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Training and financial intervention for encouraging maternal health service utilization

Results of cluster randomized trials in Shaanxi Province

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Abstract

Background: The rising maternal and child healthcare costs and the lack of training and educational resources for healthcare workers have reduced service quality in primary health centers of China. We sought to compare strategies promoting healthcare service utilization in rural western China.

Method: A randomized community trial was carried out in Zhen'an country between 2007 and 2009. Two cross-sectional surveys were conducted to compare the outcomes of financial subsidy for pregnant women seeking antenatal care and clinical training provided to healthcare workers by difference-in-difference estimation.

Results: In all, 1113 women completed the questionnaires. The proportion of postnatal visits increased three times in the training group, reaching 35.7%. The number of women who received advice from their doctors regarding nutrition and warning signs necessitating immediate medical attention also improved significantly (5.8% and 8.2%, respectively). Furthermore, the percentage of women who underwent blood tests increased significantly to 19.5% in the training group. Compared to the financial group, the training group had more women who breastfed for longer than 4 months (15.8%) and provided timely complementary feeding (8.9%).

Conclusion: The training intervention appeared to have improved prenatal care utilization. Essential obstetric training helped enhance knowledge and self-efficacy among healthcare workers.

Abbreviations: D-in-D = difference-in-differences, MCH = maternal and child health, NCMS = new cooperative medical system, PPS = probability proportionate to size.

Keywords: community-based cluster randomized trials, financial intervention, in-service training intervention, maternity and child health

1. Introduction

Since 1980, China has undergone rapid economic development during its transition from a command economy to a market economy, while creating new opportunities and challenges for itself as the world's most populous nation.[1] In general, the maternal and child health (MCH) status of China has improved significantly since 1980. A 2005 survey showed increases in the following factors in 45 counties from 10 Chinese provinces: the proportion of women who received prenatal care, the number of women who had more than four prenatal visits, number of women who had their 1st prenatal visit, and rate of hospital delivery.[2] However, due to factors such as culture and geography, China's economic development has not been paralleled by an improvement in MCH.[3] Healthcare needs of both urban and rural populations have declined, but expenditure for health services has increased.[4] Retrospective surveys have shown that out-of-pocket, fee-for-service maternity care payments continue to hamper the utilization of antenatal care and rate of hospital delivery in central China.[5,6]

Due to the rapid increase in healthcare service costs, the demand for healthcare, particularly in rural China, has not matched the increase in household income levels over the past 2 decades.[7,8] In fact, in some of the poorest counties, only 10% to 30% of the township healthcare staff comprises medical school graduates, who often lack MCH training.[9] Furthermore, the national maternal and child mortality surveillance data indicate poor coverage of MCH care services and poor quality of services provided as the leading factors contributing to maternal mortality in China.[10] Other studies indicate that the MCH services available in the most rural and poorest areas of China are not adequately used by the very women who require such services; in fact, many women avoid seeking medical advice during pregnancy.[9] An important reason for

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this lack of prenatal care visits was that the women considered it unnecessary.[11,12] Other reasons implicated are the lack of affordability, poor quality of services provided, and lack of awareness of potential health risks due to the low education levels in poverty-stricken areas.[13–15] Additionally, the deterioration of the economic situation among the rural population and problems related to accessibility, time, and transport further restrict the utilization of healthcare resources among rural women.[5]

Various interventional strategies have been implemented toward improving maternal healthcare in different areas. These projects focus on training for leadership, and rural health practitioners have shown a positive response to public health programs,[16,17] including controlling the increase in the rate of cesarean delivery.[18,19] Health and nutrition education interventions applied in low- and mid-income countries during the prenatal and postnatal periods encourage women to adopt healthier practices,[20] thereby reducing the number of high-risk births and preventing maternal and child mortality.[20,21]

This study was aimed at identifying strategies for strengthening and improving the performance of the healthcare system in rural western China, with a view to improve the overall MCH. To this end, we compared 2 different intervention models in this study, to inform future research.

