FACTORS AFFECTING CHILD MORTALITY AMONG POOR AND NON-POOR HOUSEHOLDS WITH CHILDREN UNDER FIVE IN LAO PDR: AN ANALYSIS OF THE 2015 POPULATION AND HOUSING CENSUS

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ABSTRACT:

Background: Lao PDR has the highest rate of child mortality among ASEAN countries. The reduction of child mortality is one of the core goals of the Lao government and an overarching indicator of its Sustainable Development Goals (SDGs). Overall, child mortality in Lao PDR has significantly declined. However, child mortality has still remained high and differences between socio-economic groups in terms of child mortality rates have persisted, reflecting differences in household wealth, education, place of residence and household sanitation. Therefore, the main objective of this study was to analyze the socio-economic factors affecting child mortality and to assess the inequity of child mortality between the poor and non-poor households in Lao PDR.

Methods: This study used the binary logistic regression analysis. The data from the Lao Population and Housing Census 2015 conducted by the Lao Statistics Bureau was analyzed.

Results: Findings revealed that poor households were more likely to experience child mortality. Factors associated with child mortality were rural residency, large family size, the inability to speak the Lao-Tai language, male headship, lower education of household headship, households without electricity and use of unclean energy, use of unimproved latrine and unimproved water sources.

Conclusion: To further reduce child mortality, the Lao government and its development partners, in their efforts, should lay emphasis on rural and urban poor households and guarantee that these households are able to access safe water, improved latrines and clean energy for cooking.

Keywords: Child mortality; Children under five; Poverty; Lao PDR

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INTRODUCTION

Child mortality is an important indicator of a country's development level, because it can illustrates the quality of the health care system and health monitoring systems, economic status, social welfare and inequalities in a society. The child morbidity and mortality are the results of broader factors that are interconnected, including demographic, socio-economic and sanitation factors. According to the Lao Population and Housing Census 2015, Lao PDR has 6.49 million of total population and 3.24 million are female, with 53 percent of the population being young people under 25 years old and more than 67 percent of population living in rural areas [1]. The total fertility rate is 3.2 per women and the population growth rate is about 1.4 percent per year. Lao PDR has the highest maternal mortality rate in the region. The maternal mortality rate declined from 433 per 100,000 live births in 2000 to 357 per 100,000 live births in 2011/12 [2]. Figure 1 shows that the child mortality

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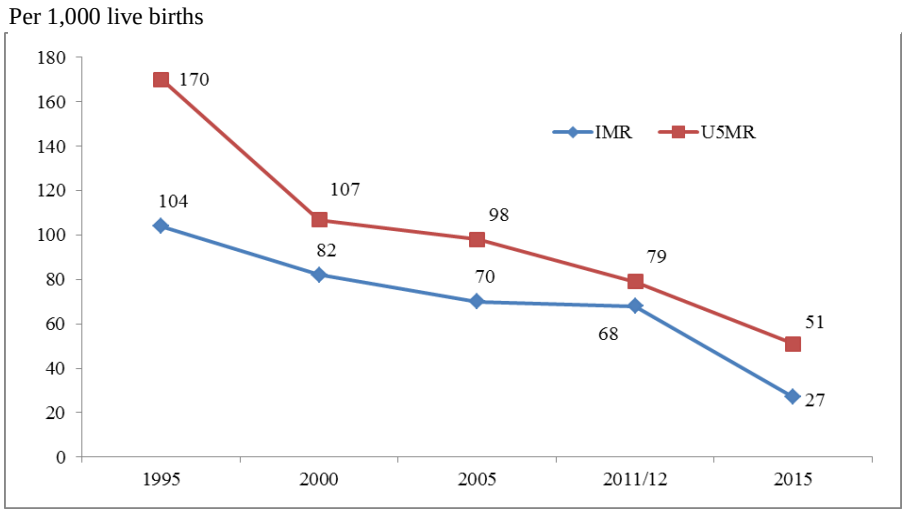

Figure 1 Trends of infant mortality and under-five mortality rates in Lao PDR since 1995 to 2015

