ECOLOGICAL ANALYSIS OF COMMUNITY-LEVEL SOCIOECONOMIC DETERMINANTS OF INFANT AND UNDER-FIVE MORTALITY IN MYANMAR: AN ANALYSIS OF THE 2014 MYANMAR POPULATION AND HOUSING CENSUS

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ABSTRACT:

Background: Investing in child health is crucial for the nation's health as well as its socio-economic development and it can balance the population dynamics. Child mortality varies within and among the regions depending on the level of socio-economic development. Much literature has long established that child mortality reflects the impact of socio-economic and environmental circumstances in which children are living. There is emerging evidence that child mortality in Myanmar is raising a serious concern because the declining trend of child mortality has stopped and even reversing direction. This ecological analysis aimed to investigate the community-level effect of socioeconomic determinants on infant and under-five mortality in Myanmar.

Methods: The recent 2014 Myanmar Population and Housing Census provided the present study the raw data. The unit of analysis in this study is not an individual person but an ecological analysis on townships of Myanmar. All the community characteristics of townships level in census data (n=413) in Myanmar in terms of level of infant and under-five mortality, female literacy, female unemployment rate, percent urban, electricity, safe drinking water, safe sanitation latrines and smoking fuel were included in the study. Descriptive analysis, simple linear regression analysis and path analysis were applied to identify the effects of socio-economic determinants.

Results: This study identified socio-economic factors having an impact on the child mortality of Myanmar in 2014. There were inverse relationships between urbanization, electricity supply, safe latrine, drinking water; and child mortality while smoky cooking-fuel has positive relationship with child mortality. Maternal literacy and female unemployment had no impact on either infant or under-five mortality in Myanmar.

Conclusion: This ecological analysis on community-level effect of socio-economic determinants suggests that providing safe drinking water, sanitation latrine and urbanization with electricity supply in communities have more impact on infant and under-five mortality rather than providing the female literacy and employment status in communities of Myanmar. The findings help to close the knowledge gap on public health and population research on child mortality in Myanmar. These results should be helpful in informing effective, appropriate township-level interventions for improving child health in Myanmar.

Keywords: Infant mortality; Under-five mortality; Ecological analysis; Socioeconomic determinants; Myanmar

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INTRODUCTION

Investing in child health is crucial for the nation's health as well as its socio-economic

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development and it can foster the balanced of population dynamics [1]. The United Nations reported that 5.9 million of under-five children in the world died in year 2015; nearly 16000 children died every day. By another meaning, an average of 43 children per thousands lives births died before their 5th birthday in 2015 while 32 children per thousands live births died before their 1st birthday. The main causes of death are pneumonia (17 %), preterm birth complications (16 %), neonatal intrapartum-related complications (11 %), diarrhoea (8 %), neonatal sepsis (7 %) and malaria (5 %). Importantly, most child deaths are caused by diseases that are related with socio-economic factors and readily preventable cost-effective interventions [2].

Generally, child mortality has been declining in all countries but there is a wide gap between developed and developing countries. Put another meaning for different level of socio-economic development which is always observed from United Nation Inter-agency Group for Child Mortality Estimation, the under-five mortality rate (U5MR) are 6 per 1000 live births (LBs) in developed countries vs 47 per 1000 LBs in developing countries; and infant mortality rate (IMR) are 5 per 1000 LBs in developed countries vs 35 per 1000 LBs in developing countries. Even in the same region, like Southeast Asian (SEA) countries, the IMR and U5MR are varied ranging from U5MR 8/1000 LBs and IMR 2/1000 LBs in Singapore to U5MR 72/1000 LBs and IMR 62/1000 LBs in Myanmar [2, 3]. It means that the different level of socio-economic status of a region may lead to different outcome of child mortality status.

Child mortality reflects the impact of socio-economic and environmental circumstances where children are living in. Many literatures such as in Denmark, Finland, Norway, and Sweden [4], different regions in Nigeria [5], Thailand [6, 7], Laos [8], Nepal [9] and Bangladesh [10] and Myanmar [11] have been confirmed that child mortality is determined by the level of socio-economic development within and across the countries and among the regions. Antai and Moradi (2011) highlighted that people living in an economically and socially deprived environmental condition is associated with increasing risk of child mortality [12]. Additionally, Nguyen [13] reported that socio-economic development promotes the child survival. For developed countries, not only the clean and safe water and sanitation, but also the high quality of health care services and child care services are crucial for decreasing infant and child mortality. They also urged that developing countries should accelerate their action to increase the national income, education, clean water and sanitation, personal hygiene practice, and health care services as they are the most determinants factors for infant and child mortality.

