The Republic of the Union of Myanmar

Ministry of Health

Department of Public Health

Child Health Division

Study on
Cause of Under-five Mortality

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2014

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ABBREVIATIONS

ARI	Acute Respiratory Infection
AMW	Auxiliary Midwife
BHS	Basic Health Staff
CI	Confidence Interval
CNS	Central Nervous System
DALY	Disability-Adjusted Life Year
DHF	Dengue Hemorrhagic Fever
HH	Household
IMCI	Integrated Management of Childhood Illness
IMMCI	Integrated Management of Maternal and Childhood Illness
IMNCI	Integrated Management of Newborn and Childhood Illness
IMR	Infant Mortality Rate
LB	Live Birth
LBW	Low Birth Weight
MAS	Meconium Aspiration Syndrome
MDG	Millennium Development Goal
MICS	Multiple Indicator Cluster Survey
MMCWA	Myanmar Maternal and Child Welfare Association
MOH	Ministry of Health
NHP	National Health Plan
ORS	Oral Rehydration Salt
PEM	Protein Energy Malnutrition
PPES	Probability Proportionate to Estimated Size
PSU	Primary Sampling Unit
RHC	Rural Health Centre
RRR	Relative Risk Ratio
RTA	Road Traffic Accident
SD	Standard Deviation
SE	Standard Error
SIDS	Sudden Infant Death Syndrome
U5MR	Under-five Mortality Rate
WCHD	Women and Child Health Development
WHO	World Health Organization

Executive summary

Investing in the health and wellbeing of the children of Myanmar is an investment in the future. Despite a decline of 28% in the under-five mortality rate, from 109 deaths per 1,000 live births in 1990, to 51 deaths per 1,000 live births in 2013, the MDG (Millennium Development Goal) target of reducing under-five mortality will not be achieved without accelerated progress. An understanding of cause-specific mortality amongst under-fives is vital in order to prioritize child survival interventions, and for effective targeting of health resources in specific geographic/ecological areas. To complement the overall mortality rates, the estimate of cause-specific mortality in the under-five was explored using the verbal autopsy method. The study aims to identify health-seeking behaviour, health service provision and develop a database on the causes of death amongst under-fives and newborns in Myanmar.

The study used a cross-sectional descriptive design with a stratified multi-stage cluster sampling. A standard verbal autopsy questionnaire, developed by WHO (World Health Organization), was adapted to support Myanmar's specific setting. This adapted questionnaire was pre-tested. There were a total of three interview teams taking field action for five selected townships. Each investigating team consisted of one doctor, for administering the questionnaire, and one BHS (Basic Health Staff) from selected RHC (Rural Health Centre) for facilitating the identification of households with under-five deaths. Each team spent 10-14 working days in each township, supervised by investigators with the aim of quality control and coordination support for the teams. Data analysis was carried out at the Department of Medical Research (Upper Myanmar) using SPSS software version 20. The relevant respondents for 958 deaths of children underfive years old were interviewed. Most of the interviewees were "mothers of the death cases". The interview period started in May 2013 and ended in Feb 2014. Forty-seven per cent of interviews were carried out in front of more than one respondent. Mean (SD) age of respondents was 33.3 (10) years and the youngest respondent was 16 years old. About 77% of interviewees were below high school level. A diagnosis consultation meeting was held with 20 paediatricians. Final cause of death was confirmed, double checked and validated based on information from the verbal autopsies.

Among neonatal deaths the most common causes were prematurity, birth asphyxia, neonatal jaundice and neonatal sepsis. In the age group 29 days old to under five years the most common causes were ARI (Acute Respiratory Infection), diarrhoea, CNS (Central Nervous System) infection and beriberi. ARI was the most common cause of death among children above 28 days to under five years. Beriberi was the second most common cause among 28 days to under-ones, after ARI. Most deaths occurred at home (52%) and in hospital (42%). Death in hospital was more common for prematurity/LBW (Low Birth Weight), birth asphyxia and neonatal jaundice. Death at home was more common for ARI, diarrhoea, neonatal sepsis, CNS infection and beriberi cases. More than half of neonatal deaths occurred in hospital (56%). However, neonatal death was also very common at home (40%). Deaths in hospitals and at health centers were more common at the age of less than 28 days. Death at home and other places, rather than hospital or health centres, was more common at over 28 days old. Mean (SD) duration of illness before death (total days) was 9.6 (41.9) days. Median duration was 2 days. Many deaths occurred on the first day of life. Regarding duration of illnesses before death, it was found that 81% of deaths occurred within 7 days of their illnesses. Younger age children had a shorter duration of illness before death ($p<0.001$). Birth asphyxia, prematurity and beriberi were the shortest in terms of duration of illness before death. Duration of illness before death was shortest for the cases of death at health centres/clinics compared to cases of deathin other places, which is statistically significant. Seventy one per cent of cases received treatment before death and most of them got medical care and medication immediately on arrival at health care providers.