Data sources: Own calculation based on LPHC 2015; LSIS 2012; MDGs report 2013

in Lao PDR significantly declines from 1995 to 2015. The under-five mortality rate (U5MR) declines from 170 deaths per 1,000 live births in 1995 to 79 deaths per 1,000 live births in 2012 [2] and 51 deaths per 1,000 live births in 2015 [3]. The trend of infant mortality rate (IMR) similarly declines with U5MR. However, the child mortality rate in Lao PDR differs among regions, rural/ urban areas, and provinces. The U5MR is lowest in the Central with 73 deaths per 1,000 live births, compared to over 100 deaths in the North and South. In rural areas the U5MR was 100 deaths per 1,000 live births compared to 45 in urban areas [2]. On the whole, Lao PDR still ranks amongst countries with the highest child mortality rates in this region [3].

Lao PDR government committed to reduce the IMR and U5MR by two-thirds to achieve the targets of the Millennium Development Goals (MDGs). By 2015, Lao PDR targeted to reduce the U5MR from 170 in 1990 to 70 per 1,000 live births and the IMR from 114 in 1993 to 68 per 1,000 live births [3]. Additionally, Lao PDR government has declared to implement the Sustainable Development Goals (SDGs) and focus on the third goal to "ensure healthy lives and promote wellbeing for all age", especially target 3.2 to "end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce infant mortality to at least 12 per 1,000 live births and under-5 mortality to at least 25 per 1,000 live births by 2030" [4]. Reducing child mortality is a significant challenge in Lao PDR as there are many factors related to child mortality such as demographic, socio-economics, sanitation and environment factors.

To achieve the national goal of developing Lao population's health and well-being and to meet SDGs by reducing child mortality, it is necessary to understand the causal factors that affect child mortality. Therefore, the main objectives of this paper are to analyze demographic, socio-economic and household sanitation factors affecting child mortality in Lao PDR and to assess the inequity of child mortality between the poor and non-poor households. Based on the 2015 Population and Housing Census (LPHC 2015), the results of this research will help prioritize both local and national policies that should be implemented within a short period and the programs requiring substantial effort and investment.

METHODS

This research was conducted by using secondary data from the LPHC 2015 conducted by Lao Statistics Bureau. The LPHC 2015 applied De jure census method and conducted fieldwork during 1-7 March 2015.

This study divided in two sections, first section uses descriptive statistics to describe the situation of child mortality, socio-economic factors, demographic factors and sanitation factors, and to assess the relationship between determinant factors and child mortality. In this section used 100 percent of child death aged less than five years old and child live births within the last 12 months that reported in the LPHC 2015. The second section was causal analysis of child mortality, a binary logistics regression analysis is applied to estimate the impact of socio-economic, demographic and sanitation

Table 1 Characteristics of sample households and household headship collected 2015

		%
Demographic variables (N = 505, 286)		
Number of under-five children	1 person	71.2
	2 persons	23.6
	3 persons or more	5.6
Ethno-linguistic	Lao-Tai	58.5
	Mon-Khmer	25.6
	Hmong-mien	11.7
	Chinese-Tibetan	3.2
	Other	1
Religion	Buddhist	62.2
	Christian	1.9
	Others (Islam, Baha'i...)	0.3
	Non-religion	35.6
Sex of headship	Female headship	9.9
	Male headship	90.1
Sanitation variables		
Drinking water sources	With improved drinking water sources	55.5
	Without improved drinking water sources	44.5
Type of latrine	With improved latrine	25.5
	Without improved latrine	74.5
Energy for cooking	With clean energy for cooking	64.9
	Without clean energy for cooking	35.1
Intensity	Number of households members divided by number of rooms in current living houses (person/room)	2.6
Socio-economic variables		
Wealth status	Poorest	24.9
	Poor	21.9
	Medium	19.6
	Rich	17.5
	Richest	16.1
Education level	Non-educated	23.2
	Primary	40.6
	Secondary	26.1
	Vocational	7.2
	Higher education	2.9
Literacy	At least one member is literate	99.8
Occupation	Unemployed and non-active economics	6.9
	Government employee	10.9
	Private employee	4.3
	Employer and self-employed	74.8
	Unpaid family worker	3.5
House materials	With permanent material	73.6
	Without permanent material	26.4
Electricity	With electricity	80.2
	Without electricity	19.8
Geographic variables		
Place of residence	Households living in rural	71
	Households living in urban	71
Region	Vientiane Capital	10.6
	North	30.9
	Central	36.9

factors on child mortality by using sample data. The sample of this study was taken from households who have children aged less than five years old and also included households who do not have children younger than five years old but experienced child death within the last 12 months prior to the census

