Clan-involved approaches to increasing antenatal care use in a rural minority area of China: implementation research

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ABSTRACT

Aim: This study aimed to test a model which involved clans and health providers to increase antenatal care attendance in rural minority areas of China with high HIV prevalence.

Methods: Formative research was conducted to determine barriers and facilitators to antenatal care use. A strategy involving clans in addressing the barriers identified was developed. Implementation of the new strategy was done through three plan-do-study-act (PDSA) cycles, lasting four months each.

Results: Awareness and uptake of antenatal care increased significantly after the intervention. The proportion of post-partum women who used any antenatal care increased from 21.3% to 64.5% (p < 0.001), and the proportion who knew that antenatal care is necessary increased from 77.8% to 89.8% (p < 0.001). The proportion of pregnant women who attended antenatal care (p < 0.001) and the proportion of pregnant women who went for a first antenatal care visit in early pregnancy (p < 0.001) all showed increasing trends during the study period.

Conclusion: Involving clans in antenatal care programmes in rural minority areas of China had an impact on antenatal care use. A quality improvement approach incorporating PDSA cycles can help local health authorities make context-specific, evidence-informed decisions to improve uptake of health services.

INTRODUCTION

Mother-to-child transmission (MTCT) is one of the main transmission routes of HIV, but the probability of MTCT can be dramatically reduced with comprehensive interventions. The World Health Organization (WHO) recommends that lifelong antiretroviral therapy (ART) should be initiated in all pregnant and breastfeeding women living with HIV regardless of WHO clinical stage and at any CD4 cell count and continued lifelong for their own health and to prevent MTCT, and antiretroviral (ARV) prophylaxis should be provided for their infants (1).

China’s efforts to prevent MTCT are increasing steadily and have achieved relatively good results (2,3). However, in some remote, poor areas, especially ethnic minority regions, the situation is suboptimal. A typical example is Liangshan Yi Autonomous Prefecture (Liangshan hereafter) in Sichuan Province. Located along one of the major drug trafficking routes from the ‘Golden Triangle’, Liangshan has had one of the highest prevalences of HIV in China in the

Key notes

- Motivating pregnant women to attend antenatal care is a challenge in some rural areas of China.
- A new strategy of involving clans in addressing barriers to antenatal care use was developed and tested through phases of a plan-do-study-act cycle.
- The proportions of pregnant women who used antenatal care, who attended antenatal care in the first trimester, and who knew that antenatal care is necessary all increased significantly.

Abbreviations

ANC, Antenatal care; ART, Antiretroviral therapy; EBF, Exclusive breastfeeding; IEC, Information, education and communication; MTCT, Mother-to-child transmission of HIV; PDSA, Plan-do-study-act; PMTCT, Prevention of mother-to-child transmission of HIV; QI, Quality improvement; WHO, World Health Organization.
past few years (4–7). MTCT has also emerged as a public health problem in Liangshan (8,9). A study conducted in 2011 showed that the prevalence of HIV among women of childbearing age was 3.83% (9). From 2008 to August 2012, 877 HIV-positive results were reported among premarital check-up and pregnant women (10).

A prevention of MTCT (PMTCT) programme has been carried out in Liangshan since 2009. However, implementation is not optimal. Coverage, especially for HIV testing of pregnant women, is still low; only 75.5% on average in 2012 (10). Local government has equipped clinics in every town with HIV testing supplies and trained health practitioners. In some counties like Zhaojue, antenatal care services and hospital delivery were free and pregnant women would receive a financial payment of 1000 RMB (about 155 U.S. dollars) if they attended all recommended five antenatal care visits. However, a considerable number of women of the Yi ethnic group, the dominant group in Liangshan, do not seek antenatal care (ANC) during pregnancy due to cultural practices. As most women who attend ANC will be tested for HIV as per local policy, identifying pregnant women and motivating them to attend ANC and be tested for HIV during pregnancy has been identified as a challenge in Liangshan.

To address the low use of ANC, this project developed and tested a new strategy which underlines the role of clans in promoting ANC to also increase coverage of the PMTCT programme.

