

HIV Screening and Awareness Survey for Pregnant Women in a Remote Area in Xinjiang Uyghur Autonomous Region of China

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Abstract: *Objective:* The number of people infected with human immunodeficiency virus (HIV) in China has increased in recent years. HIV screening for pregnant women was performed in a remote area in Xinjiang, as an effort to promote universal HIV screening in pregnant women and to help prevention of mother-to-child transmission.

Methods: Pregnant women in Burqin and Jeminay Counties in Xinjiang were offered free voluntary HIV screening. Local mid-level medical workers were trained to use Determine® HIV-1/2 kit for HIV screening. All the tested pregnant women signed a consent form, received HIV education material, and participated in an HIV knowledge survey.

Results: All the 890 pregnant women receiving HIV test had negative result. Among these women, 67.6% were Kazakh and 40.9% were farmers. Survey of HIV knowledge showed that these women's awareness about mother-to-child transmission was limited. The levels of HIV knowledge were related with ethnic background, age, education and profession of the pregnant women.

Conclusion: The results suggested that HIV infection had not become a significant problem among the pregnant women in this remote area of Xinjiang, but continued efforts to improve the awareness of HIV, especially the knowledge about mother-to-child transmission of HIV, in pregnant women were needed.

Keywords: Universal HIV screen, pregnant women, mother-to-child transmission.

INTRODUCTION

The number of people infected with human immunodeficiency virus (HIV) in China has increased in recent years. It is estimated that in 2009 there were 740,000 people living with HIV in China, with 48,000 new infections and 105,000 alive AIDS patients [1]. The transmission mode of HIV in China has changed over the recent years. While injecting drug use-related HIV infection used to be the major transmission mode, the epidemic has already started to spread from high-risk populations to the general population in recent years, and sexual transmission is currently the primary mode of transmission. Among those infected with

HIV in China reported in 2009, about 30.5% were women, so there is potential for mother-to-child transmission of HIV [1]. In 1995 the first case of mother-to-child transmission in China was identified in Yunnan province [2]. Since then, the proportion of reported cases of HIV infection caused by mother-to-child transmission has increased from 0.1% in 1997 to 1.2% in 2007 [3,4].

It has been recognized that mother-to-child transmission of HIV is the major cause of child HIV infection. Mother-to-child transmission of HIV can occur during pregnancy, during the labor and delivery, or after delivery. The most important postnatal transmission of HIV is through breastfeeding, which accounts for about 44% in children where breastfeeding to two years is the norm [5]. In industrialized countries, the rates of mother-to-child transmission of HIV in untreated non-breastfeeding populations range from 14% to 32%, but the rates are from 25% to 48% among breastfeeding populations in resource-poor settings [6]. Currently in the United States, with

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the practice of universal prenatal HIV counseling and testing, antiretroviral prophylaxis, elective cesarean delivery, and avoidance of breast feeding, perinatal HIV infection has decreased to less than 2% [7]. In the United States, lack of identification of maternal HIV infection status has been found to be responsible for new infant HIV infections [8]. Universal HIV testing of pregnant women is currently recommended by the Centers for Disease Control and Prevention as part of standard care in the United States [9]. Universal HIV testing of pregnant women may allow identification of the women who are infected with HIV but are not aware of their infectious status, and may benefit the health of both the mother and her infant [10]. The importance of reducing mother-to-child transmission of HIV has recently started to be recognized in China. In 2006 China developed the "Prevention of mother-to-child transmission guidelines", and activities to prevent mother-to-child transmission of HIV were performed in 271 counties in 2007 [4], and expanded into 453 counties in 2009 [1]. Recently the Ministry of Health of the People's Republic of China started promoting blood tests for syphilis, HIV and hepatitis B virus as a routine examination for all pregnant women [11]. The reported number of pregnant women being screened for HIV in China was about 4 million in 2009 [1], but in the same year the newborn number in the nation was 13.8 million [12]. The gap between the number of pregnant women screened for HIV and the total number of pregnant women is still obvious.