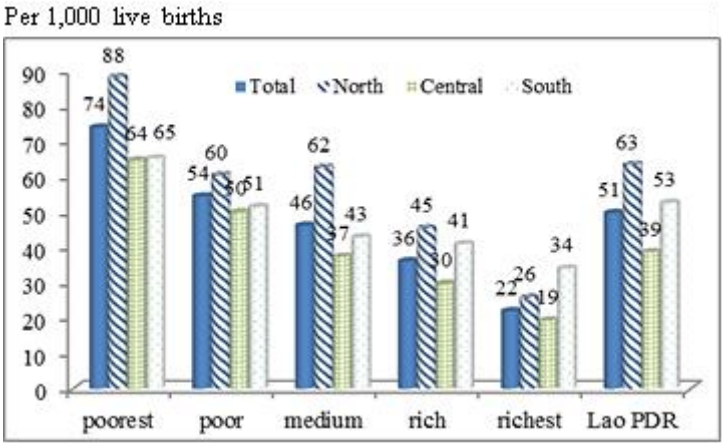

Figure 2 Under-five mortality in Lao PDR in 2015 classified by wealth quintiles and region
Data sources: Own calculation based on LPHC 2015

date. The unit of analysis is household. Throughout this paper we referred to child mortality as the death of children under-5 years of age in the interviewed households during the last 12 months prior to the census dated on 1 March 2015 (including neonatal and infant mortality).

RESULTS

Characteristics

The characteristics of sample household and household headship including demographic, socio-economic, geographic and sanitation factors are shown in Table 1. In Lao PDR in 2015, about 70 percent of households lived in rural areas. The majorities of households were Buddhist and speak Lao-Tai. Male headship was commonly seen in Lao PDR and most of these household heads had primary or lower education. Almost households had at least one child aged under-five. About three-fourth had the house made of permanent materials and four-fifth could access public electricity. For sanitation, more than half of households had an access to improved drinking water sources and clean energy for cooking. However, households accessing improved latrine were only one-fourth.

The different level of child mortality varied by wealth status across country

IMR and U5MR in Lao PDR substantially declined in recent years. Both IMR and U5MR are lower in female-headed households than in male-headed households. The IMR and U5MR also differ significantly among regions as shown in Figure 2. It shows that the poorest wealth quintile had the highest U5MR and that the richest wealth quintile had the lowest one. The U5MR in the North (63 deaths per 1,000 live births) was the highest compared to the South (53 deaths per 1,000 live births) and Central (39 deaths per 1,000 live births) and it was the highest among all wealth quintiles, except the richest quintile. At national level, the U5MR among the poorest households (74 deaths per 1,000 live births) was more than 3 times higher than in the richest households (22 deaths per 1,000 live births). Moreover, the largest difference of U5MR between the poorest and richest households was found in the North nearly 4 times (88 deaths per 1,000 live births compared to 26 deaths per 1000 live births). In the Central, there was a higher inequity between the poorest and the richest households (64 deaths per 1,000 live births compared to 19 deaths per 1,000 live births). The South had the smallest difference between poorest and richest households (65 deaths per 1,000 live births compared to 34 deaths per 1,000 live births). The North, the U5MR of poor quintile households (60 deaths per 1,000 live births) was slightly less than that of medium quintile households (62 deaths per 1,000 live births). The U5MR in the Central and the South declined when the wealth increased, but U5MR in the North did not follow these two regions' pattern. U5MR among medium households was higher than the poor.