2. Methods

2.1. Ethical approval

The survey obtained an ethical approval of the International Centre for Reproductive Health at the Ghent University, Belgium, and a local approval was obtained from the Ethics Committee of Xi'an Jiaotong University. All participants provided written, informed consent prior to study participation.

This study was conducted in Zhen'an County, in northwest China's Shaanxi province. With an average per capita income of <2700 Yuan, this region is representative of poor, rural regions in China (397.62 USD)[22] in terms of national per capita net income rankings. The major industry in this region is farming and agriculture.

We carried out community-based cluster randomized trials in this county. Matched clusters of 2 townships were established using various criteria, such as population size and distance. Within the clusters, the townships were randomly allocated into 2 intervention groups. The sample size was calculated as follows: for a 15% change in the proportion of women having adequate prenatal visit (more than 5 times) and a 1st visit within 3 months ($a=0.05$, $1-\beta=0.8$), the minimum number of women required in each group (without cluster effect) was 235.

2.2. Description of intervention

In 1 group of townships, financial intervention was implemented. The intervention was aimed at encouraging the systematic use of prenatal care by offering the women a partial deduction in the fees for prenatal visits and laboratory fees (Table 1). The deductions in the antenatal visit fees mentioned were offered when they paid the charges for the antenatal care visit at the primary health centers. Once the intervention was initiated, the women visiting township hospitals for antenatal care were informed on the deductions by the maternal and healthcare staff. Additionally, doctors also disseminated this information to newly married couples.

Table 1

Fee and intent of antenatal care for which reimbursement will be made.

Item	Frequency	Fee, RMB
Antenatal care	5	20
Blood routine inspection	1	5
Urine routine	1	5
Beta ultrasonic inspection	1	20
Total		50

In the other group of townships, clinical training was provided for the doctors and healthcare workers. Training for the healthcare staff, including doctors, midwives, and other maternal healthcare staff of the township, was focused on imparting clinical skills and record-keeping methods useful for the management of pregnant women. Three training sessions were held in Zhen'an during October 12 to 15, 2007; June 21 to 22, 2008; and October 11to 12, 2008. Teachers and doctors from the University Second Affiliated Hospital were invited as trainers and obstetricians, and MCH workers from the selected townships participated in the training. Additionally, tests were conducted before and after the 1st and 3rd training sessions.

2.3. Monitoring

Every month, the research team monitored the implementation of the interventions. In the financial intervention group, the subsidy-registered table was checked to determine how many women received the payment reduction. In the training group, antenatal care was monitored at the township hospital. Moreover, the investigators held discussions with the MCH staff regarding the training content they required in the forthcoming sessions. The monitoring reports were presented to the project staff as quarterly feedback.

2.4. Population and eligibility criteria

Two population-based, cross-sectional surveys were conducted in Shaanxi province in late March 2007 (before the intervention) and between December 2008 and March 2009 (after the intervention) as a part of the CHIMACA project (to assess the structural hindrances and promoters of quality maternal care in rural China). The survey included all the townships in the county. One-third of the villages in the townships were randomly selected to calculate the sample size; target villages were then selected for the study by using the probability proportionate to size (PPS) sampling method. The target survey population consisted of women residing in the selected villages who had given birth between January 1 and December 31, 2006, or between April 1, 2008 and March 31, 2009.

For both surveys, PhD students and medical students were recruited to conduct personal interviews and collect data. Before the survey, the doctors and MCH staff at the primary health centers recruited women who met the study criteria, via telephonic interviews or home visits. Subsequently, trained researchers and PhD/medical students administered a structured questionnaire to the women who agreed to participate in the study, either at home or in a public place. The questionnaire covered various domains including the women's demographic and socioeconomic backgrounds, history of pregnancy, and the

utilization of and expenditures on maternal healthcare during recent pregnancies.

