Association between Maternal Education and Childhood Mortalities in Myanmar

Corresponding Author:

Khaing Soe, MBBS, MIPH

Division of Health Research, Faculty of Health and Medicine,

Lancaster University,

Furness College

LA1 4YG UK

Postal address: B1 Nuriana Apartments, 13 Lower Kabete Road, Westlands, Nairobi, Kenya

Email: k.soe@lancaster.ac.uk

Co-Authors:

Paula Holland, BA (Hons), MA (Econ), PhD

Senior Lecturer

Division of Health Research

Lancaster University

Furness College

LA1 4YG UK

Email: p.j.holland@lancaster.ac.uk

Ceu Mateus, BA (Econ), MSc, PhD

Senior Lecturer in Health Economics

Health Economics Group, Division of Health Research

Lancaster University

Furness College

LA1 4YG UK

Email: c.mateus@lancaster.ac.uk

Abstract:

Maternal education is widely regarded as a core social determinant of child mortality in low-income countries. In Myanmar, the evidence related to context-specific social determinants of health including maternal education is scarce limiting grounds to advocate for a comprehensive health policy. Employing multivariate methods, the study analyzed the 2015-2016 Demographic Health Survey data exploring independent effect of maternal education on neonatal, infant and under-five mortality. The study found that maternal education was not significantly associated with neonatal mortality as its effect was confounded by household wealth and geographic residence, however it had independent effect on infant and under-five mortality. Mothers with primary education had 23% reduction in the odds of under-five mortality (p<0.001); those with secondary level had 40% reduction (p<0.001); and, those at higher level had 62% reduction (p<0.001). The study concluded that maternal education is a critical social determinant of childhood mortalities in Myanmar.

Key Words

Child mortality

Education status

Infant mortality

literacy

Maternal education

Neonatal mortality

Under-five mortality

   a. **What we already know**

- Globally, maternal education is widely regarded as an important determinant of child mortality though there are some controversies around its independent effect.

- In Myanmar, apart from few studies that reported a bivariate association between maternal education and childhood illnesses, there has not been any studies that examined the relationship between maternal education and childhood mortalities exploring its independent effect.

b. What this article adds

- This article has found that maternal education was significantly and independently associated with infant mortality and under-five mortality in Myanmar.

- The study also revealed that the role of maternal education on child mortality is more prominent during the post-neonatal period compared to the neonatal period.

INTRODUCTION

The world has seen the achievement of Target 4A of Millennium Development Goals (MDG) with the reduction of under-five mortality by half between 1990 and 2015[1]. Nevertheless, this reduction was largely attributed to the decline of child mortality in high and middle-income countries masking the mortality situation in many low-income countries[2]. Out of 64 low-income countries which contributed to 97% of the global under-five mortality, only 13 reached the MDG target of the mortality reduction while the rest did not meet the target [3]. In low-income countries, one child in 13 dies before the age of five, whereas, in high-income countries, the proportion is only 1 in 189 [4]. The inequities across countries are so pronounced that the global community has set the Target 3.2 of the Sustainable Development Goals (SDG) aiming to reduce neonatal mortality worldwide to 12 and under- five mortality to 25 per 1,000 live births by 2030 [1].

In tackling inequities in child mortality, the evidence has demonstrated that, in addition to biomedical interventions, it is imperative to address social determinants of health which influence population groups to have differential access, exposure and utilisation of effective health services resulting differential health related consequences[5,6]. It is critical to devise equity-focused health policies and identifying context-specific determinants of health inequities is important to formulate and strengthen appropriate health policies[7].

Maternal education is regarded as one of the key social determinants associated with the reduction of child mortality in low income countries[8,9]. An influential meta-analysis carried out in low income countries claimed that maternal schooling of 4-6 years is associated with a decline of infant mortality by 20% and under-five mortality by 40-60% [10]. The net effect of maternal education was elicited in another study that analysed data from 17 developing countries claiming that a one-year increase in mothers' education translated into 7 to 9 % reduction of child mortality [11]. However, some authors argued that the effect of maternal education became attenuated and even disappeared after strict adjustment of household wealth status by the multivariate methods [12]. Desai, Alva [13] asserted that maternal education did not have an independent effect on child mortality and it is merely an intermediate variable masking the relationship between household economic status and child mortality. Houweling, Jayasinghe, Chandola [14] also claimed that geographic accessibility to health services masks the relationship between maternal education and child health since geographic residence accounts for the effect of maternal education in low-income countries. Given these controversies, additional research is needed to ascertain the relationship in specific contexts.