A clan (‘Jiazhi’ in Yi) is a group of families who are related to each other, like an enlarged family whose members are connected by blood relations. Clan plays an important role in Yi residents’ daily life. Almost all aspects are managed by the clan, such as culture, economy, customs and religion. The behaviours of local residents are meant to obey the rule of the clan, and in turn, it provides strong support to its members. However, healthcare service and insurance coverage for antenatal care and hospital delivery are provided mainly through the government system. In Liangshan, most village heads are also clan leaders. Despite the importance of clans in people’s lives, health services have not taken them into account when designing programmes. Some clans in Liangshan have realised the problem of AIDS and became involved in addressing their members’ risk behaviours, promoting HIV testing and providing support to members affected by AIDS (11). However, the clans have not been mobilised for the promotion of ANC and PMTCT in Liangshan, especially, where clan leaders are not village heads.

Local Yi residents have open sexual attitudes but do not discuss sex and reproductive health in public. Living in a poor, minority area, many Yi women in Liangshan are illiterate, and only speak their local dialect, Yi (12,13). This poses a challenge for providing health education and developing health messages for reproductive and maternal health because most education materials use text rather than illustrations and are written in Mandarin. Reasons for not attending ANC had not been studied nor had the possibility of working with the clan to improve maternal health. Some clans have been involved with HIV prevention programmes (11). However, we did not know if other clans would like to be involved with ANC and what concerns they could have.

The project aimed to understand, in the contemporary social infrastructure of the Yi communities, how clans can be involved to improve utilization of ANC, thereby increasing the uptake of PMTCT in an ethnic minority area and to determine the most effective implementation strategies to increase ANC use in a rural area of China with a minority population. Specific objectives included (i) to identify implementation barriers and facilitators of utilization of ANC and HIV testing; (ii) to develop and assess a new strategy involving clans as part of ANC and in HIV testing.

STUDY CONCEPTUAL FRAMEWORK
The concept of developing a strategy to involve clans in ANC was guided by various social theories: social cognitive theory, which describes a dynamic, ongoing process in which personal and environmental factors and human behaviour exert influence upon each other; diffusion of innovations theory which addresses how ideas, products and social practices that are perceived as ‘new’ spread throughout a society or from one society to another; communication theory which explores ‘who says what, in which channels, to whom, and with what effects’ and investigates how messages are created, transmitted, received and assimilated; and community organisation and other participatory models which emphasise community-driven approaches to assessing and solving health and social problems (14). In this strategy, clans serve as links between pregnant women and the ANC programme. A conceptual framework for the study is provided in Figure 1.

SETTING AND METHODS
Setting
The project was implemented in four villages in Zhaojue County, Liangshan. Zhaojue County has 47 townships and 270 villages, with a population of 308 300. The Yi ethnic group accounts for 97.8% of the population. In 2014, the Gross Domestic Product (GDP) was 2.38 billion RMB (about 359.5 million U.S. dollars), rural and urban resident income were 19 858 RMB (about 3055 U.S. dollars) and 5611 RMB (about 863 U.S. dollars), respectively. Zhaojue has one of the highest cumulative numbers of HIV/AIDS cases in China. In 2012, the maternal mortality ratio and the neonatal death rate were 60.09 per 100 000 live births and 9.31 per 1000 live births, respectively. In 2012, only 42.9% of pregnant women attended ANC and 40.6% gave birth in hospitals. Among those who gave birth at home, the proportion of women who received HIV testing was estimated at only 28% (unpublished data from the County Center for Maternal and Child Care, 2013). We purposively selected two townships that have large populations and hospitals that provide ANC. We divided the villages within these two townships into two layers based on the distance between the villages and the township hospital. One village
within close proximity (less than 5 km) to the hospital and one farther away (more than 10 km) were randomly selected from each township.

**Study design**

This study was conducted in two stages. The first phase of the study was exploratory and used qualitative methods. The second phase was based on a quality improvement (QI) approach called the model for improvement, incorporating plan-do-study-act (PDSA) cycles, starting with small-scale tests (15). The PDSA model advocates the formation of a hypothesis for improvement (Plan), a study protocol with collection of data (Do), analysis and interpretation of the results (Study) and iteration on what to do next (Act) (16). Baseline and evaluation surveys were conducted using cluster sampling to capture the impact of implementation.