2.5. Statistical analysis

The 2 intervention groups were compared for the proportion of women reporting outcome indicators. The odds ratios and 95% confidence intervals were also calculated. Difference-in-differences (D-in-Ds) analyses within multivariate linear regressions were used to determine the intergroup differences. For the D-in-Ds analyses, we defined $I=1$ for the training group and $i=0$ for the financial intervention group, where $t=1$ represented the year 2008 and $t=0$ represented the year 2006; the coefficient of the interaction term indicated the differences between the temporal changes in the 2 intervention groups. In each group, the intervention effect was calculated by the outcome in 2008 minus the outcome in 2006. For example, the difference in the 1st visit within 3 months in the financial group (30.4%) was determined as the difference between the proportion in 2008 (82.0%) and that in 2006 (51.6%). The calculation of the intervention's effect size was adjusted for differences over time in the respective intervention arm. Additionally, the following covariates were included in the regression model: woman's age, education level, number of children, annual income of the family, and distance between village and township. Two-tailed $P<.05/P<.1$ was considered to indicate statistical significance in univariate analysis/multivariate analysis.

3. Results

In all, 1113 women completed the questionnaires, including 570 and 543 women who were pregnant in 2006 and between 2008 and 2009, respectively. In both surveys, the average age of the participants was 26 years, and the median number of years of education was 7 (Table 2).

The outcome of the intervention is shown in Table 3. In 2006, the proportion of women who had an antenatal visit within the first 3 months was 51.6% in the financial group and 51.9% in the training group; in 2008, these rates improved to 82.0% and 75.6%, respectively. Similarly, the percentage of women who had prenatal visits (more than 5 visits) and the percentage of hospital deliveries increased to as high as 16.1% and 60.4% in the financial group and 25.5% and 62.1% in the training group, respectively. For all the above parameters, there was no significant intergroup difference either before or after the intervention. Among the surveyed women, in the year 2006, 39.9% and 30% of the women in the financial group and training group, respectively, had attended postnatal visits, indicating a higher percentage in the financial group ($P=.013$). However, after the intervention, this trend reversed, with the percentages being 32.8% and 61.2% ($P<.001$), respectively. In 2006, the percentage of women who had been recommended a hospital delivery was higher in the clinical group than in the financial group; however, in 2008, the opposite was observed. At both time points, the 2 groups did not show any significant differences. At the baseline survey, approximately 3.4% and 6.5% women in the financial group and training group, respectively, did not attend prenatal visits because of the high cost; these percentages changed to 3.6% and 4.2%, indicating no significant intergroup difference in both surveys. Of the outcomes linked to our hypothesis, the expected effect was observed for a few parameters. In 2006, the percentage of doctors who provided advice to women regarding pregnancy-related danger signs was 83.6% in the financial group, which was significantly higher than that in the training group (74.0%, $P=.022$). After intervention, these percentages increased to 95.9% and 92.6%, respectively, with no significant intergroup difference. The percentage of women who underwent blood tests for anemia during their prenatal visit increased from 76.4% to 83.6% in the training group, but decreased from 80.6% to 65.6% in the financial group, indicating a significant difference between the 2 groups after intervention ($P<.001$). No preintervention differences between the 2 groups were noted in the percentage of women who fed their infants a milk substitute for 4 to 6 months (51.4% in the financial group and 57.5% in the training group); after the intervention, the percentage improved in the financial group, but decreased significantly in the training group ($P<.001$). Other outcome measures showed no consistent changes, such as the proportions of doctors providing nutritional advice, women who underwent blood pressure measurements, women who underwent more than 3 ultrasonography examinations, women who had cesarean delivery, women who breastfed for more than 4 months, and women who breastfed within 24 hours of delivery.

Table 2

Demographic characteristics of the respondents by intervention group.