Myanmar, one of the developing countries in South-East Asia region, experienced a steady decline of under-five mortality from 100 deaths per 1,000 live births in 1996 through 75 deaths in 2000 to 50 deaths in 2016 [15]. Nevertheless, the country still ranks the second highest child mortality in the region with huge disparities. The under-five mortality among the wealthiest households was 17.2 per 1,000 live births whereas that of the poorest was 62.4 [15]. Families in urban areas experienced the under-five mortality rate of 29 per 1,000 live births while the rural area had 53. The infant mortality rate as of 2016 stands at 40 deaths per 1,000 live births and the neonatal mortality at 25 deaths per 1,000 live births. These data indicate that almost 80% of child deaths occurred before one year of age and 50% before one month of age.

Myanmar has laid down national health policies, strategies and plans to improve maternal and child health situation in the country aiming to attain the universal health coverage by 2030. Nevertheless, the country lacks robust evidence regarding linkages between social determinants and health disparities including relationship between mother's education and child mortality. A few studies reported the

bivariate association between maternal education and a range of child health outcomes including morbidity and mortality parameters [16-18], however, the bivariate findings can be spurious in the presence of confounders and are not showing independent effect of maternal education. Furthermore, there have been no studies ever conducted in the country that specifically examined association between maternal education and childhood mortalities controlling for possible effects of socioeconomic factors. The objective of the present study is to examine whether maternal education is independently associated with neonatal mortality, infant mortality and under-five mortality in Myanmar. It is expected that exploring and ascertaining such an evidence could assist the country to strengthen health and education policies.

METHODS

The study analysed the nationally representative Demographic Health Survey (DHS) conducted in Myanmar in 2015-2016. The DHS employed a two-stage cluster sampling method ensuring representativeness at the national level and all fifteen states and divisions. The master sampling frame was taken from the National Population Census conducted in 2014 which consisted of all households countrywide and internally displaced populations living in temporary settlements. The first stage sampling selected 442 clusters from the master sampling frame of 4,000 primary sampling units. At the second stage sampling, a fixed number of 30 households was selected from each of the identified clusters resulting in 13,260 households from which 12,500 were interviewed yielding a 94% response rate. The DHS survey obtained informed consent form the interviewees. Out of several datasets produced by the Myanmar DHS survey, the present study analysed the Birth Recode (BR) file which comprises the full birth history of all interviewed women with one record for every child ever born by the interviewed mothers and data for the mother of each of the children. The BR file provided information about 22,989 children born to 7,796 interviewed women from which only singletons were included in the present study analysing the data of 22,562 children (20,659 weighted) and their respective mothers.

Three types of childhood mortality were identified as binary dependent variables: death of neonates (died before 28 days of age); death of infants (died before 1 year of age); and, death of under-five (died before five years of age). The study factor, maternal education, was recorded in the number of years of completed formal education grouped into four categories in line with the country's education system: 'no education'; 'primary'(Grade one to five); 'secondary' (Grade six to eleven) ; and, 'higher' (above secondary). A range of sociodemographic and economic variables were included in the analysis as independent variables to adjust for their possible confounding effects. These include paternal education, employment status of mother and father, mother's preceding birth interval, mother's age at child birth, mother's parity, child's sex, living with child's grandmother in the same household, household wealth status and geographic residence (urban/rural) of the household.

In statistical analysis, the descriptive analysis assessed the distribution of all the dependent and independent variables while the bivariate analysis examined the unadjusted associations between independent variables and dependent variables. The stepwise multiple logistic regression method was employed examining association between maternal education and the three childhood mortalities adjusting for the possible confounding effects. SPSS Version 25.0 was used in the data processing and data analysis, and sample weights were applied.

RESULTS

The descriptive analysis (Table 1) revealed that almost one tenth of the children ever born alive in Myanmar did not reach their fifth birthday and neonatal mortality contributed to about 40% of under-five mortality. Almost a quarter of mothers and fathers aged 15-49 years did not attend formal education, 29.1% of the mothers did not engage in paid employment, and 21.7% of the children lived in urban while 78.3% in rural.