An iterative PDSA process of three cycles was planned to develop the best strategy to involve clans in addressing the barriers to ANC and to improve the quality of ANC services, thereby increasing the uptake of the PMTCT programme. Figure 2 illustrates the PDSA cycle and the different phases of the study.

**Formative research**

We conducted formative research using qualitative methods to explore barriers to and facilitators of utilization of ANC for the PMTCT programme. The results of the formative research were used to develop the strategy. The participants in qualitative research included health providers, young women, young women’s husbands and leaders of the clans. In-depth interviews were conducted with a total of 40 young women, 20 husbands, 20 clan leaders and 20 health providers. Also, eight focus group discussions were convened with the same groups, two each.

Participants were selected from a purposive sample. A screening procedure was adopted which asked potential interviewees their age, residence and occupation to ensure they met the criteria for participation in the discussions described above. The interviews and discussions (up to two hours) were guided by open-ended questions and conducted by trained interviewers. All in-depth interviews and focus group discussions were tape-recorded and transcribed verbatim. To ensure privacy and anonymity, the interviews were conducted at a ‘neutral’ location, such as a hotel conference room or a private place the participants preferred. A gift worth 20 RMB (U.S.$3) was provided to each participant.
The information collected through formative research included knowledge of HIV/AIDS, knowledge of PMTCT programme; procedure for HIV testing (from both provider and client perspectives); barriers to and facilitators of using or providing ANC and HIV testing for pregnant women; the clan’s potential role in ANC; and proposals for a feasible strategy for the clan to be involved in PMTCT.

Baseline and endline surveys
A baseline survey was conducted in the four selected villages in December 2014. All eligible women in the villages were invited to participate. Inclusion criteria included (i) female; (ii) aged between 18 and 49; (iii) history of pregnancy in the last five years; and (iv) resided in Zhaojue County for at least six months. The questionnaire was designed based on the literature review and experts’ suggestions, which included demographic characteristics; history of pregnancy and ANC use; factors influencing the uptake of ANC, such as ANC-related knowledge; intention to use ANC; facilitators of and barriers to ANC uptake; needs for ANC; and knowledge and perception of AIDS. A total of 547 women meeting the eligibility criteria were interviewed. The same survey was conducted in the same villages as the baseline survey in August 2016. A total of 563 women with a history of pregnancy in the last five years were interviewed face to face.

Midterm review
A midterm review was conducted in January 2016, using qualitative and quantitative methods. The qualitative methods included in-depth interviews with five pregnant women who attended ANC services and five women who did not attend, three clan leaders and six health providers. A meeting with stakeholders, including health providers, clan leaders and women in villages, in each town was also held to discuss problems pregnant women had in accessing ANC; what changes have they seen since the programme started; what can be done by community, clan leaders and health providers; how to improve the intervention; major challenges in this study and possible solutions; clans’ role in promoting ANC; suggestions and recommendations to improve the quality of this new study; and other issues. Reports of the PDSA, monthly operational reports of clan activities conducted and health facility reports on ANC use were also analysed.

Strategy of clan-involved promotion of ANC
Based on the findings of the formative research, the implementation strategy was designed by the research team after discussions with health providers, clan leaders, women in villages and their husbands, including (i) training of doctors in town hospitals to provide ANC services; (ii) mobile clinics to villages to provide ultrasound examinations for all pregnant women; (iii) training of village physicians in rapid pregnancy testing; (iv) training key persons, such as clan leaders and respected women, to provide education on ANC in the villages.

Implementation of the PDSA
Implementation included three PDSA cycles starting from April 2015; each cycle lasted for four months, ending in June 2016. In each cycle, there were four stages:
1 **Plan (a change):** A workshop was convened where stakeholders interacted with each other, discussed details of proposed activities and defined the steps for implementing the new strategy based on findings from the formative research or the previous cycle.

