Influence of China's 2009 healthcare reform on the utilisation of continuum of care for maternal health services: Evidence from two cross-sectional household surveys in Shaanxi Province

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Research

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Abstract

Background: Continuum of care for maternal health services (CMHS) is a proven approach to improve health and safety for mothers and newborns. This study aims to explore the influence of China's 2009 healthcare reform on improving the CMHS utilisation.

Methods: This population-based cross-sectional quantitative study included 2332 women drawn from the fourth and fifth National Health Service Surveys of Shaanxi Province, conducted in 2008 and 2013 respectively, before and after China's 2009 healthcare reform. A generalised linear mixed model (GLMM) was applied to analyse the influence of this healthcare reform on utilisation of CMHS. Concentration curves, concentration indexes and its decomposition method were used to analyse the equity of changes in utilisation.

Results: According to China's policy defining CMHS, post-reform CMHS utilisation was higher in both rural and urban women. The rate of CMHS utilisation increased from 24.66% to 41.55% for urban women and from 18.31% to 50.49% for rural women (urban: $\chi2=20.64$, P<0.001; rural: $\chi2=131.38$, P<0.001). This finding is consistent when the WHO's level of CMHS is applied for rural women after reform (12.13% vs 19.26%; $\chi2=10.99$, P=0.001); for urban women, CMHS utilisation increased from 15.70% to 20.56% ($\chi2=2.57$, P=0.109). The GLMM showed the rate of CMHS utilisation for urban women post-reform was five times higher than pre-reform rates (OR=5.02, 95%CL: 1.90, 13.31); it was close to 15 times higher for rural women (OR=14.70, 95%CL: 5.43, 39.76). The concentration index decreased from 0.130 pre-reform (95%CI: -0.026, 0.411) to -0.041 post-reform (95%CI: -0.096, 0.007) for urban women; it decreased from 0.104 (95%CI: -0.012, 0.222) to 0.019 (95%CI: -0.014, 0.060) for rural women. The horizontal inequity index for both groups of women also decreased (0.136 to -0.047 urban and 0.111 to 0.019 for rural).

Conclusions: China's 2009 healthcare reform has positively influenced utilisation rates and equity of utilisation of the CMHS among both urban and rural women in Shaanxi Province. We expect that similar impacts might be observed in other settings in China and, if so, may provide lessons in policy design to other countries looking to reduce maternal and newborn mortality.

Introduction

Maternal mortality ratio (MMR) has rapidly reduced globally during the past decades, declining from 385 to 216 deaths per 100000 livebirths between 1990 and 2015 [1]. Despite global progress in reducing maternal mortality, MMR in low and middle-income countries (LMICs) is still seven times higher than in high-income countries [2]. In China, the MMR of 27 per 100000 is still 2–6 times that of developed countries (e.g. 14 per 100000 in USA; 9 per 100000 in United Kingdom; 4 per 100000 in Italy and Sweden) in the latest report by World Health Organisation (WHO) [2]. Prenatal care penetration is documented as high, with more than 80% of women in China attend ≥ 4 antenatal visits and hospital delivery [3, 4]. Yet few studies reported the percentage of women received ≥ 3 postnatal visits within 42 days after delivery. One possible means of further reducing the MMR in China would be improving adherence to postnatal visits through continuity of care (COC). COC requires access to care throughout one's lifecycle, including adolescence, pregnancy, childbirth, the postnatal period, and childhood [5]. Scholars have proposed it as a key framework for tracking maternal and neonatal health and assessing reductions in maternal and neonatal deaths [5, 6]. COC for maternal health services (CMHS) utilisation mainly includes women receiving antenatal visits, hospital delivery and postnatal visits

continuously from pregnancy to 42 days after delivery[7]. Studies from Lancet and PLOS ONE showed adherence to full CMHS can reduce neonatal mortality by 36–67% and reduce combined perinatal and maternal mortality by 15% [8, 9]. However, it has not been adequately implemented and assessed in low and middle income countries (LMICs) [10].

China embarked on a comprehensive healthcare reform in 2009 aimed at providing all citizens with equal access to basic health care with reasonable quality and sufficient financial risk protection [11]. The reform established the national basic and important public health service in order to promote the health for all, with a focus on maternal health including CHMS [12–14]. Therefore, we hypothesize that the utilisation of CHMS should have improved. To date, there has been some research exploring the determinants, effects, value, measurement of CHMS in Lao PDR [15], Nepal [16], Tanzania [17], South Africa [18], Cambodia [19]; fewer studies explore the influence of health policy on improving the utilisation of CMHS in China.