Figure 3, U5MR of households living in rural areas was higher than those living in urban areas (56 deaths per 1,000 live births compared to 33 deaths per 1,000 live births). The rural households had the higher U5MR than urban households in all wealth quintiles, but the poorest wealth quintile had the largest difference (75 deaths per 1,000 live births compared to 52 deaths per 1,000 live births). The poor, medium and rich wealth quintiles had

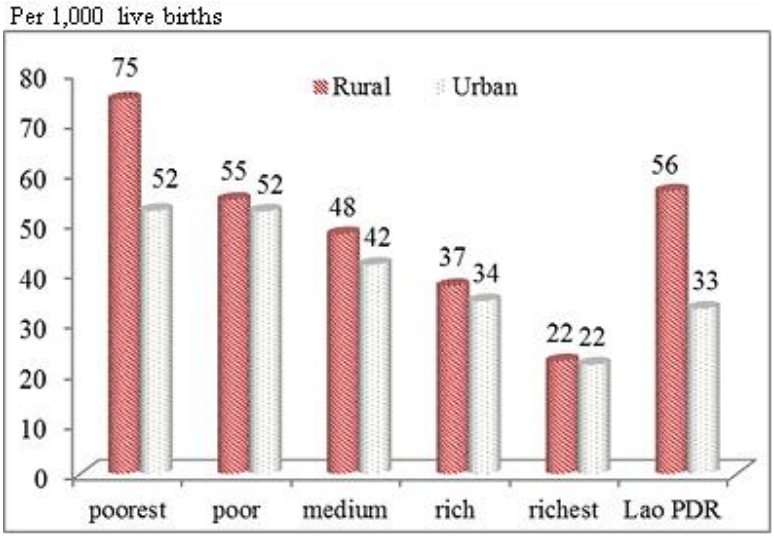

Figure 3 Under-five mortality in Lao PDR 2015 by wealth quintiles and place of residences

Data sources: Own calculation based on LPHC 2015

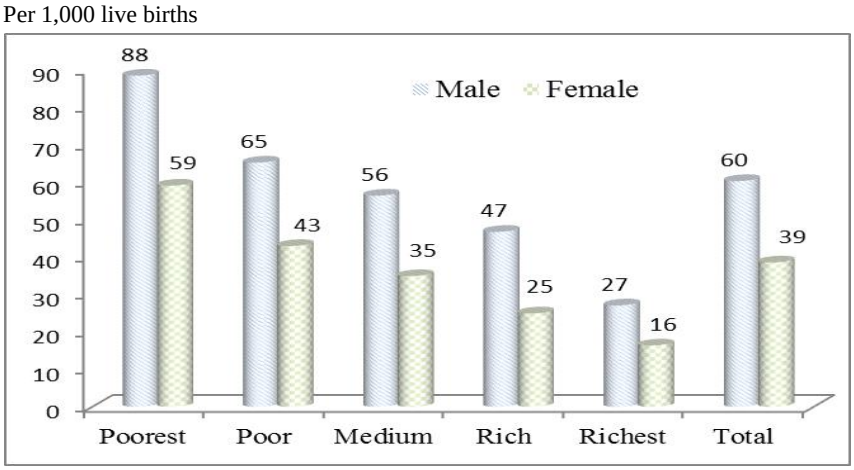

Figure 4 Under-five mortality in Lao PDR 2015 by wealth quintiles and sex of under-five

Data sources: Own calculation based on LPHC 2015.

relatively less inequity between rural and urban areas. The U5MR of rural households was higher than urban households in each wealth quintile, except the richest one.

Figure 4, U5MR of males was higher than females (60 deaths per 1,000 live births compared to 39 deaths per 1,000 live births). The males had the higher U5MR than females in all wealth quintiles.

The factors affecting child mortality

The binary logistic regression analysis was carried out to examine the effect of demographic, socio-economic, geographic, and sanitation factors on child mortality in Lao PDR in 2015. The binary logistic regression results in Table 2 show the estimated odds ratios.

