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Determinants of skilled birth attendance at childbirth in Attapeu province, Lao People's Democratic Republic

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Abstract

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The Lao People's Democratic of Republic (Lao PDR) is facing challenges of high rates of maternal mortality and neonatal mortality. Increasing the attendance of a skilled birth attendant (SBA) at childbirth is expected to be a key intervention to reduce mortality. The possible determinants of an SBA delivery at childbirth in the Lao PDR were explored. A cross-sectional study was conducted among 393 women who gave birth within the past two years in six villages in Attapeu province, The Lao PDR. To examine the association between the delivery with an SBA and its potential determinants, multiple logistic regression analysis was conducted using SAS 9.3.

The results indicated that 47.9% of the deliveries among 374 participants utilized SBAs. Multiple logistic regression analysis showed villages far from a health center (HC) (OR=0.35, 95% CI=0.19–0.64), lack of transportation (OR=0.13, 95% CI=0.06–0.25) and lack of knowledge about the Free Maternal and Child Health (MCH) policy (OR=0.52, 95% CI=0.28–0.98) were significantly associated with a non-SBA delivery. The odds ratio of an SBA delivery was over three times higher among those who received antenatal care (ANC) more than 4 times (OR=3.72, 95% CI=1.40–10.95) than those who never received ANC.

To formulate an effective intervention strategy, the following three points should be considered: community-based activities to secure transportation; promotion of HC utilization for easier access to SBA deliveries and dissemination of the Free MCH policy.

Keywords: Lao PDR, skilled birth attendants, accessibility, antenatal care, safe delivery

Introduction

Recently, the global health community has motivated efforts to reduce the under-five mortality rate and the maternal mortality ratio in developing countries, including the Lao People's Democratic Republic (Lao PDR)[1]. However, reduction of maternal and child deaths remains a significant issue in the Lao PDR, which had a maternal mortality ratio of 197 in 2015[2] and a neonatal mortality rate of 30 in 2015, and in South Asian and African countries[3]. The improvements in reproductive, maternal, newborn and child health (RMNCH) of the Lao PDR are lagging in comparison to the other ASEAN countries.

The skilled birth attendant (SBA) at delivery is regarded as a key intervention to reduce maternal and neonatal mortality worldwide[4-5]. The World Health Organization (WHO) defines an SBA as "an accredited health professional – such as a midwife, doctor or nurse – who has been educated and trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborns"[6]. The Lao government prioritized RMNCH and formulated the "National Strategy and Action Plan for Integrated Services on Reproductive, Maternal, Newborn and Child Health 2016-2025", which focused on expansion of the coverage of RMNCH services including SBA delivery. In accordance with the "SBA Development Plan 2008–2012 ("the SBA Plan")" , which is now being succeeded by the "Midwifery Improvement Plan 2016-2020", efforts have been made to increase the rate of SBA deliveries by training and deploying SBAs. In the SBA Plan, SBAs are defined as "a midwife or a nurse, physician or medical assistant with midwifery skills, including as minimum, core competencies to provide the Basic Emergency Obstetric and Newborn Care (BEmONC)". On the basis of the SBA Plan, 1784 of midwives have been produced by providing training by the Lao government and deployed to fixed health facilities, although an accreditation system is not yet established. SBAs provide RMNCH services in the health facility or through outreach to the community. The country has a sparsely distributed population and mountainous areas, and increasing access to RMNCH services is challenging. In 2010, to address the financial barriers to access of these services, the government introduced a national "Free Maternal and Child Health (MCH) policy", which dispenses with user fees and provides small cash payments to cover opportunity and transportation costs[7]. However, the rate at which SBAs are utilized in delivery care (41.5% in 2011/2012) remains low in the Lao PDR[8]. At the time of this study, although some changes have been recognized in practices and beliefs regarding pregnancy and childbirth[9], those specific to the Lao culture such as preference to home delivery, still inform some women's choices in relation to childbirth.

Under these circumstances, an effective intervention is expected to increase SBA delivery. The previous studies indicated that multiple factors such as accessibility may affect the selection of SBA deliveries[10-11]. A previous qualitative study in the Lao PDR claimed that various factors affect the selection of SBA delivery, including accessibility, cultural practices and beliefs, gender and socio-economic factors[12]. Studies in other developing countries pointed out the importance of the availability of

transportation, accessibility, the receipt of antenatal care (ANC), the women's perception of labor progress, the close proximity of attendants other than SBAs, women's decision-making power, the receipt of maternal and child health care information and educational status[13–15]. However, the influence of each of these possible determinants on the selection of an SBA delivery in the Lao PDR remains unclear, since quantitative studies have not been done in this county. With this background, a quantitative study to explore the major determinants for the selection of an SBA delivery was performed. Possible determinants that were included in our analysis were chosen based on previous qualitative studies in the Lao PDR and the concept of "Birth Preparedness and Complication Readiness (BP/CR)", which is "a strategy to promote the timely use of skilled maternal and neonatal care"[16]. According to the category of indicators of BP/CR, the selected factors are categorized into five groups, namely "cultural factors", "health-seeking behavior-related factors", "social factors", "physical and economic factors" and "ANC received". Verification of the major factors associated with SBA delivery would contribute to the formulation of effective intervention strategies to increase the coverage of SBA delivery by decision makers at the national and sub-national levels in the Lao PDR and in countries with a similar background. Therefore, this study was conducted to verify the major determinants for the selection of an SBA delivery by examining the association between the delivery with an SBA and its potential determinants, which would contribute to the development of a strategic approach to increase the coverage of SBA delivery.