However, many studies such as in China [14], Bangladesh [15], Mongolia [16], Thailand [7, 17]and Malaysia [18] have less attention on the influence of community-level factor on child survival status. The important role of community-level socio-economic factors on child mortality was highlighted by Klaauw and Wang's model examining on infant and child mortality in rural areas of India using the Indian National Family and Health Survey 1998/1999 [19], Boco's analysis of 28 Demographic Health Survey (DHS) in Sub-Saharan Africa [20]; and Adedini's analysis of Nigeria DHS [5] by examining on community level effects on child mortality. Those results showed that child mortality can be reduced substantially, particularly by improving the education and employment of women, providing safe water and reducing indoor air pollution caused by smoked cooking fuels in community.

Therefore, in this study, the ecological analysis on community-level socio-economic determinants was applied. The ecological analysis is a scientific way to perform an observational research to look at the large scale impacts on the area of interests. It is appropriate to investigate the casual hypothesis by analyzing the population's statistics based on aggregated individual data, not on the individual's characteristics. Thus the ecological analysis is important so they provide information on what community-level socioeconomic factors affect one community or group rather than the other [21, 22]. Paying attention to community-level factors in child health research can help researchers and policy makers to understand the overlooked socioeconomic factors that determine on child mortality. Therefore, it is necessary to look beyond the individual-level determinants by foreseeing the community-level which can provide the information for the policy makers to allocate the scared resources and plan strategies for improving child health [5].

In Myanmar, socio-economic gap within and among regions has wide gap. Poverty by socio-economic inequalities within and among the regions is still challenging in Myanmar [23]. Although Myanmar Government laid down the set objectives

to improve the regional development, the child mortality are markedly high in some regions by 2014 Myanmar Census. Therefore, this topic makes the researcher's interest to identify the socio-economic determinants of child mortality in Myanmar.

On the other hand, despite the reduction of child mortality rate by 28% between 1990 and 2015, the target of Millennium Development Goal 4 had not achieved. Therefore, there is emerging evidence that the child mortality in Myanmar is raising a serious concern. It is clearly stated by recent 2014 Myanmar Census that a steady decline in child mortality during the past years has come to a slow force in past years. More specifically, it has been estimated that the most recent five-year period (which corresponds to the period 2010-2014) U5MR was 72 per 1000 LB and IMR was 62 per 1000 LB respectively [24]. On the other hand, the world average U5MR was 43/1000 LBs and IMR 32/1000 LBs in 2015 [2] which were relatively lower than Myanmar. Thus, Myanmar Government now faces the big challenge of reducing the infant and child mortality. For these reasons, it is very important to identify the factors affecting the infant and child mortality; and for seeking the strategies which can be modified by more effective intervention programs by enhancing the infrastructure support, community development and women empowerment to uplift the health status of the children in Myanmar.

Again, child mortality is multi factorial causation and there are many determinants that play role in reducing child mortality. There are different departments and organizations that provide the child mortality data in Myanmar such as Ministry of Health [25], Department of Population [3, 24, 26] and Central Statistical Organization [27]. They have tried to study the level of child mortality in Myanmar yet a few studies are related with cause-specific under-five mortality survey. However, those studies have less attention on the socio-economic determinants of contextual factors on child survival status which is one of the most influential set of factors that can lead to a high child mortality patterns. Even though those Myanmar surveys offer greater flexibility in analyzing child mortality by different surveys; they are not fit for adequate analysis of community-level effect on socio-economic determinants on child mortality in Myanmar, a weakness that this present study tries to solve.

While census data provides the information of child mortality at union, regional and township level, the complete picture of community-level effect on socio-economic determinants of child mortality at national levels survey using census dataset has been rarely studied. The present study is the first and foremost study on child mortality using Myanmar Census data. Therefore, this study was designed to examine the community level socio-economic determinants of child mortality in Myanmar on a national scale. In doing so, the present study attempts to fill the information gaps among regions and their disparities.

Moreover, the conceptual thinking used in this study comes from two main sources: Mosley and Chen's Framework (1984) [28] and Klaauw and Wang's Framework (2009) [19]. The conceptual thinking is that different resident in different environmental and community exposure may lead to different child health outcomes [19, 28]. Within this conceptual framework, child health outcome can be determined by community characteristic where they live in. In lines with its objective of the present study and nature of the data set provided by 2014 Myanmar Population and Housing Census, some community factors in the mentioned frameworks were not considered in the study. Therefore, this paper aims to address the community-level effect of socio-economic determinants of infant and under-five mortality at townships level using the most recent data source of 2014 Myanmar Population and Housing Census.