In this study, two rounds of a representative cross-sectional household survey are used to analyse the influence of the 2009 Chinese healthcare reform on the utilisation of CMHS in Shaanxi Province. This study also aims to provide policy recommendations for further improving maternal health care utilisation and narrowing the gap in MMR between LMICs and high-income countries.

Methods

Study design and sample

This study analyses the influence of the 2009 Chinese healthcare reform on CMHS utilisation in Shaanxi Province. Shaanxi Province, in the west of China, was selected as the study area because of its predominantly rural character and a high proportion of poor in the population, the type of region that the policy is intended to target. By the end of 2013, there were roughly 37.60 million population with the per capital Gross Regional Product (GRP) 42,692 Chinese yuan in Shaanxi Province; the birth rate was 10.01% and the natural growth rate was 3.86%, 51.31% of residents were living in urban areas and 48.69% in rural areas [20]. The National Health Service Survey (NHSS) is a population-based cross-sectional nationally representative survey commissioned by the China's National Health Commission every five years [21-23]. Based on the structure of Chinese administrative districts and the imbalanced population distributions among the different provinces, a multi-stage stratified cluster randomized design was used to provide a representative sample in each province. Data collection for the fourth (2008) and fifth (2013) NHSS were conducted in Shaanxi Province represent time points before and after the healthcare reform of interest (2009).

In each survey round, face-to-face interviews were collected by the investigators trained by China's National Health Commission using a household health questionnaire that mainly included open-ended questions (see Supplementary Questionnaire S1 and S2 online). Data on maternal socio-economic status (including area, age, education, health insurance, annual personal expenditure, employment) as well as chronic disease, parity, antenatal visits, hospital delivery and postnatal visits from pregnancy to 42 days after delivery were collected in the interview. During data collection, experts provided supervision and revisited 5% of the sampled households to check the accuracy of data recorded by interviewers. They asked 14 key questions again to check the consistency of the information recorded and the consistency should be at least 95%. The Myer's Blended Index was used to assess the representativeness of the sample (1.67 in the 4th NHSS and 1.62 in 5th

NHSS), indicating that in both surveys there was no significant difference between the sampled age distribution and the overall age distribution of Shaanxi Province [24, 25].

In brief, 44 counties in the fourth NHSS and 32 counties in the fifth NHSS were randomly selected. 18,290 household members in the 2008 NHSS were collected, more household members (57,529) were collected in the 2013 NHSS because of the expansion of the investigation site. For our study, women who had at least one delivery were selected as the sampling unit of interest in the fourth NHSS. From the fifth NHSS, only women whose last delivery occurred after January 2010 were selected, considering the official inception date of the health system reform (September 2009). This gave us a sample of 638 women in the fourth NHSS and 1,694 women in the fifth NHSS in this analysis (Figure 1).

Indicators

China's 2009 healthcare reform in this study refers to a series of measures introduced and implemented after China's 2009 healthcare reform to strengthen women's maternal health care, mainly including the national important and basic public health service. According to WHO level, the utilisation of CMHS is categorized as: women who received ≥4 prenatal visits, hospital delivery and ≥3 postnatal visits from pregnancy to 42 days after delivery [26]. In the level of China, the utilisation of CMHS is categorized as: women who received ≥5 prenatal visits, hospital delivery and ≥1 postnatal visits from pregnancy to 42 days after delivery [27, 28]. Considering the difference of rural and urban population sample in terms of income, education and health service utilisation, the two groups were analysed separately and compared to look at geographic equity [29].

Statistical analysis

In this study, sample data has been checked for missing data and outliers and cleaned prior to data analysis. Descriptive analysis was performed to show the demographic information of maternal women in the sample and their status CMHS. A generalised linear mixed model (GLMM) including both fixed and random effects were used in this study to show the association between China's 2009 healthcare reform and CMHS utilisation when controlling for other confounding factors. The healthcare reform was specified as fixed effects, women's family code as a random effect; maternal women's age, education, employment, annual personal expenditure, health score, health insurance, chronic disease and parity were included as covariates. The model we used was as following:

[Due to technical limitations, the formulas could not be displayed here. Please see the supplementary files section to access the formulas.]   (1)

In equation (1), the linear prediction η is the combination of the fixed and random effects excluding the residuals. is the rate of CMHS utilisation. is a constant, represents the effects of on , and is a random error. The link function is binomial.