(INSERT TABLE 1 HERE)

The bivariate analyses reported that, maternal education was significantly associated with childhood mortalities indicating the reduction of mortalities with an increased level of maternal education (Table 2). The mortality variables were significantly associated with other independent variables except the

'living with grandmother' variable as it was not significantly associated with neonatal mortality. Fathers and mothers in the unskilled labour category had highest child mortality, even higher than those without employment. Child mortality increased with the age of mothers, parity and shorter preceding birth interval. Poor households and families in rural areas experienced increased child mortality.

(INSERT TABLE 2 HERE)

The logistic regression on neonatal mortality (Table 3) revealed a statistically significant association with maternal education in the univariate analysis, followed by a gradual attenuation of its significance in subsequent batches when confounding variables were sequentially added to the analysis. In the final model where household wealth level and geographic residence were included in the analysis, the association between maternal education and neonatal mortality completely disappeared. It can thus be concluded that maternal education was not independently associated with neonatal mortality.

(INSERT TABLE 3 HERE)

The logistic regression on infant mortality (Table 4) indicated that maternal education was significantly associated with infant mortality throughout the five batches of the sequential regression analysis including the final stage. It can be concluded that maternal education was independently associated with infant mortality. Compared to mothers with no education, those with primary education had 17% reduction in the odds of infant mortality, those with secondary education had 33% reduction, and those with higher education had 50% reduction of infant mortality.

(See TABLE 4 in the supplementary file)

Maternal education was significantly associated with under-five mortality throughout all the stages of the stepwise regression analysis (Table 5) indicating that maternal education was independently associated with under-five mortality. In the final model, compared to mothers with no education, those with primary education had 23% reduction in the odds of under-five mortality; those with secondary education had 40% reduction; and, those with higher education had 62% reduction.

(See TABLE 5 in the supplementary file)

In the above regression analyses, the common predictors of childhood mortalities were maternal age at child birth, mother's parity, preceding birth interval, household wealth status, child sex and rural/urban residence. Father's education was significantly associated with infant and under-five mortality, but its effect sizes were smaller than those of maternal education. There was a mixed effect of father's occupation status on under-five mortality depending on the type of occupation. Mothers who gave birth children after 35 years of age and mothers who had fewer children were more likely to experience child death. For instance, mothers with over 5 children had 67% reduction of infant mortality compared to those with 1-2 children. Mothers with shorter birth intervals were more likely to have increased child mortality. Compared to mothers who had no preceding birth, those who had another child birth within one year after the preceding birth had 230% increased risk of infant mortality whereas mothers who had child birth over two years after the preceding birth had 29% reduction of infant mortality. There was a significantly reduced risk of child deaths for girls compared to boys. The richest households had 60% reduction in the odds of infant mortality compared to those in poorest quintile. The data indicated that families that had grandmother living with them in the same households experienced 21% reduction of under-five mortality, but this variable was not significantly associated with neonatal and infant mortality. Households in rural areas had 20% increased risk of having infant mortality compared to those in urban areas.

DISCUSSION

The independent association between maternal education and infant and under-five mortality is consistent with the findings of earlier studies [19-22]. The findings indicated that the effect size of mother's secondary education was higher than that of primary level, and that of higher education was greater than that of secondary level. This 'dose-response relationship' between maternal education and child mortality clearly affirms a strong and independent effect of maternal education on childhood mortalities in the study context.

The lack of the independent association between maternal education and neonatal mortality is consistent with previous studies [23-25]. A high level of neonatal mortality in the country followed by the lack of an independent association between maternal education and neonatal mortality could probably explain that the population had limited access to maternal and new-born health services. Access to and utilisation of health services which are fully equipped for emergency delivery and resuscitation are critical for neonatal survival during and after child birth. These services are more readily available in urban areas as compared to rural and are more financially and geographically accessible to affluent families compared to disadvantaged ones.

The present study found that, compared to urban residents, mothers who lived in rural areas had increased odds of having childhood mortalities. The availability of health services varies across different geographic regions of Myanmar in a way that well-equipped health infrastructure and competent workforce are more concentrated in urban areas which is resided by only 22% of the total population, and 78% of the country population living in rural regions. The mismatch between the availability and capacity of the health services and the population in need of health care probably results in increasing health outcome differentials between urban and rural.

In Myanmar, there is no nationwide social health insurance system that effectively covers people's out-of-pocket expenditure and families need to pay direct and indirect costs to receive health care. The better-off families can access quality services as and where needed while the access is somewhat restricted for deprived families. Under these circumstances, regardless of the education levels of the mothers, household wealth level becomes a crucial determinant of the utilisation of quality health services as demonstrated in the case of neonatal mortality.