2 **Do (it in a small test):** During implementation, information was collected to assess how well the strategy was working, document problems and record any unexpected events or other observations, as well as data on the costs of labour, supplies, materials, etc. In addition, data on process indicators and short-term outcomes were collected monthly (Table 1). Data from both clans and health providers were matched to the individual information for each pregnant woman.

3 **Study (its effects):** In this stage, a steering group consisting of researchers and community members, such as leaders of clans and health providers, reviewed the data collected to determine how implementation was proceeding, whether improvements were achieved, and whether the aims were met. In addition, lessons learned were documented and discussed. Ultimately, the group was to consider the impact of the intervention and decide if it should be retained, refined or abandoned.

4 **Act (on the result):** By summarizing and communicating the lessons learned from the previous step, the group decided whether to implement the strategy on a larger scale, or modify or discard the original strategy and start over. Clans and health providers were each responsible for changes to the strategy on their side.

Based on the inputs received during the first PDSA cycle, three components were added to the implementation strategy to address the needs identified: (i) improving the health education sessions by addressing different topics, using health education materials suitable for illiterate audiences and multiple ways to deliver health education; (ii) incorporating education sessions with other clan activities and social events such as weddings, funerals and similar gatherings; (iii) using incentives to encourage village nurses to accompany pregnant women to ANC services. Changes in the intervention activities over the three PDSA cycles are summarised in Table 2.

### Data analysis

All the focus group discussions and in-depth interviews were tape-recorded and transcribed verbatim in both Yi and Mandarin. The texts were entered into Atlas.ti 5.0. Data were reviewed for main themes and coded for retrieval and analysis, then were approached using content analysis and organised in Atlas.ti 5.0. All texts were initially coded using *a priori* codes, and then data were coded again inductively based on findings. Matrices were created to help facilitate the comparison of text across different categories of informants.

We conducted descriptive analyses using SAS version 9.1.3 software (SAS Institute, Cary, North Carolina, USA) for monthly data on the amount of IEC materials distributed by clans, new pregnant women identified by clans, number of HIV testing and counselling referrals for pregnant women provided by clans, number of actual HIV tests and counselling sessions provided for pregnant women, etc. Statistical tests were conducted to find potential trends in

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**Table 1** Process indicators and short-term outcomes collected in the PDSA cycles

| Process indicators for each PDSA cycle | Health facilities | Clans |
|----------------------------------------|-------------------|-------|
| (1) Problems and difficulties encountered in current PDSA cycle | (1) Time and place | (1) Name, age, address and occupation |
| (2) Possible solutions for problems and difficulties | (2) Theme of the activity | (2) Date of pregnancy testing |
| (3) Suggestions for next PDSA cycle | (3) Type and number of participants, especially young women | (3) Result of pregnancy testing |

| Process indicators for each education activity | Health facilities | Clans |
|-----------------------------------------------|-------------------|-------|
| N/A                                           | (1) Name, age, marital status, address and occupation | (1) Name, age, address and occupation |

| Process indicators collected for each pregnant woman | Health facilities | Clans |
|------------------------------------------------------|-------------------|-------|
| (1) Name, age, address and occupation | (1) Number of ANC sessions provided | (1) Number of education activities convened |
| (2) Contact person in village | (2) Number of ANC clients referred by clans | (2) Total number of young women who participated in activities |
| (3) Date of pregnancy testing | (3) Number of pregnant women who gave birth | (3) Total number of education materials distributed |
| (4) Number of ANC visits | (4) Number of pregnant women who received HIV testing | (4) Number of identified pregnant women |
| (5) Results of HIV testing | (5) Number of pregnant women who received PMTCT interventions | (5) Number of pregnancies identified by clans using rapid pregnancy testing |

| Short-term outcomes collected every month | Health facilities | Clans |
|------------------------------------------|-------------------|-------|
| (1) Name, age, marital status, address and occupation | (1) Number of education activities convened | (1) Number of education activities convened |
| (2) Contact person in village | (2) Total number of young women who participated in activities | (2) Total number of young women who participated in activities |
| (3) Date of pregnancy testing | (3) Number of pregnant women who gave birth | (3) Total number of education materials distributed |
| (4) Number of ANC visits | (4) Number of pregnant women who received HIV testing | (4) Number of identified pregnant women |
| (5) Results of HIV testing | (5) Number of pregnant women who gave birth | (5) Number of pregnancies identified by clans using rapid pregnancy testing |
| (6) Number of pregnant women identified as HIV-positive | (6) Number of pregnant women who gave birth | (6) Number of pregnant women who gave birth |
| (7) Number of HIV-positive women who received PMTCT interventions | | |
numbers or proportions. Survey data from baseline and evaluation were also analysed and compared.

