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Factors Associated with Prenatal Care, Institutional
Delivery and Cesarean section among Adolescents in
Lao People's Democratic Republic: A Nationwide
Cross-sectional Study

ラオス国内の思春期女性における妊婦健診、施設分娩

及び帝王切開分娩に関連する因子の横断的研究

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**Factors Associated with Prenatal Care, Institutional Delivery and Cesarean section among Adolescents in Lao People's Democratic Republic: A Nationwide Cross-sectional Study**

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## Introduction

As countries work towards achieving the Sustainable Development Goals (SDGs), they are committing to "*no one left behind*". It emphasizes the role of the health sector in addressing the needs of the most disadvantaged and vulnerable. The targets of SDGs include reducing poverty, ensuring healthy lives and promoting well-being at all ages, achieving equitable access to education, and gender equality (United Nations [UN], 2016). Meanwhile, women and girls continue to experience economic discrimination, political and institutional underrepresentation, reproductive health inequalities, challenges in accessing quality education, gender-based violence, and harmful traditional practices (World Health Organization [WHO], 2014).

Worldwide, around 1.2 billion people are adolescents between the ages of 10 and 19 (WHO, 2020), and approximately 16 million adolescent women aged 15 to 19 years and two million girls under age 15 years became pregnant every year (United Nations Population Fund [UNFPA], 2015). Although the global adolescent birth rate

has declined remarkably, babies born to adolescent mothers were reported roughly 11%
of all births, and about 95% of those were estimated to be occurring in developing
countries (WHO, 2020). In the South-East Asia region alone, six million adolescent
girls were giving birth each year, which was on an average of 16% of all births in the
region (WHO, 2015). The highest adolescent birth rate at the country level in the South-
East Asia region was 94 per 1000 aged 15 to 19 years seen in Lao PDR (Ministry of
Health/Lao, and Lao Statistics Bureau, 2012). That rate was higher than the average
adolescent birth rate of 35 in South Asia and the global average of 50 per 1000 females
aged 15 to 19.

It has been indicated that adolescent pregnancy is associated with maternal
mortality and also morbidity (Conde-Agudelo, Belizan, & Lammers, 2005; Scholl,
Hediger, & Belsky, 1994; Sharma, Verma, Khatri, & Kannan, 2002). Under the
circumstances, antenatal care (ANC) visits are one of the few opportunities for women
to seek care for their health in resource-poor settings, and an important opportunity to
help women best prepare for childbirth, as well as inform them about pregnancy-related
complications and the benefits of skilled delivery care (Magoma, Requejo, Campbell,
Cousens, & Filippi, 2010). Institutional delivery is an effective intervention to reduce
maternal mortality (Darmstadt, Bhutta, Cousens, Adam, Walker, de Bernis, et al.,

2005). In fact, researchers estimate that around 16% to 33% of all maternal deaths are avoidable through the prevention of four main complications (obstructed labor, eclampsia, puerperal sepsis and hemorrhage) and by skilled attendance at delivery (Graham, Bell, & Bullough, 2000).

In recent years, addressing the social determinants of health (SDOH) that affect teenage pregnancy have been identified as critical to eliminating disparities and achieving health equity (Fuller, White, Chu, Dean, Clemmons, & Chaparro, 2016). Although definitions of SDOH vary and what is or is not included in social determinants, the term can generally be thought of as differences in social conditions that lead to health inequalities (Maness, & Buhi, 2016). An SDOH based approach may identify and alter factors contributing to adolescent pregnancy that is not feasible with individual behavior change interventions.

Although the high percentage of early childbearing is occurring in Lao PDR, factors associated with the utilization of prenatal care and facility delivery among adolescents are not well investigated. Therefore, the aim of this study was to determine the factors associated with the utilization of prenatal care, facility delivery, and cesarean section among adolescent women using the Lao PDR population-based dataset.

## Methods

### Study Design and Data Sources

This is a cross-sectional study design with pooled Lao Social Indicator Survey II (LSISII) data from 2017 (Lao Statistic Bureau, 2018). This dataset, forming the sample frame, was from a national representative sample of a particular time and a population-based, cross-sectional survey conducted in all regions of Lao PDR. The Lao Statistics Bureau (LSB) and the Ministry of Health (MOH) collected the data with financial and technical support from development partners mainly UNICEF and UNFPA.

### Study Sample

The sample for LSISII is a probability-based, stratified cluster sample of 23,299 households. Of those subjects, 22,287 households were successfully interviewed. The current study used data from women's questionnaires. The total number of women's questionnaire was 26,088. The purposive sample included following data: (*a*) adolescent women aged 10-19 years at first delivery, *(b)* women aged 20-24 years at first delivery (as control), (*c*) women who ever had only one birth

given, and (*d*) women who had given birth within the last five years. Only those who

met the inclusion criteria were extracted.


**Measurements**

The following three variables, which were included in the LSISII, were used as

outcome variables: (*a*) received prenatal care, (*b)* facility delivery, and (*c*) delivery by

cesarean section. The current study assessed the distribution of the outcomes by age at

first birth, area of residence, region of residence, educational status, marital status,

ethnolinguistic group of household head, economic strata, and other confounding

factors as independent variables. We followed the WHO definition and  defined

adolescent as ages 10 through 19 years. In order to clarify the relationship of age and

year at delivery with outcomes, only women who ever had one birth were included. For

this purpose, the age of the first child was subtracted from the women's age at the time

of the interview, and the calculated age at the first birth was used in the current analysis.