The Xinjiang Uyghur Autonomous Region is located in the north-western part of China. While only a little more than 1% of China's population live in this region, it accounts for about 10% of estimated HIV cases of China. In 2006, the confirmed cases of HIV infection in Xinjiang reached 16,035, but the estimated number of people actually infected with HIV was around 60,000 [13]. After the first case of mother-to-child transmission in Xinjiang was identified in 1996, the prevalence of child HIV infection caused by mother-to-child transmission in Xinjiang exceeded 1% in 2004, and in some areas this number was as high as 5.3% [13]. Although significant efforts have been made for the prevention and treatment of HIV in Xinjiang, many remote areas need additional help to promote universal HIV testing in pregnant women. With the help of a humanitarian grant from the College of American Pathologist Foundation, free HIV screening was offered to pregnant women in Burqin County and Jeminay County in Xinjiang from July 2009 to June 2010. A survey for the knowledge about HIV infection and mother-to-child transmission of the pregnant women was also performed.

METHODS

Study Design and Recruitment

The original goal of this project was to provide free HIV screening for pregnant women in Burqin County and Jeminay County in Xinjiang, China, as a humanitarian effort sponsored by a grant from the College of American Pathologist Foundation. This project was intended to promote the concept of universal HIV screening for pregnant women in economically underdeveloped areas and to help prevention of mother-to-child transmission of HIV. Burqin County and Jeminay County were chosen as the location for this project because they are two relatively poor counties in Xinjiang. Any pregnant woman living in these areas was eligible for receiving free HIV screening, as long as she was clinically proven to be

pregnant. Participants were recruited during their visits to local women health centers for routine prenatal examination, as well as during the local Red Cross workers' visits to remote residential areas of farmers. The HIV screening test was voluntary and followed all the local regulations. Before the test, all the pregnant women received written information provided in both Chinese and Kazakh languages, because many pregnant women in this area of Xinjiang are Kazakh. The information explained HIV infection, described ways to reduce mother-to-child transmission of HIV, and interpreted the meanings of positive and negative test results. The women were offered opportunities to ask questions and to decline testing. All participants signed consent forms which were provided in both Chinese and Kazakh languages.

HIV Screening Test

HIV screening test was performed by using Determine® HIV-1/2 test kit (Inverness Medical Japan Co., Ltd., Tokyo, Japan) and followed the instructions provided by the manufacturer. Determine® HIV-1/2 is one of the rapid HIV immunoassays approved by Chinese health authority to be used in China. In the test, 50 µl whole blood was collected by fingerstick and then applied to the sample pad, followed by adding a drop of chase buffer provided in the test kit. The result was read after 15 minutes. A red bar showing in the "patient window" indicated a positive result, and no bar indicated a negative result. The test was valid only if a red bar also showed up in the "control window". If a woman was tested positive in the first screening test, she would be retested with Determine® HIV-1/2 and another different type of screening test. Unless the repeated screening tests were both negative, a Western blot would be performed by a local qualified medical institution to confirm the diagnosis, according to "National Guideline for Detection of HIV/AIDS (2004 edition)" issued by Chinese Center for Disease Control and Prevention. Local mid-level medical workers in Burqin County and Jeminay County were trained to perform the HIV screening test. They were instructed to interpret the result with appropriate controls and use only the reagents before expiration date. Physicians from Xinjiang Medical University paid regular site visits to these two counties to inspect the screening process and make sure all the tests were performed appropriately. Screening tests were performed on-site, while the pregnant women were still waiting to know the result.

HIV Knowledge Survey

All pregnant women receiving HIV screening were also asked to voluntarily participate in a survey of knowledge about HIV infection and mother-to-child transmission. The survey asked some pregnant women's background information, such as age, ethnic group, profession, educational background and pregnancy history. It also contained twelve questions about general knowledge of HIV infection and mother-to-child transmission. Questions about how they obtain knowledge about HIV infection were also included in this survey. The survey form was provided in both Chinese and Kazakh languages. Local medical workers were trained to conduct the survey and give explanations for each question. All the pregnant women were consented for the survey, with the consent forms provided in both Chinese and Kazakh languages. The participants were informed that the survey was anonymous and their answers were confidential.

Ethical Issues

This study conformed to the Helsinki declaration and was approved by the University and Medical Center Institutional Review Board of East Carolina University. All the local regulations were followed in this study.

Statistical Analysis of the Survey Results

The survey data were analyzed by using SAS version 9 software. Descriptive statistics included means and frequencies. For each of the main factors (ethnic group, age, profession, educational background, and pregnancy history), one-way analysis of variance (ANOVA) was used to detect the differences among group means of HIV knowledge. The ANOVA analysis was then repeated with all five factors included simultaneously. The association among the main factors was analyzed by using a chi-square test. Comparison of information sources for HIV infection by different ethnic groups was also conducted by using a chi-square test. All tests were at a significance level $\alpha = 0.05$.