Methods

Study design and setting

A cross-sectional study was conducted in Attapeu province, where the indicators of RMNCH were low among the 17 provinces of the Lao PDR at the time of survey. Attapeu province is located at the southeast end of the country, along the borders of Vietnam and Cambodia. The province, which contains large mountainous areas, had a population of 141,541 in 2015[17]. The province is divided into five districts, with total of provincial hospital, five district hospitals and 30 first-level health centers (HCs). In 2011/2012, the skilled birth attendance rate in the province was 19.7%[7], which was far below the national average (41.5% in 2011/2012) .

The outcome was having an SBA delivery for the most recent deliveries in the past two years. The SBA was defined as "health professionals" such as midwives or physicians, nurses and medical assistants with midwifery skills, not including traditional birth attendants (TBAs). The factors were selected from the indicators set based on the concept of "Birth Preparedness and Complication Readiness"[17]. The selected factors are defined in the Annex 2. The factors were categorized into five groups, namely "cultural factors", "health-seeking behavior-related factors", "social factors", "physical and economic factors" and "ANC received". The survey was conducted from September 1, 2015 to September 11, 2015.

Sampling procedure

The study population comprised of 374 women who had given birth within two years before the survey in Attapeu province and were from six

villages in the catchment areas of three HCs. The total population was 9,061 and it corresponded to 6.4% of the total population of Attapeu province (9,061/141,541). The number of birth was 363 and it corresponded to 6.6% of the total number of birth in the province (363/5,512). A multi-stage sampling was used because villages were dispersed over the province, and travelling was difficult due to poor road conditions. First, we selected two districts based on the criteria to reduce the potential for bias, one from urban and one from rural districts. Then, two HCs were randomly selected from each of the districts. Finally, of the villages in the catchment area of each HC, one village was selected from the area close to the HC and the other was selected in order of the population size from the area far from the HC. The definition of close to/far from the HC was based on the Lao governments' definition, "close to" means half day round trip from the HC and "far from" means the distance reachable within one day trip. Among 8 selected villages, two villages were selected randomly to conduct a pre-survey to validate the questionnaires. Finally, data collection was done in the six villages (Figugure 1).

Because of prior information of the percentage of SBA delivery, the percentage of outcome variable of this survey was 41.5[7], so the target number was set as 374 cases sample size calculated using confidence level [CI] of 95% and the error accepted by the authors of 5%. The feasible sample size was decided based on the number of children below one year old targeted for vaccination in 2016 by the vaccine service as estimated by the Ministry of Health, the Lao PDR.

Data collection

A structured questionnaire was administered by 10 Laotian interviewers, all of whom had a basic knowledge of public health. They were trained in interview skills during a one-day session and received practical training at the pre-test villages. To avoid recall bias, only women in the study population who gave birth within two years before the survey were included, and those who refused or stopped taking the survey were excluded. Laotian interviewers read the written consent form to all participants prior to the interview, and verbal consent was obtained from all participants. The names and addresses of those who agreed to be interviewed were recorded on the interview record by the interviewers. In September 2015, the interviewers collected data about the last birth of the women through door-to-door home visits. If more than one eligible woman was present in each household, all of them were surveyed. In case the eligible woman was not at home, the interviewers made a second visit or followed her to where she was. A Laotian coordinator with similar work experience, together with the Principal Investigator (the first author), supervised the data collection and checked for missing data and incorrect answers. SBA delivery was measured according to whether the respondent indicated that a "health professional" was present at the delivery.

Most of the questions in the questionnaire were adapted from a standardized questionnaire on "Birth Preparedness and Complication Readiness" that was developed by the Johns Hopkins Program for International Education in Gynecology and Obstetrics (JHPIEGO)[17]. The questionnaire for the survey, which was prepared in English and subsequently

translated into the Lao language, was checked by back translation and pre-tested on 10 Lao women for content validity and understanding.