The findings demonstrated that the effect of maternal education on child mortality is more critical during the post-neonatal life compared to the neonatal period. Education may bring better health-related knowledge to mothers which enable them to provide caring and nurturing support to their children as they grow older. The domestic health care including hygiene and nutritional support provided by

mothers at home environment improves with mothers' education level and it determines the health and nutrition status of children22.

The multivariate effect sizes reported by the present study highlight the potential gains which the country can benefit with improved investments in the education sector. For instance, the infant mortality of the country could be reduced by 17% had all mothers been educated at primary level; while it could be further declined by 33% had all mothers received secondary education; and, by 50% had all mothers had higher education. Nevertheless, given that the data used by the present study coming from the cross-sectional Myanmar 2015-16 DHS survey, the above effect sizes will need to be validated by prospective trials in the same context.

The present study has some limitations. The study design of the primary study is a cross-sectional survey where the data related to household, mother and child were collected at a single point in time and thus it is impossible to determine the causality among different variables. Consequently, the present study could report only the association between the study variable and the dependent variable. The 'household wealth index' was derived based on the household asset items recorded through direct observation [15]. However, there was no information in the primary dataset as to whether the households really owned those assets or not. Most of the primary survey questions related to childhood mortalities were responded by interviewed mothers through recalling past events. Mothers' self-reported mortality data may have weak data quality due to underreporting [29]. While some mothers tend to omit unpleasant events such as the death of their own children at very early age, some do not remember the exact age of death of their children especially if the death occurred within the first 28 days of age [30] which could result in misclassification of child death between neonatal and infant mortality.

Finally, the findings of the present study could be applicable to other countries in the Asia and Pacific region especially to the ones which have similar levels of development, national income and investment in health and education sectors.

CONCLUSION

Myanmar needs to expand its coverage of the universal primary education to ensure all children, particularly girls from disadvantaged backgrounds, have a basic primary education. This effort should be followed by the investment on the universal secondary education and strengthening measures to ensure girls' completion up to the secondary level as it will bring tremendous gains for the country in terms of averting high levels of childhood mortalities. It is critical for the country to ensure availability and accessibility of health services for every segment of the population since the weakened effect of maternal education on neonatal mortality could be probably attributed to an increasing importance of wealth level and geographic residence to access quality health services. The study expresses concerns over health disparities by socioeconomic differentials in the country and recommends taking holistic measures to address rural/urban gaps in health services utilisation. These measures may include but not limited to promoting health knowledge of mothers who do not have formal education, organising income generation activities targeting the poor, introducing affordable health insurance schemes, subsidising the cost of medicines and commodities, providing transport allowances to alleviate transportation costs to come to hospitals/health centres in rural areas and providing cash incentive to fully utilise certain health services such as vaccination.

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TABLES

Table 1: Descriptive statistics of child mortality variables and independent variables

Variables	Number	%
Child mortalities		
Died before 28 days of age	738	3.6
Died before one year of age	1495	7.2
Died before five years of age	1841	8.9
Maternal education		
No education	4819	23.3
Primary	10578	51.2
Secondary	4379	21.2
Higher	883	4.3
Paternal education		
No education	4720	22.8
Primary	8857	42.9
Secondary	6297	30.5
Higher	785	3.8
Maternal occupation		
no work	6003	29.1
professional/managerial	671	3.2
clerical/sales	3878	18.8
agricultural self employed	2318	11.2
agricultural employee	1275	6.2
unskilled labour	887	4.3
skilled labour	5626	27.2
Paternal occupation		
no work	307	1.5
professional/managerial	1172	5.7
clerical/sales	1722	8.3
agricultural self employed	4206	20.4
agricultural employee	1728	8.4
unskilled labour	3244	15.7
skilled labour	8281	40.1
Maternal age at child birth		
15-24	893	4.3
25-34	10057	48.4
35-40	9231	44.7

Variables	Number	%
41 and above	478	2.6
Parity including current pregnancy		
1 to 2	7361	35.6
3 to 4	8327	40.3
5 or above	4971	24.1
Preceding birth interval		
no preceding birth	7545	36.5
less than a year	237	1.1
between 1 and 2 years	2637	12.8
above 2 years	10240	49.6
Child's sex		
male	10705	51.8
Female	9954	48.2
Household wealth status		
Poorest	2950	14.3
Poor	3546	17.2
Middle	4139	20
Fourth	4670	22.6
Richest	5353	25.9
Living with grandmother in same household		
No	19315	93.5
Yes	1344	6.5
Residence		
Urban	4483	21.7
Rural	16177	78.3
Total (weighted)	20659	