RESULTS

HIV Screening of Pregnant Women in Burqin County and Jeminay County, Xinjiang, China

From July 2009 to June 2010, 890 pregnant women in Burqin County and Jeminay County of Xinjiang, China,

received free HIV screening by using Determine® HIV-1/2 test kit. It was estimated that about 60% of all pregnant women in this area were tested in this study [14]. The results showed that all the 890 tested pregnant women were negative for HIV infection. All the pregnant women were tested negative in their first screening test, and no repeated screening tests were performed. Based on data collected from 865 valid survey forms, the demographics of the participating women were listed in Table 1. It was noted that 67.6% of these women were Kazakh, 40.9% were farmers and 15.4% had a college educational background.

Knowledge About HIV Infection and Mother-to-Child Transmission of the Pregnant Women

All the pregnant women who received HIV screening were also asked to participate in a survey for their knowledge about HIV infection and mother-to-child transmission. After some survey forms with incomplete data were eliminated, 865 valid survey forms were collected and statistically analyzed. The questionnaire contained twelve questions which are listed in Table 2, along with the survey results. The rates of correct answers to survey questions vary from 17.4% to 74.6%. Most women correctly answered the questions about commonly known HIV transmission pathways, such as sharing needles with AIDS patients (71.4%) or transfusion with blood contaminated with HIV

Table 1. 865 Pregnant Women Receiving HIV Screening and their Average Scores in HIV Knowledge Survey

Groups	Number of Person	Percentage (%)	HIV Knowledge Survey Result		
			Average Score*	F	P
Ethnic group				21.03	<0.000
Han	204	23.6	56.3		
Kazakh	585	67.6	44.3		
Other ethnic groups	76	8.80	48.9		
Age				5.29	0.005
<20	38	4.40	43.2		
21-29	567	65.5	49.4		
>30	260	30.1	44.2		
Profession				6.55	0.000
Government employee	102	11.8	55.6		
Service business	139	16.1	47.7		
Agriculture	354	40.9	44.4		
Housewife	270	31.2	48.6		
Educational background				9.08	<0.000
College	133	15.4	53.8		
High school	160	18.5	52.4		
Junior High School	490	56.6	45.2		
Primary School	82	9.50	42.0		
Pregnancy history				2.20	0.111
First time	545	63.0	48.7		
Second time	297	34.3	45.3		
More than third time	23	2.70	50.0		

*The score is the percentage of correct answers in the HIV knowledge survey. One-way analysis of variance (ANOVA) was used to detect differences of the average scores among groups of each main factor (ethnic group, age, profession, education background, and pregnancy history).

(70.3%), but only a small portion of them understood that HIV can not be transmitted though dining with HIV positive patients (23.6%) or though mosquito bite (22.2%). Questions related with mother-to-child transmission of HIV also received lower percentage of correct answers. Based on the local conditions, such as the availability of appropriate breastmilk substitutes and health care, local health authorities recommended the HIV-infected mothers not to breastfeed their babies, but in our survey only 17.4% pregnant women thought that an HIV-infected mother should not perform breastfeeding.

The difference among the knowledge levels of different groups of pregnant women was also analyzed. At first, one-way analysis of variance (ANOVA) was used to detect the differences among group means of HIV knowledge for each of the main factors, including ethnic group, age, profession, educational background, and pregnancy history (Table 1). The results showed that women with different ethnic backgrounds, ages, professions and educational levels had difference in their HIV knowledge (statistically significant, $P < 0.05$). No statistically significant difference was observed among women with different pregnancy histories (Table 1). However, further analysis of the data showed that the majority of the main factors (ethnic group, age, profession, educational background, and pregnancy history) were associated with each other, except between age and educational background (Table 3). In order to identify the real contribution of each factor to the difference in HIV knowledge, the ANOVA analysis was repeated with all five factors included simultaneously (Table 4). It was found that with all the factors considered, the pregnant women of different ethnic groups, ages and educational backgrounds still had significant difference in their HIV knowledge, but profession did not contribute additionally to the difference in HIV knowledge of pregnant women given their ethnic group, age and educational background (Table 4). Women with different pregnancy histories still showed no difference in HIV knowledge in this repeated ANOVA test (Table 4).