MATERIALS AND METHODS

The raw data was drawn from the 2014 Myanmar Population and Housing Census conducted by the Department of Population (DoP) during the night between the 29th March and 10th April 2014 on a de facto basic. The census supervision system for high quality of data was done by Myanmar Government in collaborating with United Nations Population Fund and other partners forming the Central Census Commission, the International Technical Advisory Board including a group of 15 experts from different countries and institutions, Central and Township-level Census Committee and an independent team of international and national census observers to local sites [24]. It provides updated information of Myanmar regarding the population and housing characteristics at Union level, regional level, sub-regional and township level including socio-economic characteristics and level of IMR and U5MR. It has

never and ever happened before in these good advantages of data file where information on women status, socio-economic development and environmental sanitation indicators at a community level of a township. Regarding the child mortality, the summary birth history was collected in the questionnaire in the 2014 Myanmar population and housing census. Single household informant or reproductive age women/mother provided the information on children. It includes the data regarding: 1) the number of children ever born, classified by the age of the women and 2) the number of children dead, classified by the age of the women [3]. Indirect estimation on IMR and U5MR was done by Department of Population for national, regional, district and even in township/town level using MORTPACK (version 4.3) [24, 29].

Myanmar administrative nomenclature is made by 15 States and Regions (including Naypyitaw territory) which are composed of districts (70 districts), which in turn are subdivided into townships (or) towns with specific boundaries, then into ward (urban), village tract and villages (rural). In Myanmar, there are 330 townships and 83 towns under the same category designated by General Administration Department of Ministry of Home Affairs thus there are 413 townships/towns in Myanmar. The unit of analysis in this study is not an individual person but an ecological analysis on a group of people. Based on the measurements for all individual within the communities in 2014 Myanmar Census data, the aggregate data of community-level socioeconomic variables were used. Therefore, the unit of analysis was the community characteristics of township/towns level in census data so all the townships/towns (n=413) were included in the study.

The independent variables included in the study as determinants at community level are based on Klaauw and Wang's concept [19] including female literacy percentage, female unemployment rate (15-64 years), percent urban, percentage of household using safe sanitation latrines, percentage of household using electricity, percentage of household using safe drinking water source and percentage of household using smoked cooking fuel, which all are measured by ratio scale. The dependent variables are level of infant and under-five mortality measured by ratio scale.

Cross-sectional descriptive study was conducted by quantitative analysis in the study. Descriptive analysis was done to identify the background characteristic of the study. Further concentrating on direct effect of each indicator on child mortality, it employed the simple regression analysis (SRA) because this study wanted to look at the direct effect without controlling the other co-variates having confounding effect on child mortality. The SRA analysis was applied whether there is linear relationship between the dependent variables and all independent variables. The results from SRA can provide the policy makers the important knowledge to understand how these indicators are critical and need to concern them to reduce the child mortalities in communities.

In the study; moreover, multivariate analysis by path analysis (PA) was followed by the SRA that allows testing of a model and estimating the both direct and indirect effects of community development indicators on outcome(s) of infant and under-five mortality. Before path analysis, correlation matrix was tested whether there is a collinearity or multi-collinearity between and among the variables. There is assumption on using PA that it is better if there is no strong correlation ($r = <0.65$) between each and among independent variables.

In the PA model, the independent variables are modeled as being correlated and as having both direct and indirect effects on dependent variables (infant and under-five mortality) through some mediator. Therefore, the result of PA pointed out to the policy makers clearly that which community-level socio-economic factors should be first treated to reduce infant and under-five mortality in Myanmar by providing a more intricate way of thinking about testing the research questions. The analyses in the study were done by SPSS and STATA software.

Therefore, this ecological study could contribute to understand the large-scale impact of community-level socio-economic characteristics of child mortality in Myanmar. By considering the effects of community wide socio-economic variables, it can provide the effective policy implications to provide the specific interventions in the community. On the other hand, it could not explain the cause and effect in individual characteristics, thus it fail to consider the multilevel analysis in which individual and group level data are aggregated and analyzed, one limitation of this study.

