P)/d^2$, and Z=1.96, d=0.05. The hospital delivery rate in Liangshan Yi Autonomous Region in 2013 was about 56%, so P=0.56. N=378, but as cluster sampling was conducted, in order to reduce sampling error, we increased the sample size by 50%. So, the sample size is 567.

Study instrument and data collection

A structured questionnaire was developed by local health experts based on literature review, formative research and pilot test. The information collected

included: (1) Demographic and household characteristics of participants, including age, income, education, ethnicity, occupation, marital status, age of the participant's husband, and family size; (2) History of pregnancy, including number of pregnancies, number of births, and whether participants accessed ANC during their pregnancies; (3) Whether they know ANC is necessary, ANC is free, where to get ANC and what ANC includes; (4) Willingness to utilize ANC measured by a series of Yes/No questions, and facilitators of and barriers to accessing ANC; and (5) whether they have heard of AIDS and knew someone who was HIV-positive

Interviewers were 5 local women who were proficient in both Yi (local language) and Mandarin. They were trained by School of Public Health, Shandong University before investigation to ensure study protocol was followed. On account of the general low educational level of some respondents, oral informed consent was obtained from each of them before the face-to-face interview. For respondents who don't know how to write their own names, the investigator signed on their behalf with their consent. This study is a cross-sectional study that does not involve clinical trials. In consideration of that most of the respondents are illiterate, the ethics committee approved this procedure. The trained investigators directly inquired about the participants and explained to them the thoughts involved in the questions. After confirming that the participants understood the questions, interviewers filled out the questionnaire according to interviewees' answers. Investigators conduct investigations at the village committee, using the "Prenatal Health Survey Form for Women of Childbearing Age" to conduct investigations. Some respondents may not

be present, so researchers need to go to their home for face-to-face investigation until we collect enough data.

Data management and statistical analysis

All the data were double entered with Epidata 3.1 and discrepancies were checked against the raw data. Data analysis was performed with SPSS 21.0. Descriptive analysis was used to describe demographic characteristics, history of pregnancies and ANC-related variables. To identify independent correlates of ANC uptake, univariate analysis was first conducted through chi-square tests comparing characteristics of women who accessed ANC during their pregnancy versus those who did not. Variables with a P values < 0.05 in the univariate analysis were eligible for entry into the multivariable logistic regression model, where adjusted OR and 95%CI were calculated accordingly.

Patient and public involvement

No patients were involved in the development of the research question nor the design of the study. The Zhaojue County Maternal and Child Health Hospital has processed the research results into science knowledge and informed local villagers through several publicity in 2018. In this process, the staff informed the villagers that both men and women should pay attention to antenatal care, and the government will bear most of the costs.

Results

Demographic characteristics

A total of 547 women with pregnancy history in the past five years (1/1/2010~12/31/2014) were approached and 538 valid questionnaires were collected, with a response rate of 98.4%. The mean age of participants was 35.6 years and 7.0% of them were less than 25 years of age. Most participants (86.2%) were illiterate. Almost half (45.1%) had 4-5 family members while 86 (16.4%) had 1-3 and family members. More than half (56.2%) had 3-4 births. Women in the ≤25-year-old group had the highest proportion of antenatal care, at 48.6%. The proportion of participants in the 25-35 age group and the 35-45 age group who participated in antenatal care was 28.6% and 17.5%, respectively. > The 45-year-old group had the lowest proportion of antenatal care, 9.2%. Similarly, the younger the spouse's age group, the higher the percentage of antenatal care, the percentage of participating in prenatal care for each of the above age groups was 44.4%, 30.6%, 20.3%, 11.1%. The higher the level of education, the higher the percentage of prenatal examinations. The percentage of women who attended primary and junior high school examinations (35.3%, 33.3%) was significantly higher than the 22.2% who did not attend school. Among women of childbearing age who have lived for more than half a year outside of Zhaojue, the proportion of people who have had antenatal care is 63.9%, which is significantly higher than that of women who have not lived outside of Zhaojue (23.1%). 34.5% of women with 3 or fewer family members ever took ANC, and the proportion of people who too ANC for 4-5 and ≥6 was 26.3% and 18% respectively. In addition, women who give fewer births have a higher rate of participation in prenatal care. Among

those with 0 to 2 births, 33.7% have received ANC, but in those with 4 to 5 births and 6 or more, this proportion is only 24.3% and 4.4%. (Table 1).