Concentration curve, concentration index (CI) and horizontal inequity index (HI) were used to measure the equity of CMHS utilisation. Before to measure equity, inequality should be measured first. Concentration curve and CI were used to measure the extent of income-related inequality of CMHS utilisation. It is calculated as twice the area between the concentration curve and the line of equality and changed from -1 to 1 [30]. A positive concentration index means that high-income women utilize more CMHS utilisation than their low-

income counterparts and negative one means the low-income group utilizes more CMHS utilisation than their rich counterparts, the formula is as following:

[See supplementary files.]   (2)

where C stands for concentration index, is CMHS utilisation index, μ is the mean of CMHS utilisation index, and is the fractional rank of annual personal consumption expenditure distribution.

Inequality can be further explained by decomposing the concentration index into its determining components, then horizontal inequity index (HI) can be computed by subtracting the contribution of need variables (such as women's age, health score and chronic disease) from the concentration index of CMHS utilisation; it is a summary measure of the magnitude of inequity in the dependent variable [31]. These determinants are selected according to previous researches but constrained by the variables collected in the investigation [15, 32]. A probit regression model was used to indirectly standardize the CMHS utilisation since the outcome variable is binary. As the standardization of health utilisation holds for a linear model of healthcare, we applied the linear approximation to the probit model to extract marginal effects of each determinant on observed probabilities of the outcome variable. The formula for the concentration index decomposition can be written as follows:

[See supplementary files.]   (3)

G is functional transformation, is the dependent variable, are needs variables, and are control variables. Then the standardized need was estimated using the following equation:

[See supplementary files.]   (4)

where is standardized continuum of maternal health service utilisation, n is sample size. The more CMHS allocated to the population with greater need, the less inequity of CMHS utilisation.

The statistical analyses were performed using STATA statistical software version 12.0 (StataCorp LP, College station 77845, USA). A two-tailed P value < 0.05 was considered statistically significant.

Results

Increasing in rate of utilisation of CMHS

The implementation of China's 2009 healthcare reform had significant positive influence on increasing the rate of utilisation of CMHS both for urban and rural women. According to China's policy defining CMHS, there were increases in utilisation rate after China's 2009 healthcare reform both for urban and rural women (urban: χ^2=20.64, P<0.001; rural: χ^2=131.38, P<0.001; Figure 2) compared with the rate of CMHS utilisation before reform. This finding is consistent when the WHO criteria are applied, as shown in Figure 2 for rural women after reform (12.13% vs 19.26%; χ^2=10.99, P=0.001). For urban women, the rate of CMHS utilisation increased from 15.70% to 20.56% according to the WHO criteria, but this was not a significant change (χ^2=2.57, P=0.109).

In specific, the GLMM shows that the rates of the utilisation of CMHS after China's 2009 healthcare reform were nearly 5 times (OR=5.02, 95%CL:1.90,13.31) higher for urban women and 15 times (OR=14.70, 95%CL:5.43,39.76) higher for rural women than the rates before healthcare reform after adjusting for maternal age, education, employment, annual personal expenditure, health score, health insurance, chronic disease and parity. (Table 2). Besides, in urban and rural women with higher education and health insurance had higher rates of CMHS utilisation after adjusting for other characteristics (P<0.05; Table 2). In addition, for rural women, women over than 31 years old (OR=2.49, 95%CL: 1.23, 5.06) and once parity (OR=0.40, 95%CL: 0.21, 0.75) had higher rates utilisation.

Improvement in equity of utilisation of CMHS

Figure 3 shows that before reform, concentration curves both in urban and rural women lay significantly below the line of equality, indicating that the utilisation of CMHS was more concentrated among the rich. However, the concentration curves lay above the line of equality after reform. In addition, the concentration index of occurring CMHS utilisation in urban women decreased significantly (P=0.021) from 0.130 (95% CL: -0.026, 0.411) to -0.041 (95% CL: -0.096, 0.007). This decreasing trend is also shown for rural women but still favors the rich and is not statistically significant (P=0.170): 0.104 (95% CL: -0.012, 0.222) before reform, and after 0.019 (95% CL: -0.014, 0.060, Table 3).