	Financial intervention		Clinical intervention	
	Pre	Post	Pre	Post
Number of townships, n	12		11	
Number of women, n	263	278	307	265
Age 35+ years, n (%)	16 (6.2)	29 (10.4)	31 (10.2)	27 (10.2)
Age, yrs	26	25	26	27
Low education,* n (%)	80 (32.8)	73 (27.5)	127 (43.5)	91 (37.3)
High family income,† n (%)	3 (1.2)	65 (23.4)	6 (2.0)	69 (26.0)
Not NCMS member, n (%)	36 (13.7)	22 (7.9)	43 (14.0)	25 (9.4)
Far from hospital,‡ n (%)	65 (24.8)	53 (19.1)	110 (37.3)	88 (33.5)
2nd+ children, n (%)	108 (41.1)	96 (42.5)	120 (39.1)	138 (52.1)

NCMS = New Co-operative Medical Scheme (health insurance).

* Low education = primary school or less.

† High family income = income more than 20,000 Yuan.

‡ Time to township hospitals more than 30 min.

Table 3

Comparison of maternal care service before and after intervention, percentages.

	Before intervention						After intervention					
	Financial intervention		Clinical intervention				Financial intervention		Clinical intervention			
	N_1	%	N_2	%	χ^2	*P*	N_1	%	N_2	%	χ^2	*P*
Number of women	263		307				278		265			
using care												
First visit <3 mo	128	51.6	153	51.9	0.003	.953	223	82.0	189	75.6	3.193	.074
High-level hospital	36	13.7	41	13.4	0.01	.92	206	74.1	200	75.5	0.135	.713
Prenatal visits 5+	162	64.0	174	58.4	1.831	.176	221	80.1	219	83.9	1.33	.248
Postnatal visits 3+	105	39.9	92	30.0	**6.209**	**.013****	88	32.8	156	61.2	**42.17**	**<.001****
Advised hospital delivery*	116	46.0	140	50.4	0.992	.319	111	40.2	89	34.4	1.956	.162
Opinion												
Visits expensive†	3	3.4	8	6.5	0.492	.483	10	3.6	11	4.2	0.126	.723
Content												
Nutrition advice	160	100.0	160	98.2	1.309	.253	254	92.0	248	95.8	2.72	.099
Danger signs advice	133	83.6	115	74.0	**5.219**	**.022****	255	95.9	239	92.6	2.53	.112
Blood pressure 3+	169	66.8	207	70.2	0.491	.484	244	88.4	217	86.1	0.626	.429
Anemia test 1+	204	80.6	181	76.4	1.473	.225	181	65.6	219	83.6	**22.855**	**<.001****
Ultrasound 3+	171	69.5	190	66.7	0.491	.483	211	77.0	181	69.9	3.472	.062
C-section	52	19.8	61	19.9	0.001	.977	36	13.0	38	14.6	0.259	.610
Infant feeding												
Breastfeeding 4 mo+	194	73.8	206	67.8	2.444	.118	120	48.2	133	56.1	3.056	.08
Milk substitute (4–6 mo)	95	51.4	130	57.5	1.564	.211	180	67.2	122	51.3	**13.25**	**<.001****
Breastfeeding within 24 h	84	32.3	113	36.9	1.322	.25	37	13.3	81	31.0	**24.73**4	**<.001****

* Did the doctor recommend that you to stay in hospital before delivery?

** Two-tailed $P < .05$ was considered statistically significant.

† "Have you had any problems during your prenatal visit?," option "The visits were too expensive."

Table 4 shows the D-in-D estimations with all outcomes, both with and without adjustments for sociodemographic characteristics. It is obvious that the clinical training had some impact on both the utilization of healthcare and the content of patient education that doctors imparted. The proportion of postnatal visits was more than 3 times greater in the training group than in the financial group. There were significant improvements in the percentages of doctors who provided advice regarding nutrition

Table 4

Intervention effects on utilization of maternal healthcare: difference in difference (D-in-D) estimation.