History, knowledge of and attitude towards ANC

Almost all participants (94.6%) reported that they were willing to use ANC during pregnancy. However, just under a quarter (24.2%) had ever received it. The majority (77.9%) thought ANC was necessary during and after pregnancy, 84.5% thought it was necessary to give birth in hospitals, 83% also knew that ANC and delivery in hospitals were free. However, almost half (45.2%) did not know what ANC included. Almost all of the participants (97.4%) heard of AIDS and more than half (54.7%) knew someone who was HIV-infected. Compared to those who ever used ANC, participants who did not were significantly more likely not to have known that ANC was necessary during pregnancy (27% vs. 5.4%, $p < 0.001$), not to have known delivery should be in hospital (17.8% vs. 8.4%, $p < 0.05$), not to have known ANC and delivery in hospitals are all free (19.4% vs. 9.3%, $p < 0.005$), not to have known government encourages ANC (39.1% vs. 24%, $p < 0.005$) (Table 2).

Independent correlates of lack of ANC uptake

In multivariable analysis, women who did not know that ANC during pregnancy was necessary (OR=, 95%CI=0.092-0.658) and those who did not know about government's support policy of ANC (OR=0.561, 95%CI=1.269-0.992) were less likely to use ANC. Women who never lived outside of Zhaojue for more than six

months (OR=4.808. 95%CI=2.012-11.494) and those who had five or more deliveries (OR=5.848, 95%CI=1.645-20.833) were more likely to have not used ANC (Table 3).

Facilitators and needs assessment of ANC

When asked about who can influence their decisions of accessing ANC, almost half reported Village Women Federation (47.9%), followed by husbands (43.8%) and parents-in-law (34.7%). The most cited reasons for not using ANC were shyness (33.3%), incapability of going without company (27.3%) and cultural custom (15.2%). In terms of facilitators of ANC, the most popular responses were reimbursement of transportation (73.8%), improved education of ANC among women (64.2%) and linking ANC to issuance of birth certificates (51.9%). About a third of participants (30.9%) thought 50 RMB (about 8 USD) for ANC was acceptable and 23.3% thought 100 RMB was acceptable, however, 22.1% were unwilling to pay anything. (Table 4)

Discussion

In this study, we investigated knowledge about, acceptance and uptake of ANC among women of child-bearing age in an ethnic minority area of China. We also explored factors associated with lack of ANC uptake among these ethnic minority women. We found that majority of participants knew that ANC was free and that it was necessary to use antenatal care during pregnancy, and most of them were willing to use ANC. However, less than a quarter had ever accessed ANC, which is much lower than reported by previous studies. In 1998, The National Health Service

Surveys reported that 81% of women used ANC, meanwhile, 76% women in rural areas accessed ANC during 1998 to 2000 [12, 13]. There were a few possible reasons for the low uptake of ANC found in our study. Firstly, the study area is undeveloped, many women do not know about the government's policy and they worry about the spending as well as transportation issues. Secondly, many women in this area are illiterate and non-independent (they said they were not able to go without company). In addition, the cultural custom of not talking about pregnancy and just delivering at home also hinder those pregnant women from taking ANC. Thirdly, the strong intention to use ANC reflected current attitudes among participants, while the actual uptake of ANC covered many previous pregnancies. In recent years, due to the implementation of the PMTCT programs in the area, the proportion of Yi women who delivered in hospitals had increased substantially. However, local governments only started to encourage and support ANC access a couple of years before the current survey. There were some informational and educational materials of ANC being distributed, but most women in the rural areas of Zhaojue were illiterate.

Knowing that ANC during pregnancy is necessary and that government's supportive policy of ANC were positively associated with history of using ANC. We also found that having had five or more deliveries was negatively associated history of taking ANC. Women with more pregnancies tended not to take ANC for two possible reasons: 1) These women were older and less educated, thus their knowledge of ANC was relatively poor and they may have no ability to communicate with health care professionals. 2) They might think that they had successfully experiences of

delivering babies therefore it is no need to care about ANC. The results of our study were similar to studies in other developing countries. For example, in the systematic review by Simkhada et al., factors associated with the utilization of ANC were: education level of pregnant women and their spouses, health service accessibility, cost, family income, etc. They also found that the attitude towards pregnancy could impact the utilization of ANC, and there was an inverse correlate between the previous pregnancy and the utilization of ANC [14]. Some studies conducted in China also had similar findings. For example, Liu and Ceng conducted studies individually in 2007 and 2010, and they found factors associated with the intention and uptake for pregnant women to take ANC could be summarized into three categories: 1) demographic characteristics of pregnant women and their spouses such as low education level, older age and low economic level; 2)number of children ; 3) policies such as birth control leading the worry about being punished even forced abortion [15, 16].