Table 1 Background characteristic of the study (n=413)

	N	Minimum	Maximum	Mean	SD
Dependent variables					
Infant mortality (Level) (per 1000 live births)	413	10	140	61.82	23.803
Under-five mortality (Level) (per 1000 live births)	413	11	178	72.79	30.173
Independent variables					
Female literacy (%)	413	8.70	99.00	78.91	21.55
Female unemployment rate (15-64)	413	1.30	18.30	4.30	2.62
Percent urban	413	1	100	27.39	27.561
Electricity (%)	413	1	100	28.94	27.190
Safe sanitation latrines (%)	413	5	100	69.06	23.045
Safe drinking water (%)	413	0	100	63.23	27.944
Smoked cooking fuel (%)	413	4	100	84.95	21.849

Table 2 Simple regression analysis for infant & under-five mortality in Myanmar (n=413)

Contextual factors of community characteristics	Mean	SD	Infant mortality				Under-five mortality			
			b-coefficient	95 % CI		R^2	b coefficient	95 % CI		R^2
				Lower	Upper			Lower	Upper	
Female literacy	78.91	21.55	-0.083	-0.190	0.024	0.006	-0.111	-0.246	0.024	0.006
Female- unemployment	4.30	2.62	-0.574	-1.451	0.303	0.004	-0.760	-1.872	0.351	0.004
Percent urban	27.39	27.561	-0.430***	-0.503	-0.357	0.248	-0.531***	-0.624	-0.438	0.235
Electricity (%)	28.94	27.190	-0.510***	-0.579	-0.441	0.34	-0.632***	-0.720	-0.543	0.324
Safe sanitation latrines (%)	69.06	23.045	-0.308***	-0.404	-0.213	0.089	-0.394***	-0.515	-0.272	0.09
Safe drinking water (%)	63.23	27.944	-0.301***	-0.379	-0.224	0.125	-0.382***	-0.479	-0.284	0.125
Smoked cooking fuel (%)	84.95	21.849	0.555***	0.464	0.646	0.259	0.685***	0.569	0.801	0.246

b coefficients = unstandardized regression coefficients

Ethical considerations

Permission to use the 2014 Myanmar Census data was obtained from DoP, Ministry of Population and Immigration, Myanmar. Moreover, the study is approved by the Institute for Population and Social Research- Institutional Review Board (IPSR-IRB) with Certificate of Approval (COA). No. 2016/02-010.

RESULTS

In the study, the IMR is ranging from 10/1000 live births (LBs) to 140/1000 LBs with mean value 61.82 and standard deviation (SD) 23.803. For U5MR, it is ranging from 11/1000 LBs to 178/1000 LBs with average value of 72.79 and SD 30.173. The lowest IMR and U5MR were 10/1000 LBs and 11/1000 LBs respectively which were found in a township where located in plain region. On the other hand, the highest IMR was stated by 140/1000 LBs and U5MR was 178/1000 LBs in another township located in hilly ethnic region of Myanmar. Therefore, the IMR and U5MR in some contexts of the study are relatively higher than national figure of IMR and U5MR (62/1000 LBs and 72/1000 LBs). The results highlights that there are markedly contextual differences among the regions in Myanmar. It may be due to geographical disparities, accessibilities to the infrastructure development and different demographic estimation method whereas census data can provide only indirect child mortality estimation which leads to relatively high child mortality rates. The detailed background characteristics are shown in Table 1.