Data analysis

First, the distribution of each variable across the study participants was checked. Then, a simple logistic regression was performed to examine the association between the outcome and each of the exposures. A likelihood ratio test was used to test the association. Finally, the multiple logistic regression was performed using the stepwise method. All of the factors shown in Table 2 were entered, and the exposure variables were selected by the stepwise method with the inclusion and exclusion criteria set at 20%. To avoid multicollinearity, one variable was removed at a time and it was decided whether to include the variable in the model according to whether its exclusion from the model changed effect estimates and standard errors of other variables. The association of the outcome and exposures was tested with the likelihood ratio test. The trend of having an SBA delivery associated with the time of ANC visits was also tested using a logistic regression model by entering the rank score (1, 2 and 3; number of times) of ANC as a continuous variable. It was assumed that the number of women having an SBA delivery would increase with the increase in the number of ANC visits. The SAS software program (version 9.3; SAS Institute Inc., Cary, NC, USA) was used for analysis.

Ethics approval

This study received ethical approval from the Ethical Review Board of Teikyo University (No. 15–035) in Japan and from the National Ethical Committee for Health Research (No. 057/2015) in the Lao PDR.

Results

Characteristics of the participants

As shown in Figure 1, in total, data was collected from 393 targets. Thus, total of 365 women were included after the data cleaning. Table 1 shows 29.4% of the participants (n = 374) were between 17 and 21 years of age, with 55.6% being of Lao ethnicity and the rest belonging to other ethnic groups (including Oye, Brao and Lavae). The mean age of the first marriage was 19.1 years. Regarding the educational level, 16.8% had never attended school, and 50.8% were educated up to a primary level. More than 55.0% had no difficulty in reading letters, whereas 19.0% were not able to read at all. Regarding employment status, 17.1% had paid work. For childbirth, 37.4% had given birth to only one child. Of the 374 participants, 179 women (47.9%) reported that their delivery had been attended by an SBA.

The simple logistic regression analysis showed that SBA delivery was negatively associated with residence in villages far from the HC (crude odds ratio [COR] = 0.33, 95% CI= 0.22–0.50), lack of transportation (COR = 0.10, 95% CI= 0.06–0.17) and the lack of knowledge about the "Free MCH policy" (COR = 0.44, 95% CI= 0.29–0.67) (Table 2). The odds of having an SBA delivery was 10 times higher among women who had received ANC more than 4 times (COR = 10.76, 95% CI= 4.94–27.04) compared to those who did not receive ANC.

The multiple logistic regression showed that a SBA delivery was less likely to be selected if a

Table 1 Distribution of the participants by socio-demographic factors

Socio-demographic factors	Number	Percent
Current age in years		
17-21	110	29.4
22-25	102	27.3
26-28	69	18.4
≥ 29	93	24.9
Currently being pregnant		
Yes	21	5.7
No	346	94.3
Ethnic groups		
Lao	208	55.6
Other	166	44.4
Marital status		
Married	361	96.5
Other (widowed, divorced and separated)	13	3.5
Marital age in years		
12-17	103	27.5
18	91	24.3
19-20	100	26.7
＞20	80	21.4
Living with partner		
Yes	362	96.8
No	12	3.2

Table 1 Distribution of the participants by socio-demographic factors (cont.)

Socio-demographic factors	Number	Percent
Education by grade completion		
Never attended	63	16.8
Primary (1-5 years)	190	50.8
Lower secondary (6-9 years)	89	23.8
Upper secondary (10-12 years)	19	5.1
Post secondary	13	3.5
Literacy levels		
Able to read a letter easily	209	55.9
With difficulty	94	25.1
Not at all	71	19.0
Having paid work		
Yes	64	17.1
No	310	82.9
Number of children born		
1	140	37.4
2	118	31.6
3	46	12.3
≥ 4	70	18.7

Table 2 Crude odds ratios and 95% confidence interval for each factor associated with SBA delivery

Factors		SBA delivery (n = 179)		Non-SBA delivery (n= 195)		Crude odds ratio	95% confidence interval		P- value
		Number (%)					Lower	Upper	
Physical and economic factors									
	Village close to Health Center	119	(66.5)	77	(39.5)	1.00			
	Village far from Health Center	60	(33.5)	118	(60.5)	0.33	0.22	0.50	**<.001**
	Transportation available to reach facility	153	(85.5)	73	(37.4)	1.00			
	Not available	26	(14.5)	122	(62.6)	0.10	0.06	0.17	**<.001**
	Know the free MCH policy	124	(69.3)	97	(49.7)	1.00			
	Do not know	55	(30.7)	98	(50.3)	0.44	0.29	0.67	**<.010**
	Concerned about cost	58	(32.4)	78	(40.0)	1.00			
	Not concerned	121	(67.6)	117	(60.0)	1.39	0.91	2.13	0.130
	Health insurance covered	7	(3.9)	3	(1.5)	1.00			
	Not covered	172	(96.1)	192	(98.5)	0.38	0.08	1.40	0.270##
Antenatal care (ANC) received									
	Never received ANC	6	(3.4)	49	(25.1)	1.00			
	1 to 3 times	47	(26.3)	62	(31.8)	5.42	2.38	14.05	**<.010**
	≥ 4 times	125	(69.8)	83	(42.6)	10.76	4.94	27.04	**<.001**
	Do not know / remember	1	(0.6)	1	(0.5)				

Table 2 Crude odds ratios and 95% confidence interval for each factor associated with SBA delivery (cont.)