			Without covariate			With covariate*		
	Difference (ΔFI)	Difference (ΔCL)	DID (B)	SE	*P*	DID (B)	SE	*P*
Number of women								
Care use								
First visit <3 mo	30.4	23.7	−0.051	0.056	.356	−0.053	0.061	.387
High-level hospital	60.4	62.1	0.025	0.048	.603	0.040	0.056	.469
Prenatal visits 5+	16.1	25.5	0.051	0.055	.352	0.062	0.047	.189
Postnatal visits 3+	−7.1	31.2	0.383	0.058	**<.001****	0.357	0.056	**<.001****
Advised hospital delivery†	−5.8	−16.0	−0.102	0.060	**.092****	−0.096	0.058	**.099****
Opinion								
Visits expensive‡	0.2	−2.3	−0.025	0.033	.448	−0.02	0.033	.538
Content								
Nutrition advice	−8.0	−2.4	0.052	0.028	**.059****	0.058	0.027	**.030****
Danger signs advice	12.3	18.6	0.094	0.045	**.035****	0.082	0.046	**.073****
Blood pressure 3+	21.6	15.9	−0.052	0.050	.304	−0.067	0.051	.188
Anemia test 1+	−15.0	7.2	0.223	0.051	**<.001****	0.195	0.058	**.001****
Ultrasound 3+	7.5	3.2	−0.043	0.056	.443	−0.058	0.067	.387
C-section	−6.8	−5.3	−0.014	0.045	.753	−0.005	0.039	.895
Infant feeding								
Breastfeeding 4+ mo	−25.6	−11.7	0.139	0.059	**.018****	0.158	0.057	**.006****
Milk substitute (4–6 mo)	15.8	−6.2	−0.221	0.065	**.001****	-0.234	0.064	**<.001****
Breastfeeding within 24 h	−19.0	−5.9	0.135	0.054	**.012****	0.089	0.052	**.088****

* Covariate: women's age, education level, number of children, annual income of the family, and distance between village and township.

** Two-tailed $P < .1$ was considered statistically significant.

† Did the doctor recommend that you to stay in hospital before delivery?

‡ "Have you had any problems during your prenatal visit?," option "The visits were too expensive."

and warning signs necessitating immediate medical attention and in the percentage of women who underwent blood tests for anemia ($P=.001$). Compared to the financial group, the training group had significantly higher percentages of women who breastfed for more than 4 months and who breastfed within 24 hours of delivery (15.8% and 8.9%, respectively) (for breastfeeding more than 4 months, $P=.06$; for breastfeeding within 24 hours, $P=.088$). However, for the financial group, the proportion of doctors who recommended hospital delivery was almost 10% higher than that in the training group. Furthermore, the percentage of women who provided their infants a milk substitute for 4 to 6 months increased to 23.4%. There was no significant difference in the parameters related to prenatal care, such as a 1st visit within 3 months, 5 or more prenatal visits, mothers who delivered at a county- or higher-level hospital, women who had undergone blood pressure measurement, or women who had more than three ultrasonography examinations and cesarean sections.

4. Discussion

All the results obtained in this study were not as expected. We hypothesized that with compensation offered via the financial intervention, the proportion of women visiting for the 1st time, the number of prenatal visits, the frequency of postnatal visits, and the content of prenatal care would improve to a certain degree. Our results showed that with the exception of the number of postpartum visits, the other outcomes showed hardly any changes or remained unchanged. Similarly, no major changes are observed regarding the examination content such as blood pressure and time of ultrasound examination, which is accompany by the prenatal visits. One possible reason for this is that compared to the total cost of the prenatal visit, the proportion of reimbursement offered by the project was not as high as that expected by the women. In 2008, the average cost of an entire prenatal visit was about 350 Yuan; the compensation offered by the project was 50 Yuan. Consequently, the project reduced only 14.3% of the cost. Moreover, the reduction in the costs were not issued directly to the pregnant woman, but deducted by the hospital at the time of the prenatal visit; therefore, there was very little influence on the women, which would have weakened the effect of intervention.[23] We suggest that our government should seriously consider the issue of maternal healthcare needs and include it in insurance scheme benefits packages. Further planning is necessary to design strategies such that healthcare facilities can be accessed by even economically backward populations, particularly essential antenatal care.[24,25]