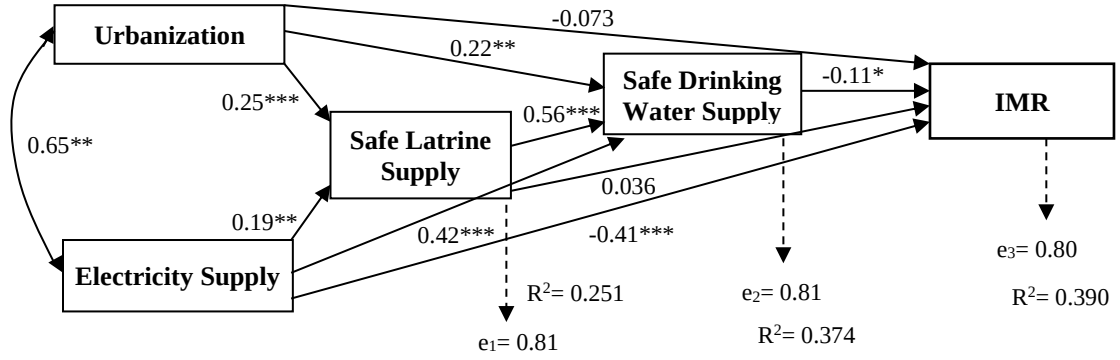
Simple regression analysis

The SRA in Table 2 shows that urban, electricity, safe latrine and safe drinking water could reduce on both infant and under-five mortality with statistically significant ($p<0.001$) while the smoked cooking fuel has the strongest positive effect on child mortality in SRA ($p<0.001$). Female literacy and female-unemployment had no effect on both infant and under-five mortalities. Without controlling the other co-variates, the electricity accounted for 34 % of the variance in IMR (R^2=0.34) and 32 % of the variance in U5MR (R^2= 0.32) which was followed by smoked cooking fuel (R^2= 0.26 and R^2= 0.25), urban (R^2= 0.24 and R^2= 0.23), safe drinking water (R^2= 0.12 and R^2= 0.12) and safe sanitation latrine (R^2= 0.09 and R^2= 0.09).

Table 3 Correlation matrix between dependent and independent variables as well as correlation between independent variables (n= 413)

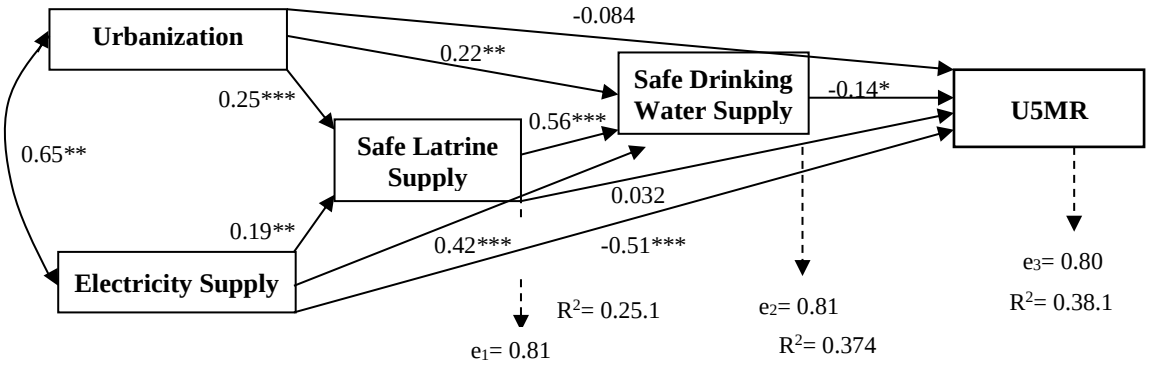
	Infant mortality	Under-five mortality	Urban	Electricity	Safe sanitation latrines	Safe drinking water
Infant mortality	1					
Under-five mortality	.999***	1				
Urban	-.498***	-.485***	1			
Electricity	-.583***	-.569***	.650***	1		
Safe sanitation latrines	-.298***	-.301***	.484***	.469***	1	
Safe drinking water	-.354***	-.353***	.350***	.457***	.557***	1

*** Pearson Correlation (r) is significant at 0.001 level*



MSEA = 0.000 (<0.05 indicates a very good fit), CFI = 1 (1 indicates a very good fit)
TLI or NNFI= 1 (>0.95 indicates a good model fit) *** p <0.001, ** p <0.01, * p<0.05
Values are described by a path coefficient which is a standardized regression coefficient (beta)

Figure 1 Path analysis on infant mortality in Myanmar



RMSEA = 0.000 (<0.05 indicates a very good fit), CFI = 1 (1 indicates a very good fit)
TLI or NNFI= 1 (>0.95 indicates a good model fit) *** p <0.001, ** p <0.01, * p<0.05
Values are described by a path coefficient which is a standardized regression coefficient (beta)

Figure 2 Path analysis on under-five mortality in Myanmar

Path analysis

The selected variables for the PA model were based on the results of significant factors and their R^2 in SRA. Moreover, lessons learned from the theoretical backgrounds, modernization leads to better environmental sanitations via safe drinking water and toilet facilities, which in turns to reduce the child mortality [30]. Therefore, in here, urbanization and electricity variables serve as modernization factors and safe drinking and safe