Moreover, to minimize the bias from the variation of the year of delivery and the

possibility of recall bias, we restricted the sample to mothers who had given birth within

the past five years.

**Statistical Analysis**

Data were statistically analyzed using EZR (version. 1.4) software (Kanda, 2013). We examined whether adolescent and other factors were associated with the outcome variables of utilization of prenatal care, facility delivery, and cesarean section. Descriptive statistics were calculated for all variables. Univariate analysis was used to assess relationships between the factors and objective variables. We used multiple logistic regression, to control for the potentially confounding roles of variables, which are described as independent variables. After testing for all possible interactions among independent variables to eliminate the influence of confounders, adjusted odds ratio (AOR) and 95% confidence interval (CI) were calculated for all significant variables. Variables that could be considered clinically influential were also added to the explanatory variables. Logistic regression analysis was used to determine the factors associated with attending prenatal care, facility delivery and delivery by cesarean section. Variables with $p$-value less than 0.05 were taken as significant factors.

**Ethical Considerations and Dataset Access**

The survey protocol of LSISII was approved by the LSB in May 2016. The protocol included a Protection Protocol, which outlines the potential risks during the

survey and mitigation management strategies. Verbal consent was obtained for each

respondent participating, and for adolescents age 15-17 years individually interviewed;

adult consent was obtained in advance of the adolescents' assent. All respondents were

informed of their right to refuse answering all or particular questions, as well as to stop

the interview at any time (LBS, 2018). For current research, permission was given by

UNICEF to access the raw dataset of LSISII on the UNICEF Multiple Indicator Cluster

Survey (MICS) web portal (http://mics.unicef.org/surveys), after review of the

submitted brief descriptions of the study to the UNICEF. The datasets were treated with

utmost confidentially.


## Results

In terms of the women's questionnaire from the LSISII, 26,088 women were

successfully interviewed. A total of 1,925 women who met the inclusion criteria were

extracted from the LSISII dataset (Figure 1). Table 1 shows the sociodemographic

characteristics of the analyzed sample.

**Sociodemographic Characteristics**

Table 1 shows the sociodemographic characteristics of women. The mean age

± standard deviation (SD) of adolescents was 17.6 ± 2.5 years. More than 90% of

women were currently married. More than half of women were living in rural areas with

roads and classified as the Lao-Thai ethnolinguistic group. Nearly half of the women

had no education, early childhood education (ECE) or only primary education and about

40.6% of women were living in the Northern region.

**Figure 1**

*Flow Chart Showing Selection of Study Sample*



Cluster sample of LSIS II  2017
23,299 households

↓

Successfully interviewed LSIS II  2017
22,287 households

↓

Successfully interviewed using women's questionnaire
26,088 women

↓

Study sample who met the inclusion criteria
1,925 women
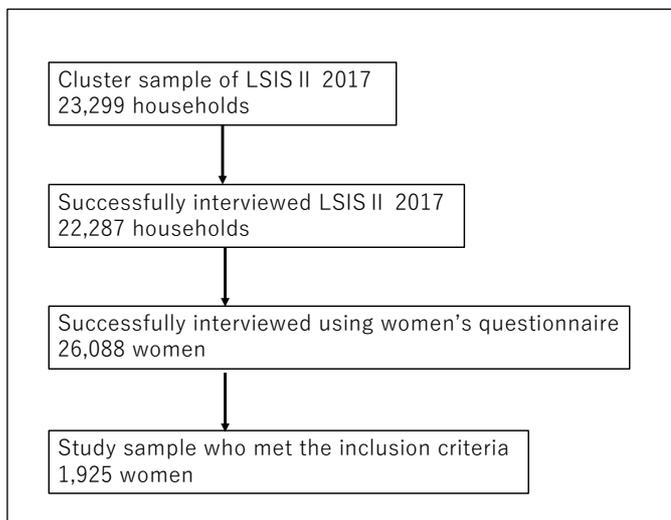
**Table 1**

*Sociodemographic Characteristics of Women*

| | Overall |
|---|---|
| Variable | n=1925 |
| **Age at first birth (years)** | 19.9 ± 2.5 |
| 20-24 years | 21.8 ± 2.5 |
| 10-19 years | 17.6 ± 2.5 |
| **Age at first birth (category)** | |
| 20-24 years | 1031 (53.6) |
| 10-19 years | 894 (46.4) |
| **Area** | |
| Urban | 498 (25.9) |
| Rural | 1427 (74.1) |
| - Rural with road | 1222 (63.5) |
| - Rural without road | 205 (10.6) |
| **Education** | |
| Post-secondary/ Non-tertiary/ Higher | 177 (9.2) |
| Lower secondary/ Upper secondary | 858 (44.6) |
| None or ECE/ Primary | 890 (46.2) |
| **Ethnolinguistic group of household head** | |
| Lao-Tai | 1063 (55.9) |
| Mon-Khmar | 524 (27.5) |
| Hmong-Mien | 247 (13.0) |
| Chinese-Tibetan | 68 (3.6) |
| **Marital union status of woman** | |
| Currently married/ in union | 1800 (93.5) |
| Formerly married/ in union | 123 (6.4) |
| Never married/ in union | 2 (0.1) |
| **Region** | |
| Central | 708 (36.8) |
| South | 436 (22.6) |
| North | 781 (40.6) |
| **Wealth index quintile** | |
| Middle/ Fourth/ Richest | 1042 (54.1) |
| Poorest/ Second | 883 (45.9) |
| **Covered by health insurance** | 207 (10.8) |
| **Early sexual intercourse (below 15 years)** | 116 (7.7) |
| **Mobile phone usage in the last 3 months** | 1503 (78.2) |
| **Own a mobile phone** | 1384 (72.0) |
| **Ever had a pregnancy that was miscarried** | 174 (66.9) |
| **Ever had miscarriages more than 2 times** | 9 (3.5) |
| **Number of miscarriages during lifetime** | 0.9 ± 0.8 |
| **Ever had a pregnancy that was stillbirth** | 28 (10.8) |
| **Ever had stillbirths more than 2 times** | 4 (1.5) |
| **Number of stillbirths during life time** | 0.2 ± 0.5 |
| **Ever used a method to avoid pregnancy** | 289 (28.2) |
| **Wanted to get pregnant at the time** | 229 (95.0) |
| **Received prenatal care** | 889 (88.2) |
| **Times received prenatal care** | 5.0 ± 2.3 |
| **Result of anemia testing: Hb level (g/dl)** | 12.2 ± 1.5 |
| **Facility delivery** | 751 (75.0) |
| **Delivery by cesarean section** | 63 (8.4) |
| **Weight at birth (grams)** | 2943.3 ± 475.8 |
| **Low birth weight** | 82 (10.7) |