Table 4 and Table 5 presented the decomposition of CIs of CMHS utilisation. Contribution to the inequality of CMHS utilisation and the proportion of contribution in the overall CIs were reported. A positive (negative) contribution represented the variable raised (reduced) the pro-rich inequality. It can be seen immediately that the majority of the CMHS inequality were attributable to age, educational, economic statuses and health insurance by defining the contributions as a proportion of each variable. Take the CMHS after healthcare reform for example, for the urban women, we found that economic, health insurance and parity had the largest (112.36%), second largest (24.08%) and third largest (11.99%) contributions to explain the inequality of CMHS; for rural women, economic statuses, education and health insurance had the largest (52.12%), second largest (38.53%) and third largest (10.01%) contributions to explain the inequality of CMHS utilisation. Finally, HI of CMHS utilisation after reform was -0.047 for urban women, evidencing a pro-poor inequity; the horizontal inequity index was 0.019 for rural women and indicating a pro-rich inequity (Table 4 and Table 5).

Discussion

The CMHS is one of the ways to improve maternal health and should be effective both in policy and in reality [33, 34]. This is the first known study to measure the influence of China's 2009 healthcare reform on the utilisation of CMHS in Shaanxi Province. In the ten years from the beginning of China's 2009 healthcare reform, many studies focused on different geographies and health conditions have demonstrated its contribution to improving population health status [13, 35–38]. In this study, we found the 2009 healthcare reform has had positive influence on improving the rate and equity of CMHS utilisation for both urban and rural women. The horizontal inequity index of CMHS utilisation decreased from 0.111 to 0.019 among rural women after the healthcare reform, but remains more concentrated among the richer rural women.

According to the concept and principles of maternal health services, each woman should receive a continuum of WHO-recommended ≥ 4 times antenatal visits, skilled delivery and ≥ 3 times postnatal visits throughout the

maternity period [39], with CHMS putatively improving self-awareness and utilisation rates so as to achieve full health for women throughout the pregnancy period. However, this study found that the utilisation rate of CMHS remains low. The post-reform survey data showed only 20.56% urban women and 19.26% rural women received CMHS. Studies in other LMICs have shown that the rate of CMHS utilisation is low because of shortages in human, financial resources and inadequate health-system infrastructure (although they used a different way to assess the continuum of care). There is 6.8% of maternal women received continuum of maternal, newborn and child health services in a rural district of Lao People's Democratic Republic [15]; 5.0% of maternal women received at least four times of antenatal visits, hospital delivery and at least once postnatal visits continuously in Ratanakiri, Cambodia[40]; 41% of maternal women received at least once antenatal visits, hospital delivery and at least once postnatal visits continuously in Nepal [16]; 7.9% of women achieved the continuum of care through continuous visits to health facilities in Ghana [41]. Considering the poor outcomes achieved, more efforts should be taken to improve the continuum of care for maternal health service.

Limitations

This is the first study, to our knowledge, that studied the influence of China's 2009 healthcare reform on the CMHS utilisation in Shaanxi. However, there are some limitations should be considered when interpreting the results. Firstly, all the data were self-reported and therefore may include recall or social desirability bias. However, the recall bias is likely to be small because pregnancy and childbirth are events that women remember for years [42]. Secondly, the measured determinants of CMHS utilisation available are limited by the pre-specified questions in the survey and there could be some potential unobserved confounding factors for which we did not control. Lastly, the imbalanced sample size before (n = 638) and after (n = 1694) the reform of interest may have some potential impacts on the results and conclusions, such as potentially introducing more selection bias and resulting with larger standard error and reduced statistical significance.

Conclusions

This study showed China's 2009 healthcare reform has had positive influence on improving the rate and equity of CMHS utilisation for both urban and rural women in Shaanxi. However, efforts should still be needed to reduce economic inequity in the rural area. Besides, the policy focus on continuum of care for prenatal visits, hospital delivery and postnatal visits may provide a scientific reference for LMICs' policymaking to improve their maternal and newborn's health.

List Of Abbreviations

CMHS	Continuum of care for maternal health services
CI	Concentration Index
CL	Confidence Limits
LMICs	Low and Middle Income Countries
MMR	Maternal Mortality Rate
NHSS	National Health Service Survey
OR	Odds Risk
WHO	World Health Organisation

Declarations

Ethics approval and consent to participate

In this study, verbal informed consent was obtained by surveyors from each participant before the investigation. In order to get the cooperation from the sampled counties, the Health institution in sample counties would contact each participant who agreed to accept the interview under the guiding of the Shaanxi Health Commission, and make an appointment with them which means if we have the participant's questionnaire, we have got the participant' consent. This method of consent was approved by the Ethics Committee of Xi'an Jiaotong University, the approval number were 2014-204 and 2015-644 separately. It conformed to the ethics guidelines of the Declaration of Helsinki.