Table 4 Direct and indirect effects on IMR and U5MR in Myanmar by Path analysis

Specific socio-economic factors	IMR		U5MR	
	Direct	**Indirect**	**Direct**	**Indirect**
Urbanization	-0.073	-0.027	-0.084	-0.038
Electricity	-0.41***	-0.05 *	-0.51***	-0.068*
Safe latrine	0.036	-0.062***	0.032	-0.079***
Safe drinking water	-0.11*	0 (no path)	-0.14*	0 (no path)

Note:
Electricity-→ Safe latrine supply→ Safe drinking water supply -→ IMR is 0.19 x 0.56 x (-0.11) = -0.0117
Electricity-→ Safe latrine supply→ IMR is 0.19 x 0.036 = 0.0068
Electricity-→ Safe drinking water supply -→ IMR is 0.42 x (-0.11) = -0.0462
Total indirect effect = (-0.0117) + (0.0068) + (-0.0462) = -0.0511

latrine variables are treated as environmental sanitation factors. In addition, the safe latrine has effect on safe drinking water after the modernization process [31]. Hence, PA also allows this study how does modernization affect on child mortality via the action of intervening variable of environmental sanitation variables.

The correlation matrix was done before the PA. The results from Pearson's correlation in Table 3 shows that the independent variables such as urban, electricity, safe latrine and safe drinking water are significantly related with the dependent variable (infant and under-five mortality), at 0.001 significance level. In addition, there was found significant correlations among independent variables (mulitcollinearity); however, they are not very strong ($r < 0.65$). Therefore, these four independent variables were further analyzed into path analysis model.

In the PA, it shows the diagram relating exogenous/independent variables (urbanization and electricity), endogenous/mediator variables (safe drinking and safe latrine) and dependent variable of child mortality (IMR and U5MR) as shown in Figure 1 and 2. As exogenous variables are correlated, it is indicated by a double-headed arrow connection them. The exogenous/mediator variables have both incoming and outgoing causal arrow in this path diagram. Both exogenous and endogenous variables affect to child mortality by outgoing arrows. Values are described by a path coefficient which is a standardized regression coefficient (beta), showing the direct effect on an independent variable on a dependent variable in the path model [32-34].

Good model fit for path analysis

Hu and Bentler [35] stated that chi-square value should not statistically significant to be a good model. On the other hand, once the sample size over 200 cases, it is almost always statistically significant [35]. It was supported by the present study as the sample size was 413 cases and its statistically significant. For the root mean squared error of approximation (RMSEA), they also mentioned that RMSEA less than 0.10 is good and less than 0.05 is very good. The comparative fit index (CFI) ranges from 0 to 1, with 1 indicating a very good fit; acceptable fit if CFI>0.9. The Tucker-Lewis Index (TLI) or Non-Normed Fit Index (NNFI) greater than 0.95 indicates a good model fit and less than 0.9 is poor fit. In the present study, the recommended three model fit indices were used and found as RMSEA= 0.000, CFI= 1 and TLI or NNFI= 1.

This study found that the electricity and safe drinking water were statistically significant to reduce IMR and U5MR in Myanmar. However, after controlling the variables in IMR, the coefficient of these variables were reduced; 0.41 for electricity ($p<0.001$) and 0.11 for safe drinking water ($p<0.05$) in PA compared with 0.51 for electricity ($p<0.001$), and 0.301 for safe drinking water ($p<0.001$)in SRA. Similarly in U5MR, the coefficient were 0.51 for electricity ($p<0.001$) and 0.14 for safe drinking water ($p<0.05$) in PA compared with 0.632 for electricity ($p<0.001$) and 0.382 for safe drinking water ($p<0.001$) in SRA. Additionally, the significant effect of urbanization ($p<0.001$) and safe latrine ($p<0.001$) in SRA led to no effect on child mortalities after controlling the other variables in PA.

In addition, urban and electricity were able to explain for 25 % of the variance in safe latrine (R^2= 0.251), which led to 37% of the variance in safe drinking water via safe latrine (R^2= 0.374); then increased to 39% of the variance in IMR via safe latrine and safe drinking water (R^2= 0.39). Similarly in U5MR, the R^2 values were increased from 0.25 to 0.37 to 0.38. Therefore, the path model highlighted that the newly added variables have explanatory

powers to determine the child mortalities.

In the study, the electricity has both direct and indirect on infant and under-five mortality while urbanization has no effect on both infant and under-five mortality. The 'safe latrine' was assumed as having only indirect effect over child mortalities combining with 'safe drinking water supply'. Although urbanization, electricity and safe drinking water had strong direct effect on IMR and U5MR, electricity supply has the greatest direct effect as well as indirect effect on IMR and U5MR (Table 3 and Table 4).