*Note: Data are expressed as mean ± SD or n (%).*

**Prenatal Care**

A total of 1,008 women responded to 'if the women had received prenatal care'. In terms of the objective variable of received prenatal care at least onetime, 889 women (88.2%) answered "yes", and 119 women (11.8%) answered "no". A univariate analysis was conducted to see the association between each variable and the utilization of prenatal care. Table 2 shows the relationships between the sociodemographic and the utilization of prenatal care.

As a result of multiple logistic regression analysis, the regression equation and its variables finally adopted are shown in Table 3. The multiple logistic regression analysis showed the following factors as significantly associated with the utilization of prenatal care: area of residence (urban (reference); rural without road: AOR = 0.33, 95% CI [0.14 to 0.82], p < 0.05), education (lower secondary/ upper secondary (reference); None or ECE/ Primary: AOR = 0.37, 95% CI [0.22 to 0.62], p < 0.01), ethnolinguistic group of house hold head (Lao-Thai (reference); Hmong-Mien: AOR = 0.26, 95% CI [0.13 to 0.54], p < 0.01), (Lao-Thai (reference); Chinese-Tibetan: AOR = 0.08, 95% CI [0.03 to 0.21], p < 0.01), region of residence (Central (reference); South: AOR = 0.42, 95% CI [0.21 to 0.82], p < 0.05), wealth index quintile (Middle/ Fourth/

Richest (reference); Poorest/ Second: AOR = 0.32, 95% CI [0.16 to 0.61], p < 0.01),

and Own a mobile (No (reference); Yes: AOR = 2.52, 95% CI [1.34 to 4.74], p < 0.01).

**Table 2**

*Relationship between Sociodemographic Variables and Utilization of Prenatal Care*

| Variable | Received prenatal care[¶] | | |
|---|---|---|---|
| | No<br>n=119 | Yes<br>n=889 | *p*.value |
| **Age at first birth (years)** | 18.9 ± 2.4 | 20.0 ± 2.4 | [a] <0.01** |
| **Age at first birth** | | | |
| 20-24 years | 39 (32.8) | 497 (55.9) | [b] <0.01** |
| 10-19 years | 80 (67.2) | 392 (44.1) | |
| **Area** | | | |
| Urban | 9 (7.6) | 228 (25.6) | |
| Rural with road | 74 (62.2) | 572 (64.3) | [b] <0.01** |
| Rural without road | 36 (30.3) | 89 (10.0) | |
| **Education** | | | |
| Post-secondary/ Non-tertiary/ Higher | 0 (0.0) | 83 (9.3) | |
| Lower secondary/ Upper secondary | 25 (21.0) | 451 (50.7) | [b] <0.01** |
| None or ECE/ Primary | 94 (79.0) | 355 (39.9) | |
| **Ethnolinguistic group of household head** | | | |
| Lao-Tai | 24 (20.2) | 454 (51.7) | |
| Mon-Khmar | 44 (37.0) | 254 (28.9) | [b] <0.01** |
| Hmong-Mien | 26 (21.8) | 145 (16.5) | |
| Chinese-Tibetan | 25 (21.0) | 25 (2.8) | |
| **Marital union status of woman** | | | |
| Currently married/ in union | 112 (94.1) | 855 (96.2) | |
| Formerly married/ in union | 7 (5.9) | 34 (3.8) | [b] .318 |
| Never married/ in union | 0 (0.0) | 0 (0.0) | |
| **Region** | | | |
| Central | 22 (18.5) | 335 (37.7) | |
| South | 40 (33.6) | 195 (21.9) | [b] <0.01** |
| North | 57 (47.9) | 359 (40.4) | |
| **Wealth index quintile (group)** | | | |
| Middle/ Fourth/ Richest | 14 (11.8) | 493 (55.5) | [b] <0.01** |
| Poorest/ Second | 105 (88.2) | 396 (44.5) | |
| **Covered by health insurance** | 0 (0.0) | 83 (9.3) | [b] <0.01** |
| **Early sexual intercourse (below 15 years)** | 9 (11.1) | 58 (8.1) | [b] .394 |
| **Mobile phone usage in the last 3 months** | 65 (54.6) | 693 (78.1) | [b] <0.01** |
| **Own a mobile phone** | 46 (38.7) | 647 (72.9) | [b] <0.01** |
| **Ever had a pregnancy that was miscarried** | 5 (62.5) | 62 (66.7) | [b] 1 |
| **Ever had miscarriages more than 2 times** | 1 (12.5) | 1 (1.1) | [b] .153 |
| **Number of miscarriages during lifetime** | 1.1 ± 1.4 | 0.8 ± 0.8 | [a] .312 |
| **Ever had a pregnancy that was stillbirth** | 1 (12.5) | 62 (66.7) | [b] 1 |
| **Ever had stillbirths more than 2 times** | 0 (0.0) | 0 (0.0) | [b] 1 |
| **Number of stillbirths during lifetime** | 0.3 ± 0.7 | 0.1 ± 0.4 | [a] .415 |
| **Ever used a method to avoid pregnancy** | 14 (15.4) | 110 (22.0) | [b] .207 |
| **Wanted to get pregnant at the time** | 13 (86.7) | 67 (90.5) | [b] .644 |
| **Times received prenatal care** | NaN (NA) | 4.96 (2.3) | [a] NA |
| **Result of anemia testing: Hb level (g/dl)** | 12.0 ± 1.4 | 12.1 ± 1.4 | [a] .563 |
| **Facility Delivery** | 23 (19.8) | 728 (82.2) | [b] <0.01** |
| **Delivery by cesarean section** | 1 (4.3) | 62 (8.5) | [b] .713 |
| **Weight at birth (grams)** | 2913.6 ± 493.1 | 2944.2 ± 475.5 | [a] .767 |
| **Low birth weight** | 3 (13.6) | 79 (10.6) | [b] .722 |