**Ethical considerations**
The protocol was approved by the WHO Research Ethics Review Committee and the Ethics Review Committee at the Shandong University School of Public Health, consistent with agreements between the institutions.

### RESULTS

**Formative research**
The main findings from the formative research include the following: (i) Misinformation about HIV/AIDS still exists among women, husbands and clan leaders regarding how HIV is transmitted. Stigma and discrimination against HIV-infected persons exist; (ii) Respondents said that most women did not go to health facilities for childbirth and even fewer women attended ANC. However, women, husbands and clan leaders indicated that utilization of maternity care services increased slightly in the last year due to a policy linking hospital births with receiving birth certificates; (iii) Main barriers to ANC uptake reported included transportation (distance and cost), low levels of knowledge about the importance of ANC, a culture of giving birth at home, women too shy or afraid to be examined by doctors, no time to attend ANC, lack of trained personnel and supplies in township hospitals to provide ANC care; (iv) Main facilitators of ANC uptake identified include increased knowledge about ANC, support from the family to attend ANC, moral and emotional support from the clan to attend ANC, transportation fee covered by government, ANC services available in close proximity, availability of someone to accompany the pregnant woman to ANC clinics (family or village nurses); (v) Clan-involved ANC promotion was determined to be feasible. All participants believed that clans would like to be involved in ANC promotion and that uptake of ANC would increase with the clan’s involvement. Detailed findings of formative research are shown in Table 3.

**Trends of women’s ANC uptake during study period**
The numbers of pregnant women who attended ANC are shown in Figure 3. ANC attendance showed an increasing trend ($\chi^2 = 6.20$, $p = 0.007$) from July 2015 to June 2016 among newly pregnant women. The proportion of pregnant women who went for a first ANC visit in early pregnancy ($\chi^2 = 29.67$, $p < 0.001$) and the proportion of pregnant women who went for a first ANC visit in early pregnancy among those who used ANC ($\chi^2 = 43.28$, $p < 0.001$) also showed an increasing trend from December 2015 (Fig. 4).

**Comparison of baseline and final surveys**
Compared to the baseline, the results from the postintervention survey showed that awareness of ANC increased significantly. The proportion of women who knew that ANC is necessary during pregnancy increased from 77.8% to 89.8% ($p < 0.001$). More women (94.8%) said giving birth in hospital was necessary compared to the baseline (84.5%), with $p < 0.001$. Over 88% of respondents knew ANC visits and childbirth in hospitals were free of charge. However, the proportion of women who knew what services health workers provide in ANC did not change significantly ($p = 0.139$). There were also significant increases in women

### Table 2

| Strategies and activities of health facilities and clans in each cycle | Health facilities | Clans |
|---|---|---|
| **Cycle 1** | (1) Train physicians in township hospitals on ultrasound examination, standard ANC including HIV testing and detection of early pregnancy (2) County hospital provides mobile clinic, including HIV rapid testing, every two months (3) Train village nurses on detection of early pregnancy and accompanying pregnant women to township hospitals for ANC (4) Township hospitals develop and record profiles for each pregnant woman and inform village nurses to remind them to attend ANC (5) Record and report process of implementation | (1) Train clan leaders to provide education messages on ANC among male clan members, and train village nurses to provide education messages on ANC among young women (2) Village nurses made responsible to detect early pregnancy, remind pregnant women to attend ANC and accompany them, and collect data | (1) Improve quality of monthly progress reports (2) Village nurses help young women with pregnancy testing |
| **Cycle 2** | (1) Provide rapid pregnancy testing kits for clans (2) Guide and participate in clans’ education activities (3) Provide incentives, such as gifts and cash, to women who come to ANC | (1) Use simplified forms to collect data from all clans (2) Cover different topics in education sessions (3) Use information, education and communication (IEC) materials suitable for illiterate audiences (4) Use multiple ways to deliver education sessions (5) Clan leaders better oriented on the importance of ANC and how to be actively involved in ANC promotion | (1) Use simplified forms to collect data from all clans (2) Cover different topics in education sessions (3) Use information, education and communication (IEC) materials suitable for illiterate audiences (4) Use multiple ways to deliver education sessions (5) Clan leaders better oriented on the importance of ANC and how to be actively involved in ANC promotion |
who received ANC \((p < 0.001)\) and women who showed their intention to use ANC \((p = 0.004)\). Details of the comparison are shown in Table 4.