Factors	SBA delivery (n = 179)		Non-SBA delivery (n= 195)		Crude odds ratio	95% confidence interval		P- value
	Number (%)					Lower	Upper	
Planned to deliver at the actual birth place	151	(84.4)	151	(77.4)	1.00			
Not planned	27	(15.1)	44	(22.6)	0.61	0.36	1.04	0.070
Do not know	1	(0.6)	0	(0.0)				
Advice from health staff (HS) for institutional delivery and from family members for home delivery #								
HS (+) and family (-)	116	(64.8)	64	(32.8)	1.00			
HS (+) and family (+)	58	(32.4)	94	(48.2)	0.34	0.22	0.53	**<.001**
HS (-) and family (+/-)	5	(2.8)	37	(19.0)	0.08	0.03	0.18	**<.001**
Wish for natural birth	168	(93.9)	176	(90.3)	1.00			
No wish	11	(6.1)	19	(9.7)	0.61	0.27	1.29	0.200
Worry about care practices at facility	71	(39.7)	65	(33.3)	1.00			
Not worry	108	(60.3)	130	(66.7)	0.76	0.50	1.16	0.200
Wished to lie on a hot bed (roast) after delivery	167	(93.3)	184	(94.4)	1.00			
No wish	12	(6.7)	11	(5.6)	1.20	0.51	2.84	0.670
Wish family members nearby	178	(99.4)	185	(94.9)	1.00			
No wish	1	(0.6)	10	(5.1)	0.10	0.01	0.55	**0.020##**

Table 2 Crude odds ratios and 95% confidence interval for each factor associated with SBA delivery (cont.)

Factors		SBA delivery (n = 179)		Non-SBA delivery (n= 195)		Crude odds ratio	95% confidence interval		P- value
		Number (%)					Lower	Upper	
Health care seeking behavior related factors	Serious health problem during childbirth	25	(14.0)	15	(7.7)	1.00			
	No problem	154	(86.0)	180	(92.3)	0.51	0.26	1.00	0.050
	Worried about quality of care	21	(11.7)	29	(14.9)	1.00			
	Not worried	158	(88.3)	166	(85.1)	1.31	0.72	2.43	0.370
	Rapid labor progress (< 3 hours)	88	(49.2)	125	(64.1)	1.00			
	Not rapid	91	(50.8)	70	(35.9)	1.85	1.22	2.80	**<.010**
	Worried about attitude of health staff	20	(11.2)	27	(13.8)	1.00			
	Not worried	159	(88.8)	168	(86.2)	1.28	0.69	2.40	0.440
	Worried about seeing male health staff	58	(32.4)	61	(31.3)	1.00			
	Not worry	121	(67.6)	134	(68.7)	0.95	0.61	1.47	0.820
	Worried about lack of privacy at facility	26	(14.5)	32	(16.4)	1.00			
	Not worried	153	(85.5)	163	(83.6)	1.16	0.66	2.04	0.620

Table 2 Crude odds ratios and 95% confidence interval for each factor associated with SBA delivery (cont.)

Factors		SBA delivery (n = 179)		Non-SBA delivery (n= 195)		Crude odds ratio	95% confidence interval		P- value
		Number (%)					Lower	Upper	
Sociodemographic F actors	Current age in years								
	17-21	62	(34.6)	48	(24.6)	1.00			
	22-25	51	(28.5)	51	(26.2)	0.77	0.45	1.33	0.350
	26-28	28	(15.6)	41	(21.0)	0.53	0.29	0.97	**0.040**
	≥ 29	38	(21.2)	55	(28.2)	0.54	0.30	0.93	**0.030**
	Currently pregnant	9	(5.1)	12	(6.3)	1.00			
	Not currently pregnant	169	(94.9)	177	(93.7)	1.27	0.53	3.19	0.590
	Ethnic group								
	Lao	118	(65.9)	90	(46.2)	1.00			
	Other	61	(34.1)	105	(53.8)	0.44	0.29	0.67	**<.010**
	Marital status								
	Married	173	(96.6)	188	(96.4)	1.00			
	Other (widowed, divorced and separated)	6	(3.4)	7	(3.6)	0.93	0.30	2.86	0.900
	Marital age in years								
	12-17	57	(31.8)	46	(23.6)	1.00			
	18	35	(19.6)	56	(28.7)	0.50	0.28	0.89	**0.020**
	19-20	53	(29.6)	47	(24.1)	0.91	0.52	1.58	0.740
	≥ 21	34	(19.0)	46	(23.6)	0.60	0.33	1.07	0.090
	Living with partner	173	(96.6)	189	(96.9)	1.00			
	Not living with partner	6	(3.4)	6	(3.1)	1.09	0.34	3.55	0.880

Table 2 Crude odds ratios and 95% confidence interval for each factor associated with SBA delivery (cont.)