*Note: Data are expressed as mean ± SD or n (%). [a] Student's t-test; [b] Peason's chi-squared test; **p < 0.01; *p < 0.05; [¶]Had at least one prenatal care.*

**Table 3**

*Multiple Logistic Regression Analysis to Identify Factors Associated with Utilization of*

*Prenatal Care*

| Variable | Adjusted odds ratio | 95%CI Lower | 95%CI Upper | *p*.value |
|---|---|---|---|---|
| **Age at first birth** | | | | |
| 20-24 years | Ref. | | | |
| 10-19 years | 0.64 | 0.40 | 1.03 | .066 |
| **Area** | | | | |
| Urban | Ref. | | | |
| Rural with road | 0.85 | 0.39 | 1.86 | .677 |
| Rural without road | 0.33 | 0.14 | 0.82 | <0.05* |
| **Education** | | | | |
| Lower secondary/ Upper secondary | Ref. | | | |
| None or ECE/ Primary | 0.37 | 0.22 | 0.62 | <0.01** |
| **Ethnolinguistic group of household head** | | | | |
| Lao-Thai | Ref. | | | |
| Mon-Khmar | 0.69 | 0.38 | 1.26 | .229 |
| Hmong-Mien | 0.26 | 0.13 | 0.54 | <0.01** |
| Chinese-Tibetan | 0.08 | 0.03 | 0.21 | <0.01** |
| **Marital union status of woman** | | | | |
| Currently married/ in union | Ref. | | | |
| Formerly married/ in union | 0.53 | 0.19 | 1.48 | .224 |
| Never married | NA | | | |
| **Region** | | | | |
| Central | Ref. | | | |
| South | 0.42 | 0.21 | 0.82 | <0.05* |
| North | 1.03 | 0.55 | 1.93 | .935 |
| **Wealth index quintile** | | | | |
| Middle/ Fourth/ Richest | Ref. | | | |
| Poorest/ Second | 0.32 | 0.16 | 0.61 | <0.01** |
| **Mobile phone usage in the last 3 months** | | | | |
| No | Ref. | | | |
| Yes | 0.58 | 0.30 | 1.12 | .106 |
| **Own a mobile phone** | | | | |
| No | Ref. | | | |
| Yes | 2.52 | 1.34 | 4.74 | <0.01** |

*Note: *significant association ($p < 0.05$); **significant association ($p < 0.01$); ¶ Had at least one prenatal care.*

**Facility Delivery**

A total of 1,002 women responded to 'if the women had delivered at any facilities'. Regarding the objective variable of facility delivery, 751 women (75.0%) delivered at any facility such as hospital or health center and 251 women (25.0%) delivered at non-facility, such as at home. Table 4 shows the relationships between the sociodemographic variables being investigated and facility delivery.

As a result of multiple logistic regression analysis, the regression equation and its variables finally adopted are shown in Table 5. The multiple logistic regression analysis showed the following factors as significantly associated with facility delivery: age at first birth (20-24 years (reference); 10-19 years: AOR = 0.55, 95% CI [0.36 to 0.84], p < 0.01), area of residence (urban (reference); rural without road: AOR = 0.48, 95% CI [0.20 to 0.88], p < 0.05), ethnolinguistic group of house hold head (Lao-Thai (reference); Hmong-Mien: AOR = 0.48, 95% CI [0.26 to 0.89], p < 0.05), region of residence (Central (reference); South: AOR = 0.41, 95% CI [0.22 to 0.76], p < 0.01), wealth index quintile (Middle/ Fourth/ Richest (reference); Poorest/ Second: AOR = 0.44, 95% CI [0.27 to 0.73], p < 0.01), and received prenatal care (No (reference); Yes: AOR = 13.20, 95% CI [6.67 to 26.10], p < 0.01).