Surprisingly, we found that having ever heard of AIDS and knowing someone who was HIV-infected were not associated with uptake of ANC. A possible reason is that women might not be aware of HIV testing services provided by ANC or that HIV was not one of the top health concerns during their pregnancy and knowledge of HIV and perceived threat of HIV were not sufficient to motivate them to get themselves tested during ANC.

Findings from our study suggest that future efforts to increase uptake of ANC and improve PMTCT should focus on the following aspects: 1) improve knowledge

of ANC among pregnant women, especially among those with low education or illiterate. For example, instead of text-based educational materials, picture-based materials should be distributed. In addition, mini-dramas or plays demonstrating the importance and benefits of ANC could be conducted at community events; 2) improve accessibility of ANC, which may involve infrastructure construction, provision of user-friendly services, etc. In this study, many participates did not know places where offer ANC, and there were also many participants halted because of the long distance and cost in journey. Therefore, making ANC more accessible is urgent. A good service attitude is another approach to attract pregnant women since one who had good experiences with ANC could put other women in motion; 3) mobilize community and family members to encourage ANC during and after pregnancy. Women in poor rural area are more likely to be lack of independence. In other words, they are not used to make decisions towards something important. So, the call of community and support of family would give them courage and belief to overcome the psychological barriers. It would make a big difference if their family members and the community encourage them to accept ANC during pregnancy. 4) HIV screening should continue to be offered at ANC clinics in order to prevent mother-to-child transmission of HIV. The knowledge of the effectiveness and benefits of PMTCT should be improved not only among women, but also among their families and other community members.

Although there are important discoveries revealed in this study, there are also limitations. First, the findings may not be generalizable to all the women of child-

bearing age in the rural area because we only selected women of child-bearing age who had pregnancy history in the last five years from two towns. Second, due to the mode of survey administration (interviewer-administered face-to-face), social desirability bias might be introduced. Third, we only focused on the uptake of ANC of the respondents within the whole five years and ignored whether or not they accepted ANC during the most recent pregnancy, so it may overestimate the uptake of ANC. Last, our HIV-related questions were not MTCT or PMCT specific, so future studies should consider HIV-related questions which are more relevant to the concerns and needs of pregnant women.

As a result, the Zhaojue County Maternal and Child Health Hospital gave a publicity to the villagers, therefore, targeted measures were taken to encourage the villagers to conduct ANC.

Conclusions

In summary, although the actual uptake of antenatal care among women of childbearing age in this rural minority area is lower than other areas, women in the region have strong intention to ANC. No experience of living outside, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were associated with lack of ANC uptake. ANC targeting PMTCT in China may need to be more comprehensive and incorporate the cultural, logistic and needs of the population in order to effectively affect this population's utilization of ANC.

Declarations

Ethic

The study protocol was approved by the Ethical Review Committees of the World Health Organization (RPC587) and Shandong University School of Public Health (20130602). Study procedures, voluntary nature of participation, participants' right to withdraw and autonomy of the participants were explained and oral informed consent was obtained from all participants.

Conflict of interest

The authors declare that they have no conflict of interest.

Author's contributions

BL, LN, CYW and WM conceived and designed the study. BL, DRS and WW trained interviewers. BBY, AGEM, HQZ, WHWZ and JMZ assisted respondents to fill out the questionnaire. BL, and DRS analyzed the data. BL, DRS and SMW contribute to writing the manuscript. CYW and WM critically revised the paper. All authors read and approved the final manuscript.

Data availability statement

All data relevant to the study are included in the article or uploaded as supplementary information.

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Key points

- Although the government provides a variety of supportive policies, the progress of prevention of mother to child transmission in Liangshan Prefecture is still not obvious.
- Ethnic minority women in rural Liangshan expressed strong intention to use ANC, but the actual uptake of ANC was low.
- No experience of living outside, higher number of births, not knowing the necessity of ANC during pregnancy and not knowing the government's promotion policies for ANC were the obstructive factors of ANC uptake.