Demographic factors

The findings found that, when controlling only demographic factors (Model 1), the number of under-five children significantly affected the child mortality. Households having more children seemed to have child deaths. However, the effect due to the number of young children was no longer statistically significant when socio-economic, geographic, and sanitation factors were controlled (Models 2-5). The ethnicity was found to be the strongest significant determinant of child mortality statistically whereas Mon-Khmer, Hmong-mien and Chinese-Tibetan households inclined towards experiencing child deaths more than Lao-Tai households. The highest probability of child death went to Chinese-Tibetan households which had 3.52 times higher likelihood

Table 2 Odds ratio of binary logistic regression analysis on demographics, sanitation, geographical and socio-economic factors affecting child mortality in Lao PDR in 2015

Child mortality		Model 1	Model 2	Model 3	Model 4	Model 5
Demographic variables						
Number children under-five in the household		1.11***	1.00	1.00	0.98	0.98
Ethno-linguistic	Lao-Tai (Ref.)					
	Mon-Khmer	2.18***	1.53***	1.50***	1.41***	1.42***
	Hmong-Mien	2.17***	1.75***	1.78***	1.66***	1.67***
	Chinese-Tibetan	3.52***	2.34***	2.26***	2.10***	2.12***
	Others	0.83	0.74	0.74	0.57*	0.57*
Religion	Buddhist (Ref.)					
	Christian	1.36**	1.37**	1.37**	1.35**	1.35**
	Others (Bahia, Islam)	1.52*	1.71**	1.77**	1.84**	1.84**
	Non-religion	1.21***	1.10*	1.10*	1.10	1.10
Sex of headship	Male (Ref.)					
	Female	0.83**	0.85**	0.87*	0.88*	0.88*
Geographical variables						
Place of residence	Urban (Ref.)					
	Rural			1.20***	1.13*	
Region	Vientiane capital (Ref.)					
	North			1.60***	1.51***	1.59***
	Central			1.42***	1.37**	1.45***
	South			1.73***	1.73***	1.86***
Sanitation variables						
Drinking water	Unimproved water (Ref.)					
	Improved water source				0.88**	0.86***
Type of toilets	Unimproved latrine (Ref.)					
	Improved latrine				0.75***	0.77***
Energy for cooking	Unclean energy (Ref.)					
	Clean energy				0.75***	0.73***
Intensity	Total number of households members divided by total number of rooms in current living houses				1.02*	1.02*
Socio-economic variables						
Wealth status	Poorest (Ref.)					
	Poor		0.85***	0.86***	1.01	
	Medium		0.76***	0.80***	1.06	
	Rich		0.63***	0.72***	1.00	
	Richest		0.43***	0.55***	0.83	
Interaction between wealth status and place of residence	Urban non-poor (Ref.)					
	Urban poor					1.02
	Rural non-poor					1.16**
	Rural poor					1.19*
Education level	Non-educated (Ref.)					
	Primary		0.82***	0.82***	0.83***	0.83***
	Secondary		0.74***	0.75***	0.77***	0.76***
	Vocational		0.66***	0.67***	0.69***	0.67***
	Higher education		0.46***	0.50***	0.52***	0.49***
Literacy	Illiterate (Ref.)					
	Literate		0.86	0.84	0.91	0.91
Occupation	Unemployed, non-active (Ref.)					
	Government employee	1.29	1.22	1.15	1.16	
	Private employee		1.20	1.28	1.25	1.26
	Employer and self-employed	1.22	1.15	1.11	1.12	
	Unpaid family worker		1.18	1.15	1.12	1.13
House materials	Non-permanent materials (Ref.)					
	Permanent materials		0.92*	0.91**	0.93*	0.92*

Table 2 Odds ratio of binary logistic regression analysis on demographics, sanitation, geographical and socio-economic factors affecting child mortality in Lao PDR in 2015 (cont.)

Child mortality		Model 1	Model 2	Model 3	Model 4	Model 5
Electricity	Without electricity(Ref.)					
	With electricity		0.84***	0.85***	0.85***	0.85***
Constant		0.01***	0.01***	0.01***	0.00***	0.00***
LR		826.7	1042.1	1079.4	1121.39	1111.8
DF		9	24	28	32	30
Significant		0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R^2		0.0226	0.0307	0.0318	0.0335	0.0332

Data sources: Own calculation based on LPHC 2015

*p < 0.10; **p < 0.05; ***p < 0.01.