**Table 4**

*Relationship between Sociodemographic Variables and Facility Delivery*

| Variable | Facility delivery | | *p*.value |
|---|---|---|---|
| | No<br>n=251 | Yes<br>n=751 | |
| **Age at first birth (years)** | 19.0 ± 2.2 | 20.2 ± 2.5 | [a] <0.01** |
| **Age at first birth** | | | |
|   20-24 years | 85 (33.9) | 449 (59.8) | [b] <0.01** |
|   10-19 years | 166 (66.1) | 302 (40.2) | |
| **Area** | | | |
|   Urban | 28 (11.2) | 206 (27.4) | |
|   Rural with road | 162 (64.5) | 484 (64.4) | [b] <0.01** |
|   Rural without road | 61 (24.3) | 61 (8.1) | |
| **Education** | | | |
|   Post-secondary/ Non-tertiary/ Higher | 5 (2.0) | 77 (10.3) | |
|   Lower secondary/ Upper secondary | 81 (32.3) | 393 (52.3) | [b] <0.01** |
|   None or ECE/ Primary | 165 (65.7) | 281 (37.4) | |
| **Ethnolinguistic group of household head** | | | |
|   Lao-Tai | 70 (28.2) | 405 (54.5) | |
|   Mon-Khmar | 101 (40.7) | 194 (26.1) | [b] <0.01** |
|   Hmong-Mien | 51 (20.6) | 120 (16.2) | |
|   Chinese-Tibetan | 26 (10.5) | 24 (3.2) | |
| **Marital union status of woman** | | | |
|   Currently married/ in union | 237 (94.4) | 724 (96.4) | |
|   Formerly married/ in union | 14 (5.6) | 27 (3.6) | [b] .197 |
|   Never married/ in union | 0 (0.0) | 0 (0.0) | |
| **Region** | | | |
|   Central | 63 (25.1) | 293 (39.0) | |
|   South | 84 (33.5) | 147 (19.6) | [b] <0.01** |
|   North | 104 (41.4) | 311 (41.4) | |
| **Wealth index quintile** | | | |
|   Middle/ Fourth/ Richest | 49 (19.5) | 455 (60.6) | [b] <0.01** |
|   Poorest/ Second | 202 (80.5) | 296 (39.4) | |
| **Covered by health insurance** | 7 (2.8) | 75 (10.0) | [b] <0.01** |
| **Early sexual intercourse (below 15 years)** | 17 (9.2) | 50 (8.1) | [b] .650 |
| **Mobile phone usage in the last 3 months** | 151 (60.4) | 604 (80.5) | [b] <0.01** |
| **Own a mobile phone** | 130 (51.8) | 560 (74.7) | [b] <0.01** |
| **Ever had a pregnancy that was miscarried** | 17 (89.5) | 49 (60.5) | [b] <0.05* |
| **Ever had miscarriages more than 2 times** | 2 (10.5) | 0 (0.0) | [b] <0.05* |
| **Number of miscarriages during lifetime** | 1.4 ± 1.2 | 0.7 ± 0.6 | [a] <0.01** |
| **Ever had a pregnancy that was stillbirth** | 2 (10.5) | 10 (12.3) | [b] 1 |
| **Ever had stillbirths more than 2 times** | 0 (0.0) | 0 (0.0) | [b] 1 |
| **Number of stillbirths during lifetime** | 0.1 ± 0.3 | 0.2 ± 0.4 | [a] .678 |
| **Ever used a method to avoid pregnancy** | 21 (11.7) | 103 (25.2) | [b] <0.01** |
| **Wanted to get pregnant at the time** | 27 (90.0) | 53 (89.8) | [b] 1 |
| **Received prenatal care¶** | 158 (62.9) | 728 (96.9) | [b] <0.01** |
| **Times received prenatal care** | 3.9 ± 2.1 | 5.2 ± 2.3 | [a] <0.01** |
| **Result of anemia testing: Hb level (g/dl)** | 11.8 ± 1.5 | 12.2 ± 1.4 | [a] <0.05* |
| **Delivery by cesarean section** | 0 (0.0) | 63 (8.4) | [b] 1 |
| **Weight at birth (grams)** | 2912.1 ± 444.2 | 2945.9 ± 477.5 | [a] .690 |
| **Low birth weight** | 3 (9.1) | 78 (10.7) | [b] 1 |

*Note: Data are expressed as mean ± SD or n (%). [a] Student's t-test; [b] Peason's chi-squared test; \*\*p < 0.01; \*p < 0.05; ¶Had at least one prenatal care.*

**Table 5**

*Multiple Logistic Regression Analysis to Identify Factors Associated with Facility*