In the training group, the content of training was mainly focused on improving clinical skills, including effective treatment of severe and comprehensive emergency obstetric complications, as well as prenatal treatment and content specification process. The results also showed that in terms of content specification, the training group showed improvements in varying degrees, particularly in areas such as the percentage of doctors providing nutritional advice to pregnant women and informing them of what emergency circumstances necessitate a hospital visit. This finding is consistent with that reported in a study in western Iran.[26] This is also consistent with reports on the declining proportion of women in China who started breastfeeding within 24 hours and continued breastfeeding for longer than 4 months.[27,28] In rural China, the duration of breastfeeding is generally short[29,30]; more than one-third of women terminate breastfeeding within 1 month of delivery.[31] We support the notion that a breastfeeding guide with recommendations and support should be provided to all women.[32–35]

The literature review did not show any consistent evidence on community-based intervention packages that have an impact on breastfeeding.[36,37] However, in our study, a greater proportion of women in the training group insisted on breastfeeding within 24 hours, as compared to those in the financial group, which is a welcome finding. Our study showed that training health providers could not only improve the quality of service[38,39] but also reduce the maternal and neonatal mortality.[40] Training health providers, which is supported by the government, is an important aspect of the long-term development plan for the overall improvement of women's and children's health.[41]

Over 2 years, the proportion of caesarean deliveries had decreased in both the intervention groups. These percentages decreased from 19.8% to 13.0% and from 19.6% to 14.6% in the financial group and training group, respectively, with decreases of 6.8% and 5.3%. The proportion of caesarean sections has increased in recent years, especially in private clinics, after the implementation of the health policy reforms.[18,42] This may be because payment is made according to the type of services provided.[43,44] Providing health education to pregnant women in low-income areas could delay the rise in the frequency of caesarean section deliveries,[45–47] which has been observed across rural areas of China.[48] Although there was no statistically significant difference between the 2 groups in this parameter, an improvement was still observed. Interestingly, the rate of caesarean delivery in maternal healthcare facilities was within 20%, whereas those reported elsewhere are higher.[49]

However, this study has a few limitations that need to be taken into consideration when interpreting the results. First, all the data collected were self-reported, which raises concerns regarding recall bias. Second, the outcome indicators could have preferably been maternal mortality or factors associated with neonatal mortality, which could have provided more convincing results. However, this was not possible in this case since such a study would require a larger sample population.[50] Taking into account the interventions implemented during the survey's time period, it was difficult to collect sufficient mortality data; therefore, this information could not be considered in the content presented herein. Third, the training group had received considerable training regarding clinical skills. However, it is impossible to determine whether the clinical skills of the doctors themselves had improved. This could affect the improvement in local maternal health status and also the quality of services provided. Pre- and postsession tests were administered to check the knowledge levels of the participants gained through the training. However, we could not confirm whether the knowledge had actually been acquired through the training sessions only; the large number of staff members involved made it difficult to individually evaluate each doctor. Further research is required to assess the actual impact of training on the use of evidence-based practices by the staff.

5. Conclusion

Essential obstetric training is effective in improving the knowledge and self-efficacy of healthcare workers. By enhancing funding and staff support and providing integrated training programs, the health conditions of underprivileged women and

children could be substantially improved. Further observations should be made to determine the success of the intervention programs implemented, and if they are found to be useful, such programs should be promoted further.

Author contributions

Data curation: Qiang Li, Xiaoning Liu.
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