**Findings and lessons learned from implementation**

We also assessed the implementation process by interviewing stakeholders regarding the implementation of the intervention, especially, the strategy of health providers working together with clans to improve the quality of the ANC programme. Main findings included the following: (i) Starting from June 2015, education sessions were convened by clans every one or two months; (ii) Main topics of education sessions included knowledge of AIDS, knowledge of ANC, early detection of pregnancy, how to get to ANC; (iii) Facility records and respondents indicated an increase in ANC uptake among new pregnant women and an increase in those who attended within the first trimester; (iv) Clans were willing to be involved in the ANC programme with the help of health providers; (v) The mechanism of health providers working together with clans functioned well in this minority area; (vi) Respondents indicated that the involvement of the clan leaders has had an important role in promoting ANC; (vii) Problems identified in delivering the interventions included some clans still did not know the benefits of ANC and did not actively organise education activities; most clan leaders are male and it is not culturally acceptable for them to talk about pregnancy with women; education sessions were not attractive to younger women; clans have difficulties in completing monthly reports.

Lessons learned during this implementation research included the following: (i) Quality of data collection is important for the functioning of the PDSA cycle approach. Since many clan members had trouble filling out monthly reports, initially reports were delayed and of poor quality. We simplified the forms for data collection, and requirements and methods for reporting were adapted for clan leaders and illiterate populations. However, reporting remains a problem; (ii) Initially the ANC education sessions were every two months, topics covered in education sessions were all similar, and people gradually lost interest. To address this problem, a programme of different topics was organised, IEC materials suitable for illiterate

| Table 3 | Major findings from formative research |
|---------|----------------------------------------|
| Topic   | Women                                  | Husbands                                | Clan leaders                                      | Health providers                           |
| Uptake of ANC | Most women did not go to hospitals or clinics for ANC and delivery before the interventions, but currently more women, especially young women, are using ANC to check their babies’ health status and to obtain birth certificates | Many women still give birth at home because of a low level of knowledge and transportation difficulties. Some women gave birth in hospitals to obtain birth certificates | Most women, especially young women, knew that they needed to attend ANC when pregnant, except for those living in remote areas and those with low education levels. Birth certificates were an incentive to give birth in hospitals. Long distance between home and clinics; being too shy or afraid to be examined by doctors; afraid of being infected by other diseases | Uptake of ANC was low before, but increased recently. There are still women who live in remote areas who do not attend ANC and give birth at home. Most women who came for ANC were accompanied by village nurses |
| Barriers to ANC | Long distance between home and clinics; low levels of knowledge about the importance of ANC; a culture of giving birth at home; being too shy or afraid to be examined by doctors; afraid of being infected by other diseases | Long distance between home and clinics; no time to attend ANC | Support from the clan and family to attend ANC; health clinics close to village | Transportation constraints (distance and money); shyness; cultural constraints; low levels of knowledge about the importance of ANC; feeling healthy so no perceived need to attend ANC; lack of trained personnel and supplies in township hospitals to provide ANC care |
| Facilitators of ANC | Reliable doctors; knowing baby’s gender and health status; incentives for attending ANC; clean and safe hospitals; knowing changes to the body during and after pregnancy | Increased knowledge about ANC; support from the family to attend ANC | Clans can and would like to play an important role in promoting ANC; clan decision will be obeyed by most members; respected persons in clan can be motivated to promote ANC. Education can be conducted for men and women separately | Support from the clan and family to attend ANC; transportation fee covered by government; ANC services available in close proximity; availability of someone to accompany the pregnant woman to ANC clinics (family or village nurses) |
| Feasibility of clan involvement in ANC | Would like to attend ANC if clan promotes it, but male clan leaders may not be the best persons; older respected women in clans preferable | Male clan members are not the best choice; neighbours and friends can also support each other | Male clan members are not the best choice, but they can educate husbands; providing funding for clans to conduct education | None |