Consent for publication

Not applicable

Availability of data and materials

This data was drawn from the fourth and fifth National Health Services Survey of Shaanxi Province. They are available from the Shaanxi National Health Commission for researchers who meet the criteria for access to confidential data, and are not opened to everyone. Researchers who want to use these data should contact Jianmin Gao (gaojm@xjtu.edu.cn).

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

JG was responsible for the field working including data collection and management. ZZ and HL provided constructive suggestions on data analysis. FX, DW and CL were responsible for the sorting of data. FX and DS did the statistical analysis. The manuscript was prepared by FX, MBK, CL, DW and ZZ. All authors read and approved the final manuscript.

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Tables

Table 1 Distribution of continuum of care for maternal health service utilisation among maternal women's socioeconomic characteristics (n=2332)

Variables	Urban (n=912)			Rural (n=1420)		
	No	Yes	P	No	Yes	P
Healthcare reform			<0.001			<0.001
Before	167(29.61)	55(15.80)		336(40.88)	80(13.38)	
After	397(70.39)	293(84.20)		486(59.12)	518(86.62)	
Age (years)			0.019			0.789
≤25	142(25.18)	104(29.89)		278(33.82)	210(35.12)	
26-30	239(42.38)	161(46.26)		258(31.39)	190(31.77)	
≥31	183(32.45)	83(23.85)		286(34.79)	198(33.11)	
Education			0.025			<0.001
≤Primary school	62(10.99)	20(5.78)		250(30.53)	98(16.39)	
Middle school	272(48.23)	171(49.42)		460(56.17)	381(63.71)	
≥High school	230(40.78)	155(44.80)		109(13.31)	119(19.90)	
Employment			0.090			0.885
No	206(36.52)	108(31.03)		126(15.33)	90(15.05)	
Yes	358(63.48)	240(68.97)		696(84.67)	508(84.95)	
Annual personal expenditure (Chinese Yuan)			0.314			<0.001
Poorest	60(10.66)	30(8.62)		270(32.89)	104(17.42)	
Poorer	86(15.28)	53(15.23)		192(23.39)	132(22.11)	
Middle	120(21.31)	63(18.10)		144(17.54)	142(23.79)	
Richer	114(20.25)	89(25.57)		140(17.05)	123(20.60)	
Richest	183(32.50)	113(32.47)		75(9.14)	96(16.08)	
Health score	86.54±8.78	88.58±7.61	<0.001	85.93±9.20	87.45±8.39	<0.001
Health insurance			0.033			0.280
No	92(16.31)	39(11.21)		24(2.92)	12(2.01)	
Yes	472(83.69)	309(88.79)		798(97.08)	586(97.99)	
Chronic disease			0.024			0.510
No	536(95.04)	341(97.99)		792(96.35)	580(96.99)	
Yes	28(4.96)	7(2.01)		30(3.65)	18(3.01)	
Parity			0.064			0.015
1	368(65.36)	248(71.26)		402(49.14)	332(55.70)	
≥2	195(34.64)	100(28.74)		416(50.86)	264(44.30)	

Table 2 Determinants of continuum of care for maternal health service utilisation by generalised linear mixed model (n=2332)

Variables	Urban (n=912)			Rural (n=1420)		
	OR	95%CL	*P*	OR	95%CL	*P*
Healthcare reform						
Before	1.00			1.00		
After	5.02	1.90,13.31	0.001	14.70	5.43,39.76	<0.001
Age (years)						
≤25	1.00			1.00		
26-30	1.10	0.62,1.96	0.741	1.40	0.80,2.44	0.239
≥31	0.78	0.38,1.59	0.493	2.49	1.23,5.06	0.012
Education						
≤Primary school	1.00			1.00		
Middle school	2.62	0.98,7.03	0.056	3.11	1.64,5.92	0.001
≥High school	4.18	1.30,13.44	0.016	4.55	1.88,11.01	0.001
Employment						
No	1.00			1.00		
Yes	1.47	0.86,2.49	0.156	1.12	0.62,2.03	0.697
Annual personal expenditure (Chinese Yuan)						
Poorest	1.00			1.00		
Poorer	0.94	0.35,2.50	0.899	1.27	0.67,2.41	0.454
Middle	0.64	0.24,1.67	0.357	1.70	0.85,3.41	0.132
Richer	0.96	0.37,2.47	0.934	1.04	0.51,2.12	0.910
Richest	0.51	0.19,1.37	0.183	1.94	0.86,4.39	0.112
Health score	1.03	1.00,1.07	0.051	1.02	0.99,1.05	0.147
Health insurance						
No	1.00			1.00		
Yes	2.67	1.13,6.30	0.026	4.25	1.00,18.13	0.05
Chronic disease						
No	1.00			1.00		
Yes	0.35	0.08,1.49	0.156	0.75	0.23,2.50	0.642
Parity						
1	1.00			1.00		
≥2	0.62	0.32,1.20	0.155	0.40	0.21,0.75	0.005