How these Pregnant Women Get their Knowledge About HIV Infection?

In order to know how the pregnant women obtained their knowledge about HIV, multiple questions were also included in the survey (Table 5). The data showed that television was the most popular way for obtaining HIV knowledge (75.1% of the surveyed women had the experience of receiving HIV knowledge through television), followed by reading material (70.5%), radio (63.8%), and hospital visit or school education (61.3%). AIDS Awareness Day was an activity organized by the local government each year to promote the awareness of HIV, but only 48.8% women learned about HIV through this activity. Regarding the different ethnic groups, it was found that Kazakh women use television, radio and AIDS awareness day to obtain HIV knowledge more than the other ethnic groups (Table 5). There was no statistically significant difference among the different ethnic groups regarding using reading material and hospital visit to obtain HIV knowledge (Table 5).

DISCUSSION

In this study, HIV screening for pregnant women was performed in Burqin County and Jeminay County in Xinjiang Uyghur Autonomous Region, China. These two counties are located near the northwestern border of China, about several hundreds miles away from the Region's capital city Urumqi. The residents in this area are composed of mixed ethnic groups, including Kazakh, Han and others. HIV infection rate has been reported to be low in the general population in this area. Until 2009, only two cases of HIV infection, including one HIV related death, had been identified in Burqin County, and none in Jeminay County [14]. No mother-to-child transmission of HIV has been reported in these two counties. The HIV screening performed in this study was the first time the status of HIV infection among pregnant women had been investigated in this area. The 890 pregnant women participating in this study were estimated to represent about 60% of pregnant women in this area [14]. Because the original goal of this project was

Table 2. Survey Results of HIV Knowledge

Survey Questions	Number of Persons with Correct Answer (Out of 865)	%
What are the major transmission pathways of HIV?	645	74.6
Can you get infected with HIV by sharing needles with AIDS patients?	618	71.4
Can you get infected with HIV through transfusion with blood contaminated with HIV?	608	70.3
Can an HIV-infected mother transmit HIV to her baby through delivery?	498	57.6
Can you get infected with HIV though extramarital heterosexual intercourse?	482	55.7
Can use of condoms prevent HIV infection if they are used properly?	462	53.4
Can a healthy looking person be an HIV carrier?	404	46.7
Can an HIV-infected mother transmit HIV to her baby through breast-feeding?	398	46.0
When did China's "AIDS Prevention and Control Act" start to be enforced?	267	30.9
Can you get infected with HIV through dining with HIV-positive patients?	208	24.1
Can HIV be transmitted through mosquito bite?	196	22.7
Is it appropriate for an HIV-infected mother to breast feed her baby?*	150	17.4

*Because appropriate breast milk substitutes and reasonable health care are available and affordable for most women in this area, local health authority recommended HIV-infected mothers not to breast feed their babies, so that the "correct" answer of this question was "No" in this survey.

to provide free HIV screen as a humanitarian effort and to include as many pregnant women in this area as possible, bias in participant selection could not be entirely avoided. Many pregnant women were recruited during their visits to local women health centers for routine prenatal examination, and this group of women probably tended to include more people living in the town area or with better economic conditions. At the same time, local Red Cross workers also visited remote residential areas to provide HIV tests for pregnant women, which helped to include more farmers and other lower income women into the tested population. Per demographics of the participants (Table 1), 67.6% of the tested women were Kazakh, which is consistent with the ethnic group distribution in this area, but the percentage of farmers among the tested women (40.9%) was lower than the reported 51% agriculture population in this area [15]. The percentage of women with college educational background (15.4%) also appeared to be higher than that in the general population in Xinjiang (7.9% in 2005) [16].

Table 3. Chi-Square Tests of Association Among Factors

X ² (DF) P	Age	Profession	Educational Background	Pregnancy History
Ethnic Group	22.96 (4) 0.000	88.15 (6) <0.000	72.65 (6) <0.000	21.21 (4) 0.000
Age		22.76 (6) 0.001	9.89 (6) 0.129	213.1 (4) <0.000
Profession			367.5 (9) <0.000	15.81 (6) 0.015
Educational background				16.21* (6) 0.013

Note: DF: degrees of freedom.
*25% of the cells have expected counts less than 5. Chi-Square may not be a valid test.