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Table 1. Differences in demographic characteristics between participants who used ANC versus those who did not

	Ever took ANC			
	No	**Yes**	**Total**	**P value**

Age				<0.001
≤25	19 (51.4)	18 (48.6)	37 (7.0)	
26-35	165 (71.4)	66 (28.6)	231 (43.8)	
36-45	160 (82.5)	34 (17.5)	194 (36.8)	
>45	59 (90.8)	6 (9.2)	65 (12.3)	
Husband's age				<0.001
≤25	15 (55.6)	12 (44.4)	27 (5.7)	
26-35	143 (69.4)	63 (30.6)	206 (43.2)	
36-45	137 (79.7)	35 (20.3)	172 (36.1)	
>45	64 (88.9)	8 (11.1)	72 (15.1)	
Education				0.04
Never attended school	360 (77.8)	103 (22.2)	463 (86.2)	
Primary	44 (64.7)	24 (35.3)	68 (12.7)	
Secondary or higher	4 (76.0)	2 (24.0)	6 (1.1)	
Lived out of Zhaojue more than half a year ever				<0.001
Yes	13 (36.1)	23 (63.9)	36 (7.5)	
No	342 (76.9)	103 (23.1)	445 (92.5)	
Household income in the last year(RMB)				0.744
≤1500	93 (44.1)	118 (55.9)	121 (24.1)	
1501-3000	145 (72.5)	55 (27.5)	200 (39.8)	
3001-4500	39 (76.5)	12 (23.5)	51 (10.1)	
≥4500	101 (77.1)	30 (22.9)	131 (26)	
Family members				0.008
≤3	57 (65.5)	30 (34.5)	87 (16.4)	
4-5	177 (73.8)	63 (26.3)	240 (45.1)	
≥6	168 (82.0)	37 (18.0)	205 (38.5)	
Number of delivery				<0.001
0-2	106 (66.3)	54 (33.7)	160 (30.8)	
3-4	221 (75.7)	71 (24.3)	292 (56.2)	

≥5	65 (95.6)	3 (4.4)	68 (13.1)

Table 2. Differences in knowledge of ANC, HIV, and PMTCT between participants who used ANC versus those who did not

	Ever took ANC			
	No	**Yes**	**Total**	**P value**
Knowing ANC is necessary for pregnant				<0.001
Yes	290 (72.5)	123 (94.6)	413 (77.9)	
No	110 (27)	7 (5.4)	117 (22.1)	
Thinking delivery should be in hospital				0.037
Yes	332 (82.2)	119 (91.5)	451 (84.5)	
No	72 (17.8)	11 (8.4)	83 (15.5)	
Knowing ANC and delivery in hospitals are all free				0.004

Yes	328 (80.6)	117 (90.7)	445 (83)	
No	79 (19.4)	12 (9.3)	91 (17)	
Knowing what ANC includes				0.436
Yes	225 (55.1)	70 (53.8)	295 (54.8)	
No	183 (44.9)	60 (46.2)	243 (45.2)	
Knowing government encourages ANC				0.003
Yes	235 (60.9)	98 (76)	333 (64.7)	
No	151 (39.1)	31 (24)	182 (35.3)	
Having ever heard AIDS				1
Yes	397 (97.3)	127 (97.7)	524 (97.4)	
No	11 (2.7)	3 (2.3)	14 (2.6)	
Knowing HIV-infected person				0.219
Yes	225 (55.7)	66 (51.6)	291 (54.7)	
No	179 (44.4)	62 (48.4)	241 (45.3)	

Table 3. Multivariable analysis of independent correlates associated with having not used ANC

	Having not used ANC	
	OR	**95%CI**
Age		
≤25	1	
26-35	4.464	(1.170-4.785)
36-45	4.464	(2.119-9.346)
>45	9.346	(3.236-27.027)
Husband's age		
≤25	1	
26-35	1.815	(0.804-4.098)
36-45	3.135	(1.346-7.299)
>45	6.410	(2.227-18.519))
Education		
Secondary or higher school	1	
Primary or lower	2.748	(1.967-3.165)
Lived out of Zhaojue more than half a year ever		
Yes	1	
No	5.882	(2.874-12.048)
Number of deliveries		
0-2	1	
3-4	1.585	(1.038-2.421)
≥5	10.989	(3.311-37.037)
Is ANC for pregnancy necessary?		
Yes	1	

No	4.056	(3.021-14.706)
Is giving birth in hospitals necessary?		
Yes	1	
No	2.151	(0.884-5.235)
Knowing ANC and delivery in hospitals are all free		
Yes	1	
No	2.347	(1.235-4.464)
Knowing government encourages ANC		
Yes	1	
No	2.033	(1.292-3.195)
Family size		
1-3	1	
≥4	2.062	(1.290-3.745)

Table 4. Facilitators and needs assessment of ANC among participants

Items	Frequency(%)
People who affect the decision of ANC	
Spouse	232 (43.8)