DISCUSSION

Female literacy

In this study, a person is considered literate if she can read and write in any language for daily use. There is wide variation in female literacy among the communities, ranging from 9 % to 99 %. It had no effect on both IMR and U5MR. John Caldwell and other scholars such as Mosley and Chen states that maternal education of a community determines the survival of the children with the entire process through various pathways by enhancing the socio-economic status in terms of fewer children, and greater health choice for children. Eventually more education results in lower child mortality [28, 36]. Many studies conducted in sub-Saharan Africa [37], 152 low-, middle-, and high-income countries [38] and UN member countries [39] had affirmed the role the of maternal literacy in infant and under-five mortality that it is the most important for child survival whether she lives in developed or developing countries [37-39] and different regions [30].

However, in the present study, both infant and under-five mortality are not related to female literacy of a community if only they can read and write. It is considerably affected by level of education of mothers in those communities rather than reading and writing any language. Bangladesh studies highlighted that children born to a mother with at least primary education has about 20% more likely to survive than children born to non-educated mother [1, 10, 40]. Further, Sartorius and Sartorius examined educational effect on child mortality in192 world-wide countries which stated that female education (mean number of education years among females) is strongly related with infant mortality in different regions for both developed and developing countries [37]. In general, low-educated caregivers have poorer access to health information than their counterparts which in turns can lead to ill-informed decisions on seeking care of their children [1]. Therefore, this study pointed out that the individual effect on level of maternal education in Myanmar is called for further analysis on IMR and U5MR.

Female unemployment

In general, mothers who have job may be more likely to access adequate health care facilities and better access to nutrition for both themselves and their children than non-job mothers. Therefore, employed mothers are more likely to access health facility and more likely to protect their children from diseases [9]. Much evidence states that the high child mortality were found in un-employment women in Denmark, Finland, Norway, and Sweden [4], Thailand [6, 7], different regions in Nigeria [5]and Bangladesh [10].

However, in the study, most of the female aged 15 to 64 are employed while 1-18 % had not a job. Female unemployment status is not statistically associated with IMR and U5MR and it appears to be less important determinants for child mortality in Myanmar. The findings are consistent with a study in Nepal [9], New Zeeland using data from Census and mortality records [41] and in Africa study using data from DHS from in Kenya, Tanzania, Rwanda [30], and Myanmar [11] which indicated that maternal unemployment status was not strongly associated with the child mortality. It may be many reasons that mother who are not working at outside may have more time for child bearing and child rearing practices. When a child becomes sick, household members or parents particularly mothers take the responsibility of care giving to their child [1]. In case of wealthier mother status, this effect may be more prominent because they are no needed to earn money at outside and they can purchase high quality of food and medical services to their children.

Percent urban

Place of residence differs the child mortality by the unequal distribution of health facilities, physical infrastructure such as transportation, communication, electricity, water and sanitation, health infrastructure, poor or good living conditions and prevalence of disease conditions[1, 42]. These differences generally result in higher child mortality in rural areas [30, 43-46]. South-east Asia studies like Laos PDR [8], Nepal [9]and Myanmar [11] where they found that children living in rural area are more likely to have childhood morbidity and mortality than those living in urban area. It is affirmed by the

present study that urbanization has reverse effect on both IMR and U5MR. Therefore, it can be assumed that children living in urban area of Myanmar usually exhibit higher child survival and quality of life. It is supported by recent 2014 Census that 70% of Myanmar people are living in rural area where there is geographical inaccessibility, limited infrastructure and health care facilities [24]. On the other hand, it has no effect on child mortalities after controlling the other co-variates. Therefore, reducing the child mortality in urban area is not universal. In some countries, child mortality may higher in urban area due to rapid urbanization and its negative impact which turns into infant and child death. Van de Poel et al [45] pointed out that child mortality is higher in urban areas of 9 out of 47 developing countries where the respiratory tract infection was occurred by air pollution of crowed situation and its urbanization of cities; moreover, urban-rural effect is not important when controlling the other variables.