All the 890 pregnant women were tested negative for HIV in this study, which suggested that HIV infection had not become a significant problem in pregnant women of this area. Many other areas of Xinjiang obviously have higher positive rate among pregnant women. For example, the positive HIV antibody testing rate among pregnant women in Yining City, Xinjiang rose continually between 1997 and 2008, remaining above 1% after 2003 [1]. The low positive rate among pregnant women in this area is not entirely unexpected, since these two counties are located in remote areas of China, and people living here traditionally have a

conservative life style. Many residents live in remote farms and have limited contact with people from areas with high incidence of HIV infection. These factors may contribute to the low HIV infection rate at this area, as well as among pregnant women. The result of this study brought some good news to HIV control and prevention in this area, at least at this moment. However, with the economic development of recent years, especially with a fast growth of tourist business in Burqin County, the situation may change anytime. In Xinjiang Uyghur Autonomous Region's capital city Urumqi, universal HIV screening for pregnant women has started to be enforced within the city, and will be extended into its suburb areas in the near future [17]. However, such practice was not available for most pregnant women in Burqin and Jeminay Counties until this project was done.

Table 4. Analysis of Variance with All Five Factors

Factor	DF	F	P
Ethnic group	2	15.89	<0.000
Age	2	3.03	0.049
Profession	3	1.64	0.178
Educational background	3	4.96	0.002
Pregnancy history	2	0.82	0.443

Note: Analysis of variance (ANOVA) with all five factors included simultaneously is performed to detect differences among group means of HIV knowledge. DF: degrees of freedom.

Education for the prevention and treatment of HIV infection is currently one of the most important parts of the local government's effort to control the growth of HIV infection in this area. Our survey results showed that many women were familiar with the most common transmission pathways of HIV, such as sharing needles among drug abusers. This is consistent with the fact that sharing needles among drug abusers was the first major HIV transmission pathway identified in Xinjiang, and most local residents have been educated about it during the past years. Our survey also showed many women could not correctly answer some survey questions related with mother-to-child transmission of HIV (Table 2). The uncertainty about mother-to-child transmission of HIV was also seen in some similar studies performed for Chinese pregnant women [18,19]. It is noted that some surveys performed in Hong Kong, Indian or Papua New Guinea showed better knowledge of mother-to-child transmission among pregnant women [20-22], but it should be cautious to compare these results directly because of

Table 5. Comparison of Information Sources for HIV Infection by Different Ethnic Groups

Source of Information	Ethnic Groups				X ²	P
	Han (204)	Kazakh (585)	Others (76)	Total (865)		
Television	149 (73.0%)	455 (77.8%)	46 (60.5%)	650 (75.1%)	11.35	0.003
Reading Material	148 (72.5%)	417 (71.3%)	45 (59.2%)	610 (70.5%)	5.24	0.073
Radio	102 (50.0%)	414 (70.8%)	36 (47.4%)	552 (63.8%)	38.02	<0.000
School or Hospital Visit	119 (58.3%)	372 (63.6%)	39 (51.3%)	530 (61.3%)	5.24	0.073
AIDS Awareness Day	83 (40.7%)	312 (53.3%)	27 (35.5%)	422 (48.8%)	15.55	0.000

probable different settings in these surveys. In our survey, we also found women with multiple pregnancy histories did not show better HIV knowledge than the first-time pregnant women, although they had more chances to interact with health workers during their clinic visits (Table 1). If local health workers can take the full opportunity to educate the pregnant women about HIV knowledge during their clinic visits, this situation probably can be improved in the future.

In summary, in spite of the limit in the recruitment of participants discussed earlier, this study is the first report about the status of HIV infection in pregnant women in this remote area of China. The incidence of HIV infection among pregnant women in this area was still low, but at the same time the local pregnant women also showed limited knowledge about mother-to-child transmission of HIV. Additional efforts to improve the awareness about mother-to-child transmission of HIV and to prevent women becoming infected with HIV, especially during pregnancy and breast feeding, will help to keep the low prevalence of HIV infection among pregnant women in this remote area of China.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

HH, YPS, and KH contributed to study concept and design. YPS provided local supervision for this project in Xinjiang, China. JU, ZG, YH, YF, XQ, PX, JB, MYH, and LY contributed to data collection and analysis. YPS and QW were responsible for the statistical analysis. All authors approved the current version of the manuscript.

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