Factors	SBA delivery (n = 179)		Non-SBA delivery (n= 195)		Crude odds ratio	95% confidence interval		P- value
	Number (%)					Lower	Upper	
Education level by grade completion								
Never attended	26	(14.5)	37	(19.0)	1.00			
Primary (1-5 years)	89	(49.7)	101	(51.8)	1.25	0.71	2.25	0.440
Lower secondary (6-9 years)	45	(25.1)	44	(22.6)	1.46	0.76	2.81	0.260
Upper secondary (10-12 years)	9	(5.0)	10	(5.1)	1.28	0.45	3.62	0.640
Post secondary	10	(5.6)	3	(1.5)	4.74	1.31	22.71	**0.030**
Literacy level								
Able to read a letter easily	115	(64.2)	94	(48.2)	1.00			
With difficulty	37	(20.7)	57	(29.2)	0.53	0.32	0.87	**0.010**
Not at all	27	(15.1)	44	(22.6)	0.50	0.29	0.87	**0.010**
Have paid work	43	(24.0)	21	(10.8)	1.00			
No paid work	136	(76.0)	174	(89.2)	0.38	0.21	0.67	**<.010**
Number of children born								
1	88	(49.2)	52	(26.7)	1.00			
2	53	(29.6)	65	(33.3)	0.48	0.29	0.79	**<.010**
3	17	(9.5)	29	(14.9)	0.35	0.17	0.68	**<.010**
≥ 4	21	(11.7)	49	(25.1)	0.25	0.14	0.46	**<.001**

New variable is formed by combining dichotomous response option to the question on advice. Family members include husband, mother, mother-in-law and relatives.

##An exact test was conducted.

woman lived in a village far from a HC (Adj. OR = 0.35, 95% CI= 0.19–0.64), lack of transportation (Adj. OR = 0.13, 95% CI= 0.06–0.25) or lack of knowledge about the Free MCH policy (Adj. OR = 0.52, 95% CI= 0.28–0.98) (Table 3). The odds of having an SBA delivery was more than three times higher among those who received ANC more than 4 times (Adj. OR = 3.72, 95% CI= 1.40–10.95) compared to those who never received ANC. The test for trend revealed that the OR of SBA delivery increased as the number of ANC visits increased ($\beta = 0.59$, $P < 0.010$).

The odds of having an SBA delivery among women who received advice from health staff for institutional delivery and advice from family members to have a home delivery was almost half (OR = 0.49, 95% CI = 0.26-0.92) that of the women who received advice from health staff and not from family members. In addition, the lack of a plan for the birth place (OR = 0.33, 95% CI= 0.16-0.67) and the absence of health problems during childbirth (OR = 0.15, 95% CI=0.05-0.45) were associated with lower odds of having an SBA delivery. In contrast, the absence of concerns in relation to the quality of care at the facility doubled the odds of having an SBA delivery (Adj. OR = 2.61, 95% CI = 1.06-6.52).

Discussion

SBA delivery is a key intervention to reduce maternal mortality, and it is also a key strategy for RMNCH in the Lao PDR. This study showed that proximity to the HC, availability of transportation and knowledge about the Free MCH policy were potential major determinants of an SBA delivery. In addition, the results suggested that ANC represented an effective opportunity to promote SBA delivery and that family members' advice and the planning of the birth place affected the selection of an SBA delivery. Moreover, serious health problems during childbirth and concerns over the quality of care at the facility were associated with SBA delivery.

These determinants of SBA delivery were also indicated in previous studies in developing countries and in the Lao PDR. Thus, it is believed that the results of this study are consistent with previous studies. This study showed which determinants were strongly associated with SBA delivery among various factors, while such quantitative analysis had not been done for the RMNCH in the Lao PDR. The results support the interventions to increase the skilled birth attendance rate in accordance with the "National Strategy and Action Plan for Integrated Services on Reproductive, Maternal, Newborn and Child Health 2016-2025" ("National Strategy")[18].

On the basis of these results, the following four interventions would be suggested: 1) community-based activities, 2) promotion of HC utilization, 3) dissemination of Free MCH information and 4) promotion of birth preparedness through ANC.

Community-based activities

First, a community-based activity is proposed, built on the existing community-based health network such as the Village Health Committee, Village Health Volunteers (VHVs) and the Village Lao Women's Union to secure transportation because the availability of transportation was one of the major determinants of SBA delivery. This result corresponds to those of preceding studies[13,19]. In other developing countries, community-based activities have been conducted,

Table 3 Adjusted odds ratio and 95% confidence interval for factors associated with SBA delivery

Factors	Adjusted odds ratio	95% confidence interval		P- value
		Lower	Upper	
Physical and economic factors				
Village close to Health Center	1.00			
Village far from Health Center	0.35	0.19	0.64	**<.001** †
Transportation available to reach facility	1.00			
Not available	0.13	0.06	0.25	**<.001** †
Know the free MCH policy	1.00			
Do not know	0.52	0.28	0.98	**0.040** †
Concerned about cost	1.00			
Not concerned	1.77	0.94	3.37	0.080
Antenatal care (ANC) received				
Never received ANC	1.00			
1 to 3 times	2.51	0.89	7.80	0.090
≥4 times	3.72	1.40	10.95	**0.010** †
Test for trend				**<.010**

Table 3 Adjusted odds ratio and 95% confidence interval for factors associated with SBA delivery (cont.)