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audiences were developed, and multiple ways to deliver education sessions were used; (iii) The project provided funds to convene the education sessions, support which may not be sustainable. However, in the later stages of implementation, clans started to organise activities without this support; (iv) Clan leaders need to be well oriented on the importance of ANC to be actively involved in ANC promotion. Therefore, we focused on training clan leaders to understand that ANC attendance will benefit the future of their clans; (v) Most clan leaders are men, and it is not culturally acceptable for them to talk about pregnancy with women. We developed a new strategy of inviting respected old women to deliver education sessions, which was found to be acceptable during the qualitative evaluation; (vi) Hospital testing of HIV for pregnant women may incur negative impact on the families unaware of the risk of HIV infection and transmission, so protecting confidentiality of those who get tested for HIV is important; (vii) Local healthcare providers also played an important role in the intervention. For the sustainability of this PDSA cycle based project in rural minority areas, local health providers need to be involved.

**DISCUSSION**

This study introduced health education and service interventions at the community level and improvements to the quality of ANC services through PDSA cycles. Clan leaders were involved in the PDSA cycle and participated in the design and review to help guide the development of the intervention model. Clan leaders were also involved in health education interventions in the community. In our study, the intervention package showed a significant increase in the uptake of ANC services in this rural minority area of China. Comparing pre-intervention and postintervention responses on indicators of knowledge of importance of ANC, awareness of a policy on free services and the uptake of ANC, all significantly increased during the one-year period. In the villages where the programme was implemented, the number of pregnant women who attended ANC, and the number and proportion of pregnant women who attended the first ANC visit in early pregnancy also showed an increasing trend. The project provides an experience of applying PDSA cycles and involving the community in the health programme in rural minority areas. It is also a concrete example of ‘implementation science’ and may be applied in other areas in Liangshan.

The community, such as clans, plays an important role in people’s daily life and thus has the potential to influence uptake of ANC. The results of this study show that the theory-driven conceptual framework we developed was effective in this rural minority area of China. Although ANC is mainly implemented by the government system, it is possible for clans to actively participate in promoting the