Table 2: Bivariate association between childhood mortalities and independent variables

Independent Variables	Neonatal mortality		Infant mortality		Under-five mortality	
	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance
Maternal education		0.000		0.000		0.000
No education	4.6		9.8		12.9	
Primary	3.4		7.5		9.0	
Secondary	2.9		4.7		5.5	
Higher	2.6		3.1		3.3	
Paternal education		0.000		0.000		0.000
No education	4.5		9.7		12.8	
Primary	3.6		7.6		9.1	
Secondary	2.9		5.3		6.2	
Higher	3.3		4.1		4.7	
Maternal occupation		0.006		0.000		0.000
no work	3.2		6.1		7.7	
professional/managerial	4.2		5.5		6.7	

Independent Variables	Neonatal mortality		Infant mortality		Under-five mortality	
	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance	Percentage	Chi square test statistical significance
clerical/sales	3.0		5.6		6.9	
agricultural self employed	3.9		9.0		10.7	
agricultural employee	4.5		7.9		9.7	
skilled labour	2.6		5.3		6.4	
unskilled labour	4.1		9.2		11.3	
Paternal occupation		0.000		0.000		0.000
no work	2.3		5.8		7.5	
professional/managerial	2.8		4.5		5.5	
clerical/sales	1.7		4.1		5.1	
agricultural self employed	3.7		7.9		9.9	
agricultural employee	4.2		7.6		9.6	
skilled labour	2.6		4.8		5.9	
unskilled labour	4.3		8.9		10.8	
Maternal age at child birth		0.003		0.000		0.000
15-24	2.4		4.4		4.7	
25-34	3.0		5.8		6.7	
35-40	3.7		7.8		9.5	
41 and above	4.2		8.3		11.0	
Parity including current pregnancy		0.000		0.000		0.006
1 to 2	4.7		8.4		9.7	
3 to 4	3.2		7.0		8.6	
5 or above	2.5		6.0		8.2	
Preceding birth interval		0.000		0.000		0.000
no preceding birth	4.0		7.2		8.6	
less than a year	10.5		21.9		25.3	
between 1 and 2 years	6.4		13.5		16.2	
above 2 years	2.4		5.3		6.9	
Child sex		0.002		0.000		0.001
male	4.0		7.9		9.5	
female	3.2		6.5		8.2	
Household wealth status		0.000		0.000		0.000
poorest	4.5		9.9		12.5	
poorer	3.9		7.9		9.5	
middle	3.6		7.3		9.0	
richer	3.0		5.6		6.5	
richest	1.9		3.2		4.3	
Living with grandmother		0.128		0.020		0.004
No	3.6		7.4		9.1	
Yes	2.8		5.7		6.8	
Residence		0.000		0.000		0.000
urban	1.7		3.9		4.8	
rural	4.1		8.2		10.1	

Table 3 : Stepwise logistic regression of maternal education on neonatal mortality adjusting