Note: In model 5, the place of residence and wealth status variables are excluded, because of the inclusion of the new variable which captures the interaction between wealth status and place of residence.

of child deaths than Lao-Tai households. These results varied slightly, but overall robust across all model specifications. In terms of the religion, households belonging to Christian and other religions including Baha'i and Islam were statistically and significantly likelier to experience child deaths than Buddhist households in all five models. Non-religious households were more likely to experience child deaths than Buddhist households as presented in Model 1-3. Female-headed households were less likely to have child mortality than male-headed households. This result showed statistically significant in all models.

Socio-economic factors

According to Model 2 and 3, the poorest households encountered the highest child mortality while the lowest child mortality was among the richest households. In other words, the richest had 45-57 percent less likely to experience the child mortality than the poorest. However, this effect reversed and was no longer significant when controlling sanitation variables (Model 4). Concerning the interaction between the wealth status (poor/non-poor) and the place of residence of households (urban/rural), Model 5 shows that poor households in rural areas had the highest experience of child deaths (19 percent more likely than non-poor households in urban areas). The second highest was non-poor households in rural areas (16 percent more likely than the non-poor in urban areas). Both effects were statistically significant. The household head's education is a key socio-economic indicator that can affect child deaths in households. Model 2-5 show that the education of household head had a statistically significant negative effect on child mortality. Households with heads having a higher education level had the lowest child mortality. The literacy, as defined as having at least one household member who can read and write with understanding, had a negative relationship with child mortality, yet was not significant in all models. Surprisingly, the high skilled occupation of the household head was positively associated with the child mortality, but not statistically significant. When considering the house materials, households living in houses made of permanent materials were statistically and significantly 9 percent less likely to experience child deaths than households living in houses made of non-permanent materials. The electricity was also a critical determinant of child mortality. Households having electricity were 15 percent less likely to have child deaths than households without electricity statistically and significantly.

Geographic factors

Geographic factors were statistically significant determinants of child mortality. Households in rural areas have statistically, significantly and positively a relationship with the child mortality in both Model 3 and 4. With regard to the region, the Southern part of Lao PDR had the most probability of child mortality followed by the Northern part (both effects were statistically significant).

Sanitation factors

Sanitation factors were also found to be determinants, with statistical significance, of child mortality. Households that obtained drinking water from improved drinking water sources were negatively related to child mortality. They were 12-14 percent less likely to experience child deaths than households that obtained drinking water from unimproved drinking water sources. Households using improved latrines came with a negative relationship with child mortality, around 23-25

percent less likely to experience child deaths than households using unimproved latrines. Households using clean energy for cooking were 25-27 percent less prone to experience child mortality than households using unclean energy for cooking. Regarding the intensity of household (persons per room) was positively related to child mortality. The higher intensity of household pointed towards the higher child mortality.

DISCUSSION AND CONCLUSION

This study examined the determinants of child mortality in Lao PDR and assessed the inequity of child mortality between the poor and non-poor households. Overall, the empirical findings of this study indicate that demographic, socio-economic, geographic and sanitation-related factors affect the child mortality.

Demographic factors influencing the child mortality were made of the number of children aged under-five in a household, sex of the household head, as well as the ethno-linguistic background and religion of the household. This study disclosed similar results as of those obtained in the study of Susan [5] that households with the higher number of young children significantly experienced child deaths more than those having the lower number of children because they tended to lack of basic minimum food supply and inadequate amounts of all nutrients. However, the number of under-five children appeared to not be significant when controlling socio-economic, geographic and sanitation factors (Model 2-5). In Lao PDR, the ethno-linguistic group considerably influenced the child mortality. This study made clear that all Mon-Khmer, Hmong-Mien and Chinese-Tibetan linguistic groups were likely to experience child deaths greater than the Lao-Tai linguistic group. Nonetheless, Constantin and Lee in 1995 [6] said that child mortality is different among ethno-linguistic groups in Malaysia, yet not statistically significant. The reasons may concern about non-Lao speaking people's difficult access to health care information and health care services, especially mother and child health services. In terms of household headship, households with male headship tended to experience child deaths than their female counterparts. However, this finding is consistent with the study conducted in Nepal in 2006 [7]. It might be reasoned that mothers with the role of household headship had a full autonomy in caring their children that resulted in the lower rate of child mortality.