**Table 4** Comparison of awareness and uptake of ANC between pre-intervention and postintervention surveys

|                                | Pre-intervention N (%) | Postintervention N (%) | p     |
|--------------------------------|------------------------|------------------------|-------|
| Is ANC necessary during pregnancy? |                         |                        |       |
| No or do not know               | 117 (22.2)             | 54 (10.2)              | <0.001|
| Yes                            | 410 (77.8)             | 473 (89.8)             |       |
| Is giving birth in hospitals necessary? |                         |                        |       |
| No or do not know               | 83 (15.5)              | 29 (5.2)               | <0.001|
| Yes                            | 451 (84.5)             | 528 (94.8)             |       |
| Know ANC and childbirth in hospital are free |                         |                        |       |
| No                             | 91 (17.0)              | 67 (11.9)              | 0.017 |
| Yes                            | 445 (83.0)             | 495 (88.1)             |       |
| Know what ANC includes         |                         |                        |       |
| No                             | 243 (45.2)             | 229 (40.7)             | 0.139 |
| Yes                            | 295 (54.8)             | 333 (59.3)             |       |
| Ever attended ANC              |                         |                        |       |
| No                             | 408 (78.7)             | 200 (35.5)             | <0.001|
| Yes                            | 130 (21.3)             | 363 (64.5)             |       |
| Intention to attend ANC in the next pregnancy |                         |                        |       |
| No                             | 29 (5.4)               | 12 (2.1)               | 0.004 |
| Yes                            | 504 (94.6)             | 550 (97.9)             |       |
use of ANC and in identifying pregnant women. Specifically, social cognitive theory (an interpersonal level theory) and theories of social networks and social support which explore the influence of social relationships on health decision-making and behaviour (community-level theories) played important roles in our new strategy. Other studies have shown that community-based interventions are effective in improving maternal and child health. For example, Bich and colleagues (17) conducted a quasi-experimental, pretest–posttest, nonequivalent control group study in Vietnam to test the effect of a community-based education model on fathers’ knowledge, attitudes and involvement in supporting exclusive breastfeeding (EBF). They found that compared to fathers in the control group, fathers in the intervention group had higher breastfeeding knowledge scores and higher scores reflecting more positive attitudes towards early initiation of breastfeeding and six months of EBF. Fathers in the intervention group were also more likely to report active involvement in supporting mothers to practise EBF during the antenatal and post-partum periods. Kumar and colleagues (18) assessed the effect on maternal health outcomes of a community-based behaviour change management intervention for essential newborn care leading to a reduction in neonatal mortality in India in a cluster-randomised controlled trial with one control and two intervention arms. They demonstrated that community-based strategies focused on prevention and care-seeking effectively complemented facility-based strategies towards improving maternal health, while synergizing with newborn care interventions. In our study, both clans and residents said that they accepted clan involvement in ANC services in formative research and the baseline survey.

Results from the evaluation also showed that this strategy was effective in increasing ANC uptake among newly pregnant women. This finding suggests that community-based interventions for ANC might be feasible and effective in other rural minority areas of China.

One of the big challenges facing the health community is how to take proven interventions and implement them in the real world. Research on health systems, such as implementation research, is crucial to meeting that challenge, providing a basis for the context-specific, evidence-informed decision-making needed to make what is possible in theory a reality in practice (17). Implementation research is the scientific inquiry into questions concerning implementation – the act of carrying an intention into effect, which in health research can be policies, programmes or individual practices. It seeks to understand and work within real-world conditions, rather than trying to control for these conditions or to remove their influence as causal effects (18). In our study, we used methods based on a QI approach, incorporating the PDSA cycles. In each cycle, strategies and activities adopted by clans and health providers were based on findings from formative research, the baseline survey or problems encountered in the previous cycle. Decisions for change were made by clans and health providers separately. By the end of the study, a clan-involved ANC programme suitable to the local context was developed and provided to decision-makers. Our study showed that a QI approach incorporating PDSA cycles is feasible and effective in maternal and child health in a rural minority area of China.

The limitations of this study should be acknowledged. Firstly, during the project time, there was a nationwide implementation of universal health insurance for rural residents, the new rural cooperative medical scheme, launched in 2010 and finished around 2014-2015, which could have influenced women’s care seeking. However, we believe this scheme had little impact on our study results as a different local policy stipulating free antenatal care services had already been introduced in the study area before the start of the study, but the uptake of ANC was still low. Secondly, number of pregnancy during the study period was small, we did not have enough power to detect if there was an increasing trend of uptake of ANC. However, we did find significant difference in uptake of ANC between pre-intervention and postintervention surveys. In addition, the proportion of pregnant women who went for a first ANC visit in early pregnancy among those who used ANC showed a significant increasing trend.

CONCLUSION
We showed that involving clans in ANC programmes in rural minority areas of China had an impact on ANC use. In addition, a QI approach incorporating plan-do-study-act cycles can help local health authorities make context-specific, evidence-informed decisions to improve uptake of health services. Challenges such as data collection and understanding of implementation research remain.

CONFLICT OF INTEREST
All authors declare that there are no financial and other conflict of interests. Technical coordination and support were provided by the Department of Maternal, Newborn, Child and Adolescent Health, WHO, Geneva.

DISCLAIMER
Anayda Portela and Nigel Rollins are staff members of the World Health Organization. The authors alone are responsible for the views expressed in this publication and they do not necessarily represent the views, decisions or policies of the World Health Organization.

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