for potential confounders : adjusted odds ratio (standard error) p value

Independent Variables	Batch 1 (maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education and occupation)	Batch 4 (parents' education, occupation, maternal and child characteristics)	Batch 5 (parents' education, occupation, maternal, child, household and community characteristics)
Maternal education	0.000	0.015	0.074	0.006	0.08
No education	Reference	reference	reference	reference	reference
Primary	0.728(0.087) 0.000	0.784(0.095) 0.010	0.800 (0.096) 0.020	0.760 (0.098) 0.005	0.777 (0.099) 0.011
Secondary	0.613(0.113) 0.000	0.695(0.129) 0.005	0.784 (0.132) 0.065	0.679 (0.136) 0.005	0.799 (0.138) 0.104
Higher	0.560(0.220) 0.008	0.590 (0.264) 0.046	0.614 (0.283) 0.085	0.486 (0.285) 0.011	0.712 (0.295) 0.251
Paternal education		0.073	0.11	0.116	0.095
No education		reference	reference	reference	reference
Primary		0.880 (0.098) 0.193	0.899 (0.099) 0.281	0.868 (0.100) 0.159	0.880 (0.101) 0.202
Secondary		0.749 (0.117) 0.014	0.843 (0.119) 0.152	0.792 (0.121) 0.053	0.879 (0.122) 0.288
Higher		1.007 (0.257) 0.979	1.426 (0.271) 0.190	1.182 (0.271) 0.536	1.535 (0.276) 0.120
Maternal occupation			0.353	0.433	0.388
no work			reference	reference	reference
professional/managerial			1.682 (0.242) 0.032	1.502 (0.245) 0.097	1.536 (0.254) 0.089
clerical/sales			1.067 (0.122) 0.595	0.960 (0.123) 0.739	0.997 (0.125) 0.978
agricultural self employed			1.124 (0.15) 0.436	1.016 (0.151) 0.915	0.940 (0.151) 0.682
agricultural employee			1.248 (0.190) 0.243	1.213 (0.191) 0.312	1.124 (0.183) 0.537
unskilled labour			0.875 (0.228) 0.557	0.809 (0.229) 0.353	0.872 (0.229) 0.551
skilled labour			1.056 (0.105) 0.604	0.947 (0.107) 0.610	0.878 (0.107) 0.225
Paternal occupation			0.000	0.000	0.006
no work			reference	reference	reference
professional/managerial			1.113 (0.447) 0.811	1.045 (0.450) 0.921	1.183 (0.453) 0.710
clerical/sales			0.812 (0.440) 0.636	0.773 (0.443) 0.561	0.942 (0.445) 0.894
agricultural self employed			1.771 (0.409) 0.172	1.862 (0.412) 0.132	1.645 (0.414) 0.229
agricultural employee			1.783 (0.424) 0.172	1.818 (0.426) 0.161	1.687 (0.416) 0.220
unskilled labour			1.331 (0.411) 0.488	1.297 (0.415) 0.530	1.469 (0.426) 0.356
skilled labour			2.077 (0.401) 0.067	2.128 (0.403) 0.061	1.930 (0.405) 0.105
Maternal age at child birth				0.000	0.000
15-24				reference	reference
25-34				1.709 (0.235)0.023	1.775 (0.236) 0.015
35-40				2.722 (0.232) 0.000	3.020 (0.233) 0.000
41 and above				3.406 (0.238) 0.000	4.042 (0.241) 0.000
Parity				0.000	0.000
1 to 2				reference	reference
3 to 4				0.511 (0.091) 0.000	0.507 (0.091) 0.000
5 or above				0.274 (0.123) 0.000	0.254 (0.124) 0.000

Independent Variables	Batch 1 (maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education and occupation)	Batch 4 (parents' education, occupation, maternal and child characteristics)	Batch 5 (parents' education, occupation, maternal, child, household and community characteristics)
Preceding birth interval				0.000	0.000
no preceding birth				reference	reference
less than a year				3.224 (0.228) 0.000	3.075 (0.229) 0.000
between 1 and 2 years				1.886 (0.108) 0.000	1.854 (0.108) 0.000
above 2 years				0.637 (0.093) 0.000	0.628 (0.093) 0.000
Child sex					
male				reference	reference
female				0.799 (0.077) 0.004	0.798 (0.077) 0.003
Household wealth status					0.003
poorest					reference
poorer					0.897 (0.103) 0.293
middle					0.773 (0.114) 0.024
richer					0.700 (0.132) 0.007
richest					0.496 (0.191) 0.000
Living with grandmother in same household					
No					reference
Yes					0.833 (0.171) 0.285
Residence					
urban					reference
rural					1.852 (0.146) 0.000

Table 4: Stepwise logistic regression of maternal education on infant mortality controlling for potential confounders: adjusted odds ratio (standard error) p value