Parents-in-law	184 (34.7)
Parents	31 (5.8)
Family	5 (0.9)
Village doctor	105 (19.8)
Women's association of village	254 (47.9)
Others	108 (20.4)
No idea	10 (1.9)
Refuse to answer	2 (0.4)
People who support to use ANC	
Spouse	287 (53.9)
Parents-in-law	253 (47.6)
Parents	122 (22.9)
Family	7 (1.3)
Village doctor	236 (44.4)
Women's association of village	382 (71.8)
Others	27 (5.1)
No idea	6 (1.1)
People who oppose to use ANC	
Spouse	9 (1.9)
Parents-in-law	10 (2.1)
Village doctor	18 (3.8)
Women's association of village	25 (5.2)
Others	427 (89)
No idea	12 (2.5)

Refuse to answer	8 (1.7)
Reasons for objecting to using ANC	
Cultural custom	5 (15.2)
Incapability of going for ANC without company	9 (27.3)
Shyness	11 (33.3)
Cost of transportation	2 (6.1)
Others	10 (30.3)
Refuse to answer	5 (15.2)
How to promote the usage of ANC	
Carrying out health education to women	340 (64.2)
Carrying out health education to spouses	100 (18.9)
Getting reimbursement for transportation	391 (73.8)
Issuing birth certificate based on ANC	275 (51.9)
Others	27 (5.1)
No idea	24 (4.5)
Money willing to pay for ANC	
Unwilling to pay anything	110 (22.1)
<50	154 (30.9)
<100	118 (23.7)
<200	99 (19.9)
<500	15 (3.0)
≥500	1 (0.2)
Favorable accompanying person taking ANC	
Husband	162 (39.2)

Mother or mother-in-law	82 (19.9)
Family	16 (3.9)
Women's association of village	140 (33.9)
Village doctor	1 (0.2)
Others	12 (2.9)

The STROBE- statement checklist.

	Item	STROBE- recommendation	Page #
Title and Abstract	1	(a) Indicate that the study was an observational study and, if applicable, use a common study design term	1
		(b) Indicate why the study was conducted, the design, the results, the limitations, and the relevance of the findings	1
Background / rationale	2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	3	(a) State specific objectives, including any primary or secondary prespecified hypotheses or their absence	5
		(b) Ensure that the level of organization[a] is clear for each objective and hypothesis	5
Study design	4	Present key elements of study design early in the paper	
Setting	5	(a) Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	
		(b) If applicable, include information at each level of organization	
Participants [b]	6	(a) Describe the eligibility criteria for the owners/managers and for the animals, at each relevant level of organization	5
Variables	7	(a) Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. If applicable, give diagnostic criteria	
Data sources / measurement	8*	(a) For each variable of interest, give sources of data and details of methods of assessment (measurement). If applicable, describe comparability of assessment methods among groups and over time	7
Bias	9	Describe any efforts to address potential sources of bias due to confounding, selection, or information bias	7
Study size	10	(a) Describe how the study size was arrived at for each relevant level of organization	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	7

Statistical methods	12	(a) Describe all statistical methods for each objective, at a level of detail sufficient for a knowledgeable reader to replicate the methods. Include a description of the approaches to variable selection, control of confounding, and methods used to control for non-independence of observations	7
		(b) Describe the rationale for examining subgroups and interactions and the methods used	7
Participants	13*	(a) Report the numbers of owners/managers and animals at each stage of study and at each relevant level of organization - e.g., numbers eligible, included in the study, completing follow-up, and analyzed	8
Descriptive data on exposures and potential confounders	14*	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders by group and level of organization, if applicable	8
Outcome data	15*	(a) Report outcomes as appropriate for the study design and summarize at all relevant levels of organization	8
		(b) For proportions and rates, report the numerator and denominator	8
Main results	16	(a) Give unadjusted estimates and, if applicable, adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders and interactions were adjusted. Report all relevant parameters that were part of the model	9
		(b) Report category boundaries when continuous variables were categorized	9
Strengths and Limitations	19	Discuss strengths and limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
~~**Funding**~~ **Transparency**	22	(a) Funding- Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based (b) Conflicts of interest-Describe any conflicts of interest, or lack thereof, for each author (c) Describe the authors' roles- Provision of an authors' declaration of transparency is recommended (d) Ethical approval- Include information on ethical approval for use of animal and human subjects (e) Quality standards-Describe any quality standards used in the conduct of the research	14

[a] Level of organization recognizes that observational studies in veterinary research often deal with repeated measures (within an animal or herd) or animals that are maintained in groups (such as pens and herds); thus, the observations are not statistically independent. This non-independence has profound implications for the design, analysis, and results of these studies.
[b] The word "participant" is used in the STROBE statement. However, for the veterinary version, it is understood that "participant" should be addressed for both the animal owner/manager and for the animals themselves.
*Give such information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.