Factors	Adjusted odds ratio	95% confidence interval		P- value
		Lower	Upper	
Advice from health staff (HS) for facility delivery and from family members for home delivery				
HS (+) and family (-)	1.00			
HS (+) and family (+)	0.49	0.26	0.92	**0.030**
HS (-) and family (+/-)	0.28	0.07	1.02	0.070
Wish for natural birth	1.00			
No wish	0.26	0.06	1.11	0.070
Wished to lie on a hot bed (roast) after delivery	1.00			
No wish	6.00	1.06	45.14	0.060
Health care seeking behavior related factors				
Serious health problem related to birth	1.00			
No problem	0.15	0.05	0.45	**<.010** †
Worried about quality of care	1.00			
Not worried	2.61	1.06	6.52	**0.040**
Rapid labor progress (< 3 hours)	1.00			
Not rapid	1.84	1.00	3.42	0.050 †
Worried about lack of privacy at facility	1.00			
Not worried	0.51	0.21	1.21	0.130

Table 3 Adjusted odds ratio and 95% confidence interval for factors associated with SBA delivery (cont.)

Factors	Adjusted odds ratio	95% confidence interval		P- value
		Lower	Upper	
Have paid work	1.00			
No paid work	0.23	0.10	0.52	**<.001** †
Number of children born $$	0.64	0.48	0.85	**<.001** †

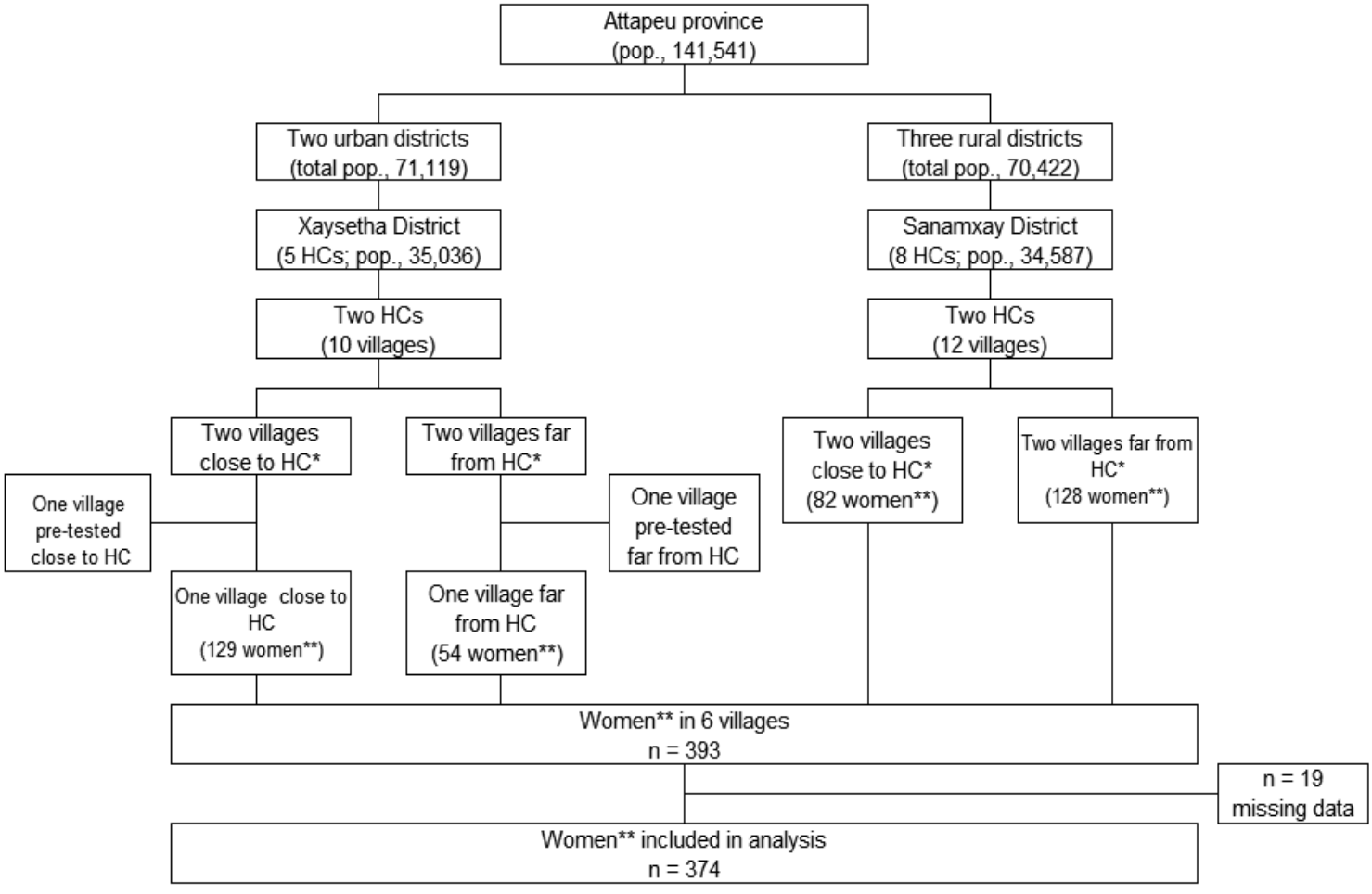
Note: Deviance 301 (df = 341), $p = 0.942$.