Socio-economic determinants comprised the household's wealth status, the education and the availability of electricity and the construction materials of the household's home. These determinants significantly affected the child mortality in Lao PDR. The wealth status of households was statistically significant to the child mortality. This study found that the poorest households were the most vulnerable group to experience child deaths. Not different from the finding by Anyamele and UNICEF in 2015 [8, 9], the higher rate of child mortality occurred among the poor households. Nevertheless, the wealth status became not significant when controlling all factors in the same model (Model 4). In terms of the interaction between the wealth status and the place of residence, poor households living in rural areas were most likely to have the highest child mortality and this phenomenon is similar to the finding in Brazil in 1997 [3, 10]. It is reasoned that the rural area had limited resources including hospitals and health personnel.

Education is a key of socio-economic factors that affected child mortality [11], the education of headship directly affected the child health care seeking and child nutrition [12, 13]. This research found the consistent results that all education levels of household's heads significantly affected child mortality in Lao PDR in 2015. Household heads with higher education were less likely to experience child mortality. Therefore, to reduce child mortality in Lao PDR, the higher education among should be pursued. Regarding the house materials, this study found that households with permanent houses were less likely to get experience on having child deaths than temporary houses. This study found the similar result in England, Scotland, and Wales, children living in the worst or temporary housing materials were associated with higher child mortality rates [14]. Furthermore, the accessibility to electricity of households affected child mortality in Lao PDR. This study showed that households with electricity were less likely experienced child deaths than households without electricity statistically. This similar finding was found in developing countries during 1990s, the households with electricity negatively affected child mortality [15].

Considering geographic factors, child mortality was also affected by the place of residence of the household, i.e. the region where the household lives and whether the place of residence is in the urban or

rural area. In this study, the place of residence affected child mortality in Lao PDR; households living in rural areas were more likely to experience child deaths. These similar findings were discovered in developing countries in 1984 and Lao PDR in 2007, the place of residence was significantly associated with child mortality [16, 17]. It may be due to the rural areas have poor infrastructures and limit to access health care services. In term of regions, this study indicated that households living in the North and South were more likely to experience child death than the Central. This similar finding existed in Lao PDR in 2012, the North and the South had the higher child mortality rate than the Central [2].

Sanitation-related factors which affected the child mortality were the availability of improved drinking water, improved latrines and clean energy for cooking. In this study, the households using improved drinking water were negatively related to child mortality. These similar findings were found in Bangladesh in 2001 that improved drinking water source was strongly and negatively related to the child mortality [18] and in Egypt in 2003, the improved drinking water source could reduce the risk of child mortality [19]. Regarding the type of latrine, this study reveals that households using improved latrine were less likely to have child deaths than households using unimproved latrine and having no latrine. This similar finding was found in in Egypt in 2003, the improved latrine negatively affected child mortality [19].

In terms of the energy for cooking, this study found that households using clean energy for cooking were less likely to experience having child deaths than households using unclean energy for cooking. This finding was similar in Nigeria in 2014. The domestic energy for cooking had a relation with the risk of child death and the unclean energy for cooking positively affected the child mortality [20]. Finally, the intensity of households was positively related to the child mortality in Lao PDR. In this study, the higher intensity of household was related to the higher child mortality. This similar finding was presented in the analytical framework for the study of child survival in developing countries in 1984, the higher intensity of household crowded was related to the higher child mortality [11].

The above mentioned findings have important implications for the design of policies to further reduce child mortality in Lao PDR. Firstly, there is clearly a need to reach people who live in rural and urban poor areas. Rural poor households live far from health care facilities and also lack the ability to pay for their health care. Urban poor households live close to health facilities but unable to afford health care expenses. Secondly, education lies at the root of wealth, quality of life and, therefore, also child health. Improving the level and quality of education is a means of child mortality reduction. Thirdly, households' infrastructure needs to be improved by giving vulnerable households a better access to clean water, energy and toilets. Finally, the Lao government might need to consider targeting specific regions as well as specific ethnic and religious groups with tailor-made programs to mitigate the child mortality. Overall, the challenges for policy-makers are manifold, but so are the possible starting points as this study has demonstrated.

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