*Delivery*

| | | Facility delivery | | |
|---|---|---|---|---|
| | | 95%CI | | |
| Variable | Adjusted odds ratio | Lower | Upper | *p*.value |
| **Age at first birth** | | | | |
| 20-24 years | Ref. | | | |
| 10-19 years | 0.55 | 0.36 | 0.84 | <0.01** |
| **Area** | | | | |
| Urban | Ref. | | | |
| Rural with road | 0.90 | 0.51 | 1.61 | .732 |
| Rural without road | 0.48 | 0.20 | 0.88 | <0.05* |
| **Education** | | | | |
| Post-secondary/ Non-tertiary/ Higher | Ref. | | | |
| Lower secondary/ Upper secondary | 0.97 | 0.34 | 2.81 | .955 |
| None or ECE/ Primary | 0.72 | 0.25 | 2.06 | .537 |
| **Ethnolinguistic group of household head** | | | | |
| Lao-Thai | Ref. | | | |
| Mon-Khmar | 0.63 | 0.36 | 1.08 | .091 |
| Hmong-Mien | 0.48 | 0.26 | 0.89 | <0.05* |
| Chinese-Tibetan | 0.52 | 0.20 | 1.37 | .184 |
| **Marital union status of woman** | | | | |
| Currently married/in union | Ref. | | | |
| Formerly married/in union | 0.93 | 0.33 | 2.62 | .891 |
| Never married | NA | | | |
| **Region** | | | | |
| Central | Ref. | | | |
| South | 0.41 | 0.22 | 0.76 | <0.01** |
| North | 1.09 | 0.64 | 1.85 | .747 |
| **Wealth index quintile** | | | | |
| Middle/ Fourth/ Richest | Ref. | | | |
| Poorest/ Second | 0.44 | 0.27 | 0.73 | <0.01** |
| **Covered by health insurance** | | | | |
| No | Ref. | | | |
| Yes | 1.40 | 0.51 | 3.89 | .517 |
| **Early sexual intercourse below 15 years** | | | | |
| No | Ref. | | | |
| Yes | 1.52 | 0.72 | 3.21 | .274 |
| **Mobile phone usage in the last 3 months** | | | | |
| No | Ref. | | | |
| Yes | 1.30 | 0.68 | 2.49 | .433 |
| **Own a mobile phone** | | | | |
| No | Ref. | | | |
| Yes | 0.98 | 0.53 | 1.82 | .954 |
| **Received prenatal care¶** | | | | |
| No | Ref. | | | |
| Yes | 13.20 | 6.67 | 26.10 | <0.01** |

*Note: *significant association (p < 0.05); **significant association (p < 0.01); ¶Had at least one prenatal care.*

**Delivery by Cesarean Section**

In total, 751 women responded to the question of whether or not they had undergone a cesarean section. For the objective variable of whether or not the woman underwent a cesarean section, 63 women (8.4%) answered "yes" and 688 women (91.6%) answered "no". Table 6 shows the relationships between the sociodemographic variables being investigated and cesarean section.

The number of explanatory variables was narrowed down because of the small sample size. As a final result of multiple regression analysis, the regression equation and its variables finally adopted are shown in Table 7. The multiple logistic regression analysis showed the following factors as significantly associated with delivery by cesarean section: age at first birth (20-24 years (reference); 10-19 years: AOR = 0.42, 95% CI [0.22 to 0.82], $p < 0.05$) and area of residence (urban (reference); rural: AOR = 0.43, 95% CI [0.24 to 0.78], $p < 0.01$).

**Table 6**

*Relationship between Sociodemographic Variables and Delivery by Cesarean Section*

| Variable | Delivery by Cesarean Section | | p.value |
|---|---|---|---|
| | No n=688 | Yes n=63 | |
| **Age at first birth (years)** | 20.1 ± 2.5 | 21.3 ± 2.1 | [a] <0.01** |
| **Age at first birth** | | | |
| 20-24 years | 399 (58.0) | 50 (79.4) | [b] <0.05* |
| 10-19 years | 289 (42.0) | 13 (20.6) | |
| **Area** | | | |
| Urban | 177 (25.7) | 29 (46.0) | [b] <0.01** |
| Rural | 511 (74.3) | 34 (54.0) | |
| **Education** | | | |
| Post-secondary/ Non-tertiary/ Higher | 65 (9.4) | 12 (19.0) | |
| Lower secondary/ Upper secondary | 364 (52.9) | 29 (46.0) | [b] .073 |
| None or ECE/ Primary | 259 (37.6) | 22 (34.9) | |
| **Ethnolinguistic group of household head** | | | |
| Lao-Tai | 367 (53.8) | 38 (62.3) | |
| Mon-Khmar | 180 (26.4) | 14 (23.0) | [b] .620 |
| Hmong-Mien | 113 (16.6) | 7 (11.5) | |
| Chinese-Tibetan | 22 (3.2) | 2 (3.3) | |
| **Marital union status of woman** | | | |
| Currently married/ in union | 664 (96.5) | 60 (95.2) | |
| Formerly married/ in union | 24 (3.5) | 3 (4.8) | [b] .488 |
| Never married/ in union | 0 (0.0) | 0 (0.0) | |
| **Region** | | | |
| Central | 262 (38.1) | 31 (49.2) | |
| South | 134 (19.5) | 13 (20.6) | [b] .128 |
| North | 292 (42.4) | 19 (30.2) | |
| **Wealth index quintile** | | | |
| Middle/ Fourth/ Richest | 413 (60.0) | 42 (66.7) | [b] .347 |
| Poorest/ Second | 275 (40.0) | 21 (33.3) | |
| **Covered by health insurance** | 62 (9.0) | 13 (20.6) | [b] <0.05* |
| **Early sexual intercourse (below 15 years)** | 45 (8.0) | 5 (9.1) | [b] .795 |
| **Mobile phone usage in the last 3 months** | 549 (79.9) | 55 (87.3) | [b] .185 |
| **Own a mobile phone** | 511 (74.3) | 49 (79.0) | [b] .450 |
| **Ever had a pregnancy that was miscarried** | 42 (60.0) | 7 (63.6) | [b] 1 |
| **Ever had miscarriages more than 2 times** | 0 (0.0) | 0 (0.0) | [b] 1 |
| **Number of miscarriages during lifetime** | 0.7 ± 0.6 | 0.7 ± 0.7 | [a] .897 |
| **Ever had a pregnancy that was stillbirth** | 7 (10.0) | 3 (27.3) | [b] .132 |
| **Ever had stillbirths more than 2 times** | 0 (0.0) | 0 (0.0) | [b] 1 |
| **Number of stillbirths during lifetime** | 0.1 ± 0.4 | 0.3 ± 0.5 | [a] .295 |
| **Ever used a method to avoid pregnancy** | 90 (24.0) | 13 (38.2) | [b] .096 |
| **Wanted to get pregnant at the time** | 51 (89.5) | 2 (100.0) | [b] 1 |
| **Received prenatal care**¶ | 666 (96.8) | 62 (98.4) | [b] .713 |
| **Times received prenatal care** | 5.1 ± 2.3 | 6.1 ± 2.7 | [a] <0.05* |
| **Result of anemia testing: Hb level (g/dl)** | 12.1 ± 1.4 | 12.5 ± 1.2 | [a] .260 |
| **Facility delivery** | 688 (100.0) | 63 (100.0) | [a] NA |
| **Weight at birth (grams)** | 2930.0 ± 461.2 | 3117.1 ± 605.5 | [a] <0.05* |
| **Low birth weight** | 72 (10.8) | 6 (9.7) | [b] 1 |