Abbreviations: *OR* Odds Ratio; *CL* Confidence Limits

Table 3 Inequality of urban and rural women's continuum of care for maternal health service utilisation before and after healthcare reform (n =2332)

Area	Before healthcare reform			After healthcare reform			*P*
	CI	95% CL		CI	95% CL		
		Lower	Upper		Lower	Upper	
Urban	0.130	-0.026	0.411	-0.041	-0.096	0.007	0.021
Rural	0.104	-0.012	0.222	0.019	-0.014	0.060	0.170

Abbreviations: *CI* Concentration Index; *CL* Confidence Limits

Table 4 Decomposition analysis of concentration index on urban women's continuum of care for maternal health service utilisation before and after healthcare reform (n=912)

Variables	Before healthcare reform (n=222)				After healthcare reform (n=690)			
	Elasticity	CI	Contribution to CI	%	Elasticity	CI	Contribution to CI	%
Age (years)								
≤25	Reference				Reference			
26-30	-0.286	0.062	-0.018	-13.70	0.080	0.033	0.002	-6.42
≥31	-0.138	0.012	-0.002	-1.30	0.005	-0.039	-0.0002	0.50
Education								
≤Primary school	Reference				Reference			
Middle school	1.491	-0.234	-0.350	-268.90	0.200	-0.077	-0.015	37.40
≥High school	2.210	0.175	0.387	297.50	0.135	0.142	0.019	-46.98
Employment								
No	Reference				Reference			
Yes	-0.029	-0.444	0.001	0.99	0.153	-0.009	-0.001	3.37
Annual personal expenditure (Chinese Yuan)								
Poor	Reference				Reference			
Poorer	0.055	-0.069	-0.004	-2.96	-0.056	-0.770	0.043	-105.54
Middle	-0.004	0.280	-0.001	-0.96	-0.104	-0.357	0.037	-90.68
Richer	0.072	0.449	0.033	25.01	-0.107	-0.066	-0.007	17.16
Richest	0.040	0.545	0.022	16.95	-0.253	0.480	-0.121	296.16
Health score	2.961	0.005	0.014	10.47	0.621	0.003	0.002	-4.74
Health insurance								
No	Reference				Reference			
Yes	0.289	-0.078	-0.023	-17.40	0.275	-0.036	-0.010	24.08
Chronic disease								
No	Reference				Reference			
Yes	-0.012	0.029	-0.0003	-0.27	-0.012	-0.202	0.002	-6.04
Parity								
1	Reference				Reference			
≥2	-0.219	-0.029	0.006	4.82	-0.281	-0.018	0.005	-11.99
Needs variables	-	-	-0.006	-4.80	-	-	0.006	-16.70
HI[4]	-	-	0.136	-	-	-	-0.047	-

Abbreviations: *CI* Concentration Index; *%* Pure percentage contributions of determinants to the socioeconomic inequality in continuum of maternal health service utilisation; *HI* Horizontal inequity index. Needs variables mean contribution of factors to *CI*, including age, health score and chronic disease.

Table 5 Decomposition analysis of concentration index on rural women's continuum of care for maternal health service utilisation before and after healthcare reform (n=1420)