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education and occupation)	Batch 4 (parents' education, occupation, maternal and child characteristics)	Batch 5 (parents' education, occupation, maternal, child, household and community characteristics)
Maternal education	0.000	0.000	0.000	0.000	0.001
No education	reference	reference	reference	reference	reference
Primary	0.749 (0.061) 0.000	0.828 (0.066) 0.004	0.841 (0.061) 0.010	0.817 (0.069) 0.004	0.838 (0.070) 0.020
Secondary	0.455 (0.086) 0.000	0.555 (0.097) 0.000	0.632 (0.099) 0.000	0.579 (0.102) 0.000	0.676 (0.104) 0.000
Higher	0.294 (0.201) 0.000	0.369 (0.231) 0.000	0.424 (0.243) 0.000	0.359 (0.245) 0.001	0.504 (0.252) 0.007
Paternal education		0.000	0.002	0.001	0.01
No education		reference	reference	reference	reference
Primary		0.855 (0.069) 0.022	0.861 (0.069) 0.030	0.838 (0.070) 0.012	0.845 (0.071) 0.018
Secondary		0.664 (0.084) 0.000	0.734 (0.085) 0.000	0.702 (0.087) 0.000	0.766 (0.088) 0.002
Higher		0.760 (0.216) 0.205	0.996 (0.226) 0.987	0.849 (0.226) 0.470	1.059 (0.230) 0.804
Maternal occupation			0.013	0.0129	0.659
no work			reference	reference	reference
professional/managerial			1.318 (0.205) 0.177	1.199 (0.208)0.382	1.256 (0.211) 0.281
clerical/sales			1.046 (0.090) 0.617	0.954 (0.092) 0.607	0.995 (0.093) 0.955
agricultural self employed			1.339 (0.105) 0.005	1.239 (0.107) 0.044	1.158 (0.107) 0.169
agricultural employee			1.095 (0.144) 0.530	1.080 (0.146) 0.596	1.032 (0.145) 0.829
unskilled labour			0.985 (0.162) 0.925	0.921 (0.164) 0.616	0.989 (0.165) 0.947
skilled labour			1.261 (0.075) 0.002	1.155 (0.077) 0.061	1.097 (0.077) 0.228
Paternal occupation			0.000	0.000	0.051
no work			reference	reference	reference
professional/managerial			0.881 (0.296) 0.668	0.835 (0.299) 0.547	0.918 (0.301) 0.776
clerical/sales			0.861 (0.277) 0.590	0.815 (0.280) 0.465	0.945 (0.282) 0.841
agricultural self employed			1.296 (0.258) 0.315	1.342 (0.261) 0.259	1.214 (0.263) 0.460
agricultural employee			1.289 (0.278) 0.351	1.303 (0.275) 0.335	1.215 (0.275) 0.480
unskilled labour			0.983 (0.261) 0.947	0.963 (0.264) 0.886	1.019 (0.266) 0.943
skilled labour			1.449 (0.250) 0.139	1.481 (0.254) 0.121	1.325 (0.256) 0.271
Maternal age at child birth				0.000	0.000
15-24				reference	reference
25-34				1.688 (0.177) 0.003	1.767 (0.177) 0.001
35-44				2.826 (0.174) 0.000	3.156 (0.175) 0.000
45 and above				3.249 (0.179) 0.000	3.892 (0.181) 0.000
Parity				0.000	0.000
1 to 2				reference	reference
3 to 4				0.569 (0.067) 0.000	0.561 (0.067) 0.000
5 or above				0.330 (0.086) 0.000	0.302 (0.087) 0.000
Preceding birth interval				0.000	0.000
no preceding birth				reference	reference

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education and occupation)	Batch 4 (parents' education, occupation, maternal and child characteristics)	Batch 5 (parents' education, occupation, maternal, child, household and community characteristics)
less than a year				3.550 (0.171) 0.000	3.364 (0.17) 0.000
between 1 and 2 years				2.073 (0.079) 0.000	2.036 (0.079) 0.000
above 2 years				0.725 (0.067) 0.000	0.716 (0.067) 0.000
Child sex					
male				reference	reference
Female				0.816(0.055)0.000	0.815 (0.055) 0.000
Household wealth status					0.000
poorest					reference
Poorer					0.834 (0.073) 0.128
Middle					0.738 (0.081) 0.000
Richer					0.628 (0.096) 0.003
Richest					0.409 (0.141) 0.000
Living with mother-in-law					
No					reference
Yes					0.820 (0.125) 0.111
Residence					
Urban					reference
rural					1.275(0.100) 0.011

Table 5: Stepwise logistic regression of maternal education on under-five mortality controlling for potential confounders: adjusted odds ratio (standard error) p value