*Note: Data are expressed as mean ± SD or n (%). [a] Student's t-test; [b] Peason's chi-squared test; **p < 0.01; *p < 0.05; ¶Had at least one prenatal care.*

**Table 7**

*Multiple Logistic Regression Analysis to Identify Factors Associated with Delivery by*

*Cesarean Section*

| | **Delivery by Cesarean Section** | | | |
|---|---|---|---|---|
| | Adjusted | 95%CI | | |
| Variable | odds ratio | Lower | Upper | *p*.value |
| **Age at first birth** | | | | |
| 20-24 years | Ref. | | | |
| 10-19 years | 0.42 | 0.22 | 0.82 | <0.05* |
| **Area** | | | | |
| Urban | Ref. | | | |
| Rural | 0.43 | 0.24 | 0.78 | <0.01** |
| **Education** | | | | |
| Post-secondary/ Non-tertiary/ Higher | Ref. | | | |
| Lower secondary/ Upper secondary | 0.68 | 0.32 | 1.46 | .327 |
| None or ECE/ Primary | 0.82 | 0.36 | 1.85 | .628 |
| **Wealth index quintile** | | | | |
| Middle/ Fourth/ Richest | Ref. | | | |
| Poorest/ Second | 1.19 | 0.65 | 2.19 | .581 |
| **Received prenatal care[¶]** | | | | |
| No | Ref. | | | |
| Yes | 1.89 | 0.24 | 14.70 | .545 |

*Note: *significant association ($p < 0.05$); **significant association ($p < 0.01$); [¶] Had at least one prenatal care.*

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# Discussion

This study identified factors associated with the utilization of prenatal care, facility delivery, and cesarean section among adolescent women in Lao PDR. Examining these perspectives is an essential step to identifying appropriate strategies for increasing skilled delivery for adolescent women. Clarifying the factors of adolescent women's decision-making process whether to receive prenatal care or where to deliver is essential for determining how to improve nationwide healthcare services and health policies. Women and their families are then more likely to seek skilled delivery care and have positive pregnancy experiences and birth outcomes.

Our study results showed that factors significantly associated with the utilization of prenatal care were region and area of residence, particularly rural regions without roads, educational background, household wealth index quintile, and more specifically, ethnic difference. Ownership of a cell phone was also influential, which probably reflects the economic background and information availability on health services such as prenatal care.

The following factors were significantly associated with facility delivery: region and area of residence, household wealth index quintile, and ethnicity.

Importantly when comparing women in their twenties, women in their teens were

shown to be more significantly associated with facility delivery. In addition, receiving

prenatal care was shown to be a protective factor, suggesting that connecting women to

prenatal care can lead to an increase in the institutional delivery rate.

The results also showed that residing in rural areas and adolescent women were

factors with a low cesarean section rate. The current study showed that the cesarean

section rate was lower in adolescent women (4.3%) than in women in their 20s (11.1%).

This percentage is lower than the average cesarean section rate of 23.2% (Ghanchimeg,

2014) for women in their teens and early twenties in other developing countries,

including those in Asia, suggesting that adolescent women in Lao PDR do not readily

practice having cesarean section. Previous research pointed out the three factors that are

associated with maternal health care (MHC) utilization in Southern Laos: a)

accessibility to health facility, b) women's knowledge, c) socio-cultural beliefs (Phoxay,

Okumura, Nakamura, & Wakai, 2001), and with accessibility to a health facility, which

supports our findings.

**Accessibility to Health Facility**

The results of this study revealed that rural area of residence was strongly associated with the use of prenatal care and institutional delivery, and with the cesarean section rate. In the highland and mountainous areas of Lao PDR, which cover nearly 70% of the country. Limited mobility in the rural areas without roads and the lack of access to health care services in isolated areas may contribute to the low utilization of maternal services in rural areas. Previous studies have shown that efforts to reduce distance to health facilities and health education focusing on potential threats of home deliveries at the individual and community levels significantly increase health facility deliveries in rural communities (Kifle, Kesete, Gaim, Angosom, & Ayara, 2018). In addition, the cost of delivery at a health facility is exempted in Lao PDR; however, the cost of transportation to access the health facility is not included. It has been reported that women choose to give birth at home due to the high cost of transportation (Sychareun, Hansana, Somphet, Xayavong, Phengsavanh, & Popenoe, 2012). Lack of access to health facilities due to long distances and high transportation costs can be seen as a problem.