Electricity

In general, it is believed that children who are living in household with electric facilities are greater chance of surviving than the children who are living in household without electric facilities. It may be assumed as one of the proxies of household socio-economic status which determine the child mortality [5, 47]. A study in Myanmar, 1997, found that the risk of a child death are reduced by almost 50% if the mother lives in a household that has electricity [11]. In addition, a study of Klaauw and Wang highlighted the access to electricity to household that providing 1 percent of household with access to electricity reduces the child mortality with approximately 0.11 in rural India [19, 31]. In this study, electricity coverage is ranging from 1 % to 100 %. It had higher impact on child mortality than India study with statistically significant at < 0.001 level. It would reduce 0.51/1000 LBs for IMR and 0.63/1000 LB for U5MR if the household in that community access to electricity increased by one percent. Even after controlling the other co-variates, it has significant effect on child mortalities. Then, it can conclude that providing access to electricity in a community reduces IMR and U5MR by enhancing the socio-economic status of a household in terms of reducing smoking fuels for cooking and consequences of child-hood respiratory diseases.

Safe sanitation latrines

Safe latrine is important factor for child mortality [5, 30, 39, 40, 42-44, 47, 48]because about 50% of the population in the developing countries are without adequate sanitation [1]. In the study, safe sanitation latrine means household access to toilet facilities which are flush and water seal. It is ranging from 5 % to 100% in communities of Myanmar. Even though it has no direct effect on child mortality after controlling the others, it has strong indirect effect on child mortality combining with safe drinking water. .

Safe drinking water

The UNICEF stated that about 20% of the developing countries has no access to safe water sources[1]. It was surprising that some communities in Myanmar have no access to safe drinking water source such as from water purifier/bottled, tap water/piped, tube well/bore hole, and protected well/spring. Household access to a safe drinking water has substantially reduced and statistically significant effects on infant and under-five mortality. It is supported by other studies in both developed and developing countries' studies where infant and child mortality is closely related with safe water supply and access to drinking water[5, 7, 14, 30, 39, 40, 42-44, 47, 48]. Therefore, it is needed to provide the sanitation facilities for safe drinking water and safe latrine together to increase child survival status.

Smoked cooking fuel

Smoked cooking fuel is main source of cooking in Myanmar. The household using smoked cooking fuel is ranging from 4 % to 100. There are positive relationship between household using smoked cooking fuel and child mortality. The IMR andU5MR would increase by 0.541/1000 LBs and 0.666/1000 LBs respectively when the household in community using smoked cooking fuel increased by one percent with statistically significant ($p<0.001$). The present findings was supported by recent 2014 Myanmar census that 69.2% of the household use firewood as their main source of energy for cooking and eating [24]. It makes air pollution particularly impact on children health. It was affirmed by 2001 FRHS [11] that indoor air pollution was related with under-five mortality; and recently Myanmar Ministry of Health's 2012-2013 cause-specific under-five mortality survey, presenting the most leading cause of under-five mortality are respiratory diseases like pneumonia [25]. The similar findings was found in an India study which stated that household solid fuel was used in 87% of households with child deaths in 1998; and it can increase the probability of child death and respiratory tract

infection [49].

LIMITATIONS OF THE STUDY

According to the nature of secondary data, it is difficult to assess the data quality and accuracy of each variable included in the study. Data on child death comes from mothers or household heads who can respond the questionnaire at the time of data collection in 2014 Census. It may do the difficulty of recalling details of her/their memory regarding child births and deaths in their past. This study does not cover additional determinants of child mortality such as individual characteristics of mother and children. Moreover, there is no data about average income of working age groups in the households and gross domestic product (GDP) of each township.

RECOMMENDATION AND CONCLUSION

As children are vulnerable group in a household, they may have the risks from household contamination such as water-borne diseases, air-borne diseases, communicable-diseases, skin infections. The UNICEF states that better environmental sanitation alone can reduce the incidence of diarrhea-related diseases by one-third; while combination with better personal hygiene practices can reduce by two-third after the modernization and urbanization process [1]. This study pointed out the important community-level factors determined child mortality in Myanmar were electricity and smoking cooking fuel which were followed by percent urban, safe drinking water, safe latrine. Female literacy and female unemployment were less important determinants and they are called for further individual analysis. The results of this study will be generalized in other similar setting of developing countries such as some SEA and Africa countries where there are high child mortality. Therefore, the new government of Myanmar should allocate their resources and budgets for regional development by providing the urbanization with electricity supply and sanitation infrastructures. At the same time, women social empowerments are needed via equitable access of education and occupation for them. The more they invest on infrastructure development, sanitation facilities and women empowerment, the higher the child survival of Myanmar. To conclude that, the further analysis with individual- and household-level socio-economic characteristics using 2014 Myanmar Census are needed for child mortality for comprehensive understanding of child survival status in Myanmar.

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