Variables	Before healthcare reform (n=416)				After healthcare reform (n=1004)			
	Elasticity	CI	Contribution to CI	%	Elasticity	CI	Contribution to CI	%
Age (years)								
≤25	Reference				Reference			
26-30	-0.004	0.033	-0.0001	-0.14	0.031	-0.014	-0.0004	-2.29
≥31	0.284	-0.023	-0.007	-6.38	0.058	-0.022	-0.001	-6.69
Education								
≤Primary school	Reference				Reference			
Middle school	0.350	0.029	0.010	9.70	0.160	-0.011	-0.002	-8.87
≥High school	0.135	0.131	0.018	17.09	0.058	0.154	0.009	47.40
Employment								
No	Reference				Reference			
Yes	-0.104	0.0003	-0.0001	-0.03	0.059	0.002	0.0001	0.64
Annual personal expenditure (Chinese Yuan)								
Poor	Reference				Reference			
Poorer	0.048	0.288	0.014	13.29	0.005	-0.413	-0.002	-11.71
Middle	0.032	0.661	0.021	20.16	0.025	-0.008	-0.002	-10.57
Richer	0.006	0.875	0.006	5.316	-0.005	0.329	-0.002	-9.12
Richest	0.034	1.072	0.036	34.82	0.019	0.755	0.015	77.19
Health score	-0.005	-0.001	0.000	0.004	0.620	0.002	0.001	6.33
Health insurance								
No	Reference				Reference			
Yes	0.722	0.0004	0.0003	0.29	0.303	-0.006	-0.002	-10.01
Parity								
1	Reference				Reference			
≥2	-0.918	-0.005	0.004	4.22	-0.315	-0.003	0.001	4.38
Needs variables	-	-	-0.007	-6.52	-	-	-0.0004	-2.65
HI[4]	-	-	0.111	-	-	-	0.0194	-

Abbreviations: *CI* Concentration Index; *%* Pure percentage contributions of determinants to the socioeconomic inequality in continuum of maternal health service utilisation; *HI* Horizontal inequity index. Needs variables mean contribution of factors to *CI*, including age and health score.