**Women's Knowledge**

On the other hand, a previous study suggests that maternal knowledge about birth complications is an essential factor in increasing the facility delivery in rural area of Lao PDR where a majority of inhabitants were ethnic minorities (Horiuchi, Nakdouangma, Khongsavat, Kubota, & Yamaoka, 2020). In this prior study, it was reported that even when women lived relatively close to a health facility, nearly 30 % of women chose home delivery, without a Skilled Birth Attendant (SBA). Improving women's access to the information they need and strengthening health education will be important in preparing them for childbirth and will further increase the rate of deliveries by SBAs at health facilities.

An increased likelihood to underutilize prenatal services and facility delivery with a lower household wealth index quintile was also found in the current study. Several research articles have discussed the impact of household economic status on the utilization of health services (Simkhada, van Teijlingen, Porter, & Simkhada, 2008). In order to promote the utilization of MHC services and reduce financial barriers, the Lao government introduced the "Free Maternal Health Services Policy" in 2012. On the other hand, a previous study has pointed out the lack of information dissemination on

free delivery policy (Chankham, Yamamoto, Reyer, Arafat, Khonemany, Panome et al.,

2017). In this prior study, most of the women (97.7%) who delivered at a facility knew

information about the free delivery policy, suggesting that obtaining information leads

to better access to MHC services. It also suggests that more educated women are more

knowledgeable about policy. The results of the current study also indicate that women's

educational background is strongly related to their utilization of prenatal care services.

At the same time, the average number of prenatal care visits was $5.0 \pm 2.3$ times, which

suggests that women who accessed prenatal care once received the required number of

check-ups. To disseminate more information about this policy, the need for skilled

births care, and the services available to mothers, outreach to vulnerable groups such as

rural, adolescent, and less educated populations is essential.


Moreover, several studies have also pointed out that the use of the Mother and

Child Health (MCH) handbook is an evidence-based intervention for improving

mothers' knowledge and behavior (Yanagisawa, Soyano, Igarashi, Ura, & Nakamura,

2015; Hagiwara, Ueyama, Ramlawi, &Sawada, 2013). In Lao PDR, the MCH handbook

was introduced in 1995, and its effective use has been promoted since 2005 in line with

the nationwide dissemination of the MCH care standards defined by the Ministry of

Health (JICA, 2017). However, at present, the MCH handbook is distributed to pregnant women at the time of their first prenatal care and is not used as a means of providing information to women who do not have access to prenatal care. Thus, there is a prior need to provide more information to women in the vulnerable groups. Based on our study those at higher risk are the rural dwellers, adolescents, and those less educated about policies, the need for skilled delivery care, and the services available to mothers. Thus, there is a great need to create systems that will enable women in the vulnerable groups to receive the care they need.

**Socio-cultural Beliefs**

In a previous qualitative study, the perceived advantages of home deliveries included not only low cost, convenience, and closeness to their family, but also desirable birthing practices by a Traditional Birth Attendant (TBA) (Sychareun et. al., 2012). Women and their families expressed great confidence in TBA's skills and their knowledge. In our study, the issues of socio-cultural beliefs were inferred by the lower likelihood of utilization of MHC services among women in rural areas and ethnic minorities. Sychareun et al. (2012) suggested that improving MHC services to meet the needs of women living in rural areas could help reduce maternal mortality in Lao PDR.

For example, accepting the attendance of family members when women deliver babies,

allowing TBA's practices when they do not conflict with biomedical evidence pointing

to the need for a more SBA, allowing women to give birth in a desirable position,

improving privacy, and reducing the participation of male staff in deliveries where

possible. Supporting women to have their desired delivery, even if it is in a health

facility, is essential to increasing the utilization of MHC services.

**Limitations**

Our study has some limitations. This study was based on the LSISII, a large

nationally representative survey conducted in 2017. The large sample used in this study

allowed for the examination of a variety of potential relating factors. However, as with

other cross-sectional survey data, the design of the study limits the interpretation of

causality of factors related to underutilization of MHC services. In addition, although

we limited the data to the past five years to minimize bias, there is still a possible recall

bias in the data used because the information collected relies on women's memories of

their pregnancies. The factors associated with utilization of prenatal care, facility

delivery, and reduction of cesarean section in this study were selected from the results

of the univariate analysis and variables considered to be clinically relevant. However,

these limitations are unlikely to affect the validity of the analysis. We included only primipara women in the analysis, limiting the generalizability of the results to include multipara women. Furthermore, in this study, we could not reach the analysis of birth outcomes due to insufficient sample size. Future studies should analyze the extent to which similar factors actually affect birth outcomes.

## Conclusion

We conducted this study to determine the factors associated with the utilization of prenatal care and the rates of facility delivery and cesarean section in a nationwide sample of Lao PDR. The results revealed a significant association between social determinants and underutilization of maternal care services. Strategies to enhance the use of prenatal care, increase the rates of facility delivery and the proper rates of cesarean section in Lao PDR should be a priority in rural areas. In addition, vulnerable women should receive immediate assistance and support to ensure that all of them have access to the necessary prenatal care and skilled delivery care, particularly teenagers, less educated women, primiparas, women living in rural areas and the south, and women from poor families.

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