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education and occupation)	Batch 4 (parents' education, occupation, maternal and child characteristics)	Batch 5 (parents' education, occupation, maternal, child, household and community characteristics)
Maternal education	0.000	0.000	0.000	0.000	0.000
No education	reference	reference	reference	reference	reference
Primary	0.671 (0.055)0.000	0.762 (0.060) 0.000	0.768 (0.060) 0.000	0.751 (0.062) 0.000	0.772 (0.063) 0.000
Secondary	0.392 (0.079) 0.000	0.497 (0.089) 0.000	0.555 (0.090) 0.000	0.521 (0.094) 0.000	0.606 (0.095) 0.000
Higher	0.227 (0.195) 0.000	0.293 (0.222) 0.000	0.329 (0.233) 0.000	0.286 (0.235) 0.000	0.387 (0.241) 0.000
Paternal education		0.000	0.000	0.000	0.000
No education		reference	reference	reference	reference
Primary		0.798 (0.068) 0.000	0.803 (0.062) 0.000	0.785 (0.064) 0.000	0.794 (0.064) 0.000
Secondary		0.618 (0.076) 0.000	0.678 (0.078) 0.000	0.647 (0.079) 0.000	0.710 (0.080) 0.000
Higher		0.727 (0.202) 0.113	0.943 (0.210) 0.781	0.800 (0.211) 0.839	1.974 (0.214) 0.900
Maternal occupation			0.035	0.284	0.828
no work			reference	reference	reference
professional/managerial			1.291 (0.190) 0.177	1.188 (0.192) 0.368	1.247 (0.195) 0.258

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education and occupation)	Batch 4 (parents' education, occupation, maternal and child characteristics)	Batch 5 (parents' education, occupation, maternal, child, household and community characteristics)
clerical/sales			1.046 (0.082) 0.579	0.951 (0.83) 0.547	0.997 (0.084) 0.970
agricultural self employed			1.221 (0.096) 0.037	1.129 (0.097) 0.212	1.055 (0.097) 0.581
agricultural employee			1.009 (0.132) 0.947	1.001 (0.133) 0.999	0.964 (0.133) 0.781
unskilled labour			0.975 (0.148) 0.864	0.916 (0.149) 0.559	0.979 (0.150) 0.885
skilled labour			1.229 (0.068) 0.002	1.126 (0.070) 0.008	1.073 (0.070) 0.311
Paternal occupation			0.000	0.000	0.038
no work			reference	reference	reference
professional/managerial			0.848 (0.265) 0.534	0.817 (0.568) 0.451	0.885 (0.270) 0.650
clerical/sales			0.848 (0.245) 0.501	0.819 (0.248) 0.422	0.934 (0.250) 0.785
agricultural self employed			1.315 (0.228) 0.230	1.382 (0.244) 0.266	1.241 (0.233) 0.353
agricultural employee			1.280 (0.241) 0.306	1.312 (0.231) 0.851	1.213 (0.245) 0.431
unskilled labour			0.952 (0.231) 0.830	0.957 (0.234) 0.815	1.002 (0.236) 0.994
skilled labour			1.369 (0.221) 0.155	1.431 (0.225) 0.110	1.268 (0.226) 0.294
Maternal age at child birth				0.000	0.000
15-24				reference	reference
25-34				1.807 (0.170) 0.000	1.900 (0.170) 0.000
35-44				3.153 (0.167) 0.000	3.536 (0.168) 0.000
45 and above				3.905 (0.171) 0.000	4.707 (0.173) 0.000
Parity including current pregnancy				0.000	0.000
1 to 2				reference	reference
3 to 4				0.584 (0.061) 0.000	0.576 (0.062) 0.000
5 or above				0.368 (0.077) 0.000	0.337 (0.078) 0.000
Preceding birth interval				0.000	0.000
no preceding birth				reference	reference
less than a year				3.200 (0.163) 0.000	3.010 (0.0164) 0.000
between 1 and 2 years				1.948 (0.073) 0.000	1.908 (0.074) 0.000
above 2 years				0.747 (0.061) 0.000	0.737 (0.061) 0.000
Child sex					
male				reference	reference
Female				0.858 (0.050) 0.002	0.857 (0.050) 0.002
Household wealth status					0.000
poorest					reference
Poorer					0.790 (0.068) 0.001
Middle					0.727 (0.074) 0.000
Richer					0.581 (0.089) 0.000
Richest					0.447 (0.125) 0.000
Living with grandmother					
No					reference
Yes					0.797 (0.114) 0.048
Residence					
Urban					reference

Independent Variables	Batch 1(maternal education)	Batch 2 (maternal & paternal education)	Batch 3 (parents' education and occupation)	Batch 4 (parents' education, occupation, maternal and child characteristics)	Batch 5 (parents' education, occupation, maternal, child, household and community characteristics)
rural					1.284 (0.091) 0.006