† Significant in variable selection by stepwise method with inclusion and exclusion criteria of 0.05 (sensitivity analysis)

$ The last three categories are combined, since the odds ratios of each category are almost the same.

$$ Continuous variable used instead of categorical, since a linear trend was observed.

Figure 1 Flow-chart of the sampling procedure



All of the population data is from the EPI office, Ministry of Health, Lao PDR.

* Out of villages under the control of each HC, 1 village close to and 1 village accessible on a day trip from HC were selected in order of the population size.

** Women interviewed who gave birth within 2 years. HC, Health Center

including formulating women's groups, the establishment of emergency funds by community groups[20], purchasing ambulance vehicles, and using volunteers to accompany the pregnant women to the health facility, and some of these activities were found to be effective[21]. In rural areas in the Lao PDR, reflecting cultural contexts, the measures that facilitate the lending and borrowing of vehicles among villagers is proposed in areas with limited public transportation with the establishment of a community group for birth preparedness coordinated by VHVs, the members of the Lao Women's Union and TBAs whom the villagers may trust. Birth preparedness includes "identifying a skilled provider and making the necessary plans to receive skilled care"[17]. Community groups could encourage each woman or her family to save or borrow money to cover the cost of transportation. Education on the risks of pregnancy and delivery and on the significance of SBA delivery should also be provided through the community group. There is also strong evidence that a community-based intervention would improve the uptake of ANC[22].

Promotion of HC utilization

Second, the promotion of HC utilization is proposed. This is related with the factor of proximity to the HC. The HC was not fully utilized especially in the villages far from HC. For 20.2% of the participants from villages far from the HC (n = 178), the birth place was the provincial hospital; in contrast, only 2.8% of the births took place at the HC (Fig. 2). The HC can be accessed at a lower cost than the provincial hospital. Therefore, the promotion of HC utilization would enable women to access an SBA delivery more easily. Although an SBA was deployed in all three of the surveyed HCs, their first-level intrapartum care was limited. The capacity of care at HCs, including first-level intrapartum care, should be upgraded in parallel with the promotion of HC utilization. Moreover, the attendance of home deliveries by HC staff can be a transitional option for women with transportation difficulties in villages far from the HC until accessibility is improved, including improvement of road conditions. The community members (i.e., VHVs, members of the Lao Women's Union and TBAs) could play a role in connecting villagers with the HC, which would lead to the promotion of SBA delivery. All the recommendations in this paragraph also support the "National Strategy" to strengthen communication between HC staff and community, to promote active community participation on birth preparedness, and to promote the utilization of HCs and SBAs.

Dissemination of Free MCH information

Third, although it was obvious that knowledge about the Free MCH policy was associated with SBA delivery, 40.9% of the participants had no knowledge about it. This suggests that there is a need to disseminate information about the policy at opportunities such as health promotion days, outreach activities and ANC sessions. As women with a higher educational background were more likely to know about the Free MCH policy (OR = 1.3, 95% CI=1.03–1.65), it is necessary to provide information that is easily understood by people with lower educational levels. In the Free MCH protocol, the transportation fee is subsidized only for institutional delivery.

Promotion of birth preparedness through ANC

Fourth, the promotion of the aforementioned birth preparedness should be encouraged through ANC. ANC was found to be an important opportunity at which to promote SBA delivery because the result of the analysis showed the OR of SBA delivery increased as the number of ANC visits increased. The rate of women who received ANC at least once amounted to 85.3%. To promote planning of the birth place and transportation, it would be necessary for HC staff to encourage SBA delivery not only to pregnant women but also to their family members. HC staff also should provide education on the risks of pregnancy and delivery, even if no health problems are observed, and on the significance of SBA delivery. Enhancing the quality of ANC can also be expected to reduce women's concerns about the quality of care at health facilities.

Limitation of the study

First, this study did not cover the hardest-to-reach villages, which might have different determinants. Second, the economic status and the socio-demographic and cultural factors of the husband or partner were not included in this study due to limited availability of data. Third, the sample size was decided according to feasibility of the survey conditions and within the limitations of time and budget even though the formula of prevalence calculation was used. Finally, a sampling weight was not applied because the rollout was introduced in six villages. These limitations should be addressed in a future study. Nonetheless, the research result and recommendations are applicable to other areas with a similar background to Attapeu province.