Figures
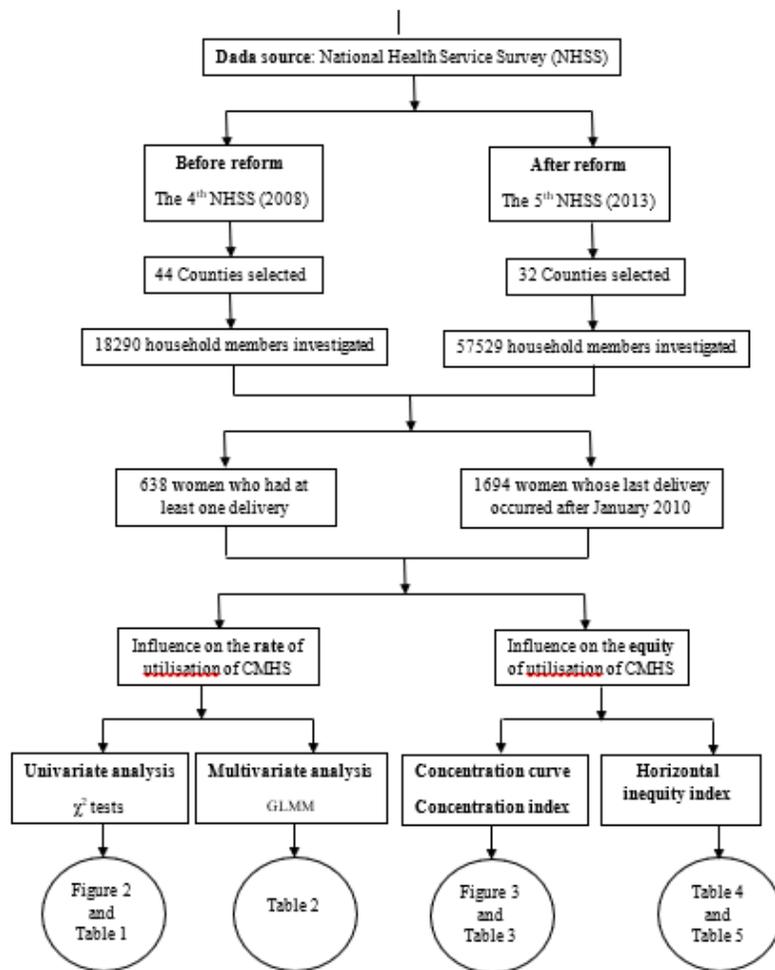
Figure 1

Study flow chart
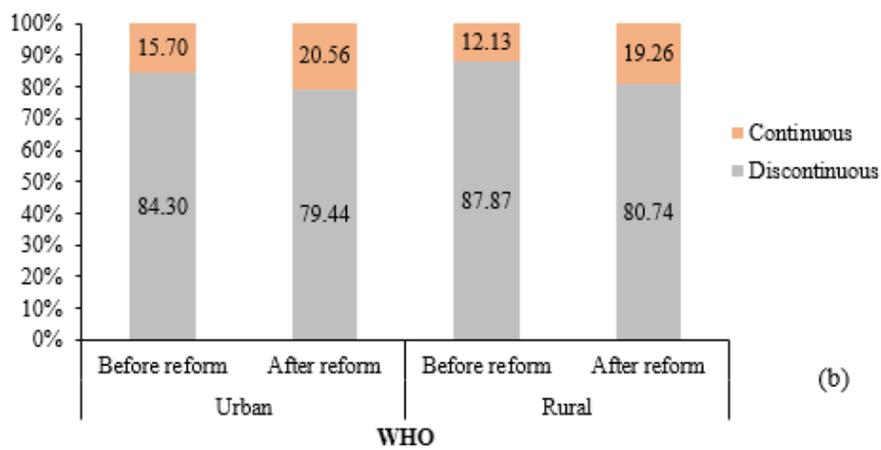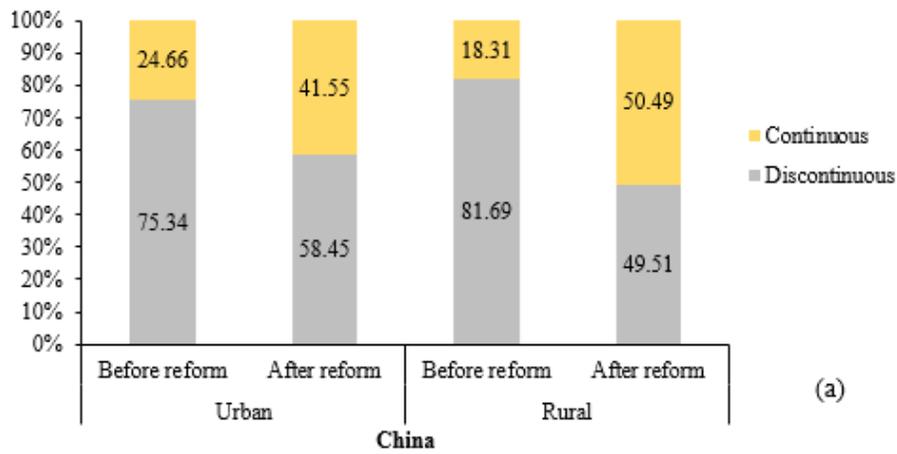
Figure 2

Comparison of continuous maternal health service utilisation before and after healthcare reform
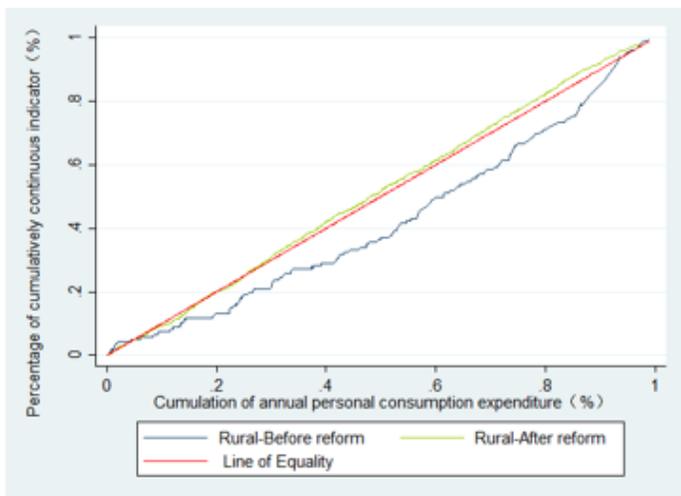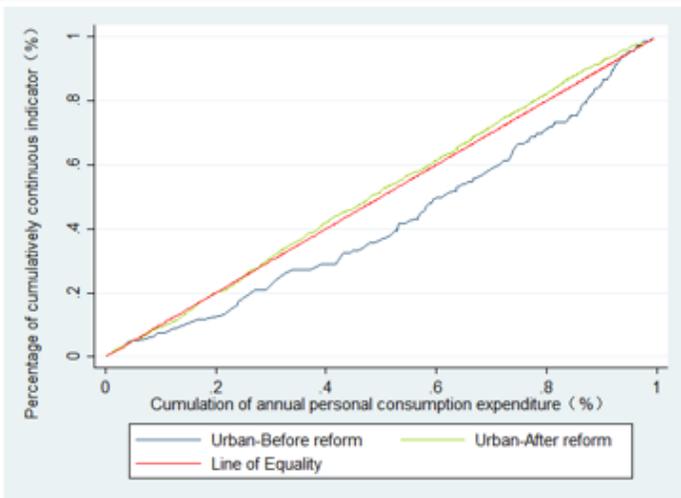
Figure 3

Concentration curves on continuum of care for maternal health service utilisation before and after healthcare reform