Conclusions and recommendations

Proximity to a HC, availability of transportation and knowledge about the Free MCH policy were the potential major determinants of SBA delivery. A community-based activity to secure transportation is critical to promote SBA delivery. Promotion of HC utilization is necessary in addition to publicizing the Free MCH policy and promoting birth preparedness through ANC.

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References

1. World Health Organization. Success factors for women's and children's health: Lao PDR.; 2015.
2. World Health Organization. Trends in maternal mortality: 1990 to 2015, estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division. WHO, Geneva; 2015.
3. United Nations Inter-agency Group for Child Mortality Estimation. Levels and trends in child mortality: report 2015. United Nations Children's Fund, New York, 2015.
4. Campbell OM, Graham WJ. Strategies for reducing maternal mortality: getting on with what works. Lancet. 2006; 368(9543):1284-99.
5. Bhutta ZA, Das JK, Bahl R, Lawn JE, Salam RA, Paul VK, Sankar MJ, Blencowe H, Rizvi A, Chou

VB, Walker N; Lancet Newborn Interventions Review Group; Lancet Every Newborn Study Group. Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost? Lancet. 2014; 384(9940):347-70.

6. World Health Organization. Making pregnancy safer: the critical role of the skilled attendant: a joint statement by WHO, ICM and FIGO. World Health Organization. 2004.
7. The World Bank. Maternal health out-of-pocket expenditure and service readiness in Lao PDR. The World Bank. 2013.
8. The Government of Lao PDR. Lao social indicator study (LSIS) 2011-2012. Ministry of Health and Lao Statistics Bureau. 2012.
9. Alvesson HM, Lindelow M, Khanthaphat B, Laflamme L. Changes in pregnancy and childbirth practices in remote areas in Lao PDR within two generations of women: implications for maternity services. Reprod Health Matters. 2013; 21(42):203-11.
10. World Health Organization. Maternal mortality, Key Facts [Cited 2018 October 1] Available from: http://www.who.int/en/news-room/fact-sheets/detail/maternal-mortality
11. Koblinsky M, Matthews Z, Hussein J, Mavalankar D, Mridha MK, Anwar I, Anwar I, Achadi E, Adjei S, Padmanabhan P, Marchal B, De Brouwere V, van Lerberghe W; Lancet Maternal Survival Series steering group. Going to scale with professional skilled care. Lancet. 2006; 368(9544):1377-86.
12. Sychareun V, Hansana V, Somphet V, Xayavong S, Phengsavanh A, and Popenoe R. Reasons rural Laotians choose home deliveries over delivery at health facilities: a qualitative study. BMC Pregnancy and Childbirth. 2012; 12:86.
13. Edmonds JK, Paul M, Sibley L. Determinants of place of birth decisions in uncomplicated childbirth in Bangladesh: An empirical study. Midwifery. 2012; 28(5):554-60.
14. Hailu D, Berhe H. Determinants of institutional childbirth service utilisation among women of childbearing age in urban and rural areas of Tsegedie district, Ethiopia. Midwifery. 2014; 30(11):1109-17.
15. Choulagai B, Onta S, Subedi N, Mehata S, Bhandari GP, Poudyal A, Shrestha B, Mathai M, Petzold M, Krettek A. Barriers to using skilled birth attendants' services in mid- and far-western Nepal: a cross-sectional study. BMC Int Health Hum Rights. 2013; 13:49.
16. JHPIEGO. Monitoring birth preparedness and complication readiness: Tools and indicators for maternal and newborn health. 2004.
17. Ministry of Health, Expanded program on immunization. Vientiane Capital, Lao PDR: Ministry of Health, 2015.
18. Ministry of Health. National Strategy and Action Plan for Integrated Services on Reproductive, Maternal, Newborn and Child Health 2016-2025. Lao PDR, 2017.
19. Tey, NP., and Lai, SL. Correlates of and barriers to the utilization of health services for delivery in South Asia and Sub-Saharan Africa. The Scientific World Journal, 2013; 2013:423403.
20. Kamiya Y, Yoshimura Y, Islam MT. An impact evaluation of the safe motherhood promotion

project in Bangladesh: evidence from Japanese aid-funded technical cooperation. Soc Sci Med. 2013; 83:34-41.

21. Hussein, J., Kanguru, L., Astin, M., & Munjanja, S. What kinds of policy and programme interventions contribute to reductions in maternal mortality? The effectiveness of primary level referral systems for emergency maternity care in developing countries. Social Science Research Unit, Institute of Education, University of London; 2011.
22. Mbuagbaw L, Medley N, Darzi A, Richardson M, Habiba Garga K, Ongolo-Zogo P. Health system and community level interventions for improving antenatal care coverage and health outcomes. Cochrane Database Systematic Review. 2015; (12):CD010994.