The pattern of the causes of death was not significantly different between States and Regions. However, beriberi was ranked 4th in the Regions while it wasranked 8th in the States. CNS infection ranked higher in the Regions compared to the States. In urban areas, prematurity/LBW was a leading cause of death in newborns whereas diarrhoea and ARI were commonest in the post-neonatal period to under five years of age. In rural areas, birth asphyxia among newborns and ARI amongst under-fives were the most common. Some 221 cases (23%) had attempted intervention for the illness of the child at home. Of them, 53% administered medication with some medicines thatwere kept at home. About 34% took herbal medicines.The main reason for the delay in seeking treatment was a lack of awareness or knowledge of the importance of symptoms(80%). Mean duration for a clients' delay before seeking treatment was 4.9 (17.4) days. Median interval between the first and last site of treatment was 2 days. An awareness of the severity of symptoms/signs was noted as the main factor for deciding whereto seek treatment (59%). Referral of the provider was given as the second most frequent reason.

Some of the key recommendations based on the study findings were that the health system should have a greater focus on reducing deaths due to non-infectious preventable causes like prematurity/LBW and birth asphyxia, while simultaneously accelerating the progress made in infectious diseases. Myanmar needs to focus on the quick scaling-up of evidence-based interventions that reduce neonatal mortality. As most of the high impact interventions to reduce neonatal mortality are effectively provided at health facilities rather than at community level, it is essential for Myanmar to strengthen health facilities and to reverse the current proportion of home- to facility-based deliveries. There is a demand for a greater level of consideration in sub-national planning, financing and geographically-targeted scaling-up of health interventions, to address causes of deaths and the disparity in receiving health care, specifically among children residing in the states and regions as well as amongst the rural and urban population. Multi-faceted interventions are needed, that focus on strengthening the health system in order to provide an increase in services, a better enabling environment, adequate knowledge among caregivers and a strong demand for those services. Further, access to quality of health care services needs to be ensured through two tandem approaches; strengthening of existinghealth care at health facilities as well as expanding this to community level health care, in order to provide integrated preventative, curative and well promotedservices to an under-served population and to reduce inequity in health care access.

1. Background and Rationale

Investing in the health and wellbeing of the children of Myanmar is an investment in the future development of Myanmar. Children under five years of age constitute about 11.67% of total population in Myanmar, according to the report from the Central Statistical Organization in 2008. The health of these children is a priority for the nation, as is achieving the MDG4 target for 2015 (of reducing under-five mortality in 1990 by two-thirds).

Despite the decline (annual reduction rate 3.3%) in the under-five mortality rate from 109 deaths per 1,000 live births in 1990 to 51 deaths per 1,000 live births in 2013[1],the target of reducing under-five mortality in MDG will not be achieved in Myanmar without accelerated progress.

Compared to the estimates of under-five mortality (19/1000) and its annual reduction rates (4.8%) in the East Asia and Pacific Region, Myanmar needs to provide a greater focus and increase its investment to catch up with other peers in this region.The findings from the MICS(Multiple Indicator Cluster Survey) 2010 shows that more under-five children die in rural than in urban areas, and more under-five children in the poorest wealth quintile died compared to the richest ones.

Cause-specific mortality amongst under-five children is required for prioritizing newborn and child survival interventions as well as for targeting health resources in specific geographic/ecological areas[2]. However, this information is not readily available at a statistically representative national level. The latest such information for Myanmar is available only for 2002-2003. Though the under-five mortality rate has been included in the MICS conducted in 2010, the causes of under-five death were not included[3].

To know the estimates of cause-specific mortality among under-fives, a study was undertaken using the verbal autopsy method. In recent years this method has been widely used to provide information on cause of death in settings where death occurs at home and the death certification system is weak. A cause specific death study

[1] Levels and Trends in Child Mortality, Report 2014. UNICEF

[2] A standard Verbal Autopsy Method for Investigating Causes of Death in Infants and Children (WHO/ CDS/CSR/ISR/99.4)

[3] Multiple Indicator Cluster Survey- Myanmar 2010

using verbal autopsy for a nationally representative sample was last undertaken in 2002-2003[4]. Thereafter, a cause of death study was conducted in only one township in 2008[5].

This study aimed to identify health seeking behaviour as well as health service provision. Over a period of time it can also help to assess the impact of health interventions in Myanmar, which are being scaled-up as per the National Child Health Development Strategic Plans 2010-2014 and 2015-2018[7].

A Child Death notification system has been developed and reports on child deaths have been collected by the DOH (Department of Health) from all townships in the country since 2009[6]. To keep this reporting simple for BHS, the probable causes of death are classified in 19 main categories, e. g. diarrhoea, cough, fever, rash, unconsciousness, fit, difficulty breathing etc. This has been extremely helpful in reporting under-five deaths in community settings, but is not able to classify the cause of death very accurately, as the form only lists main presenting symptoms. In order to understand the causes of under-five deaths this study was carried out with the following objectives.

[4]Under-five Mortality Survey (2002-03) Report. DOH

[5]Department of Health Planning(2008) Community based verification of cause of death in Pyinmana Township (Report)

[6]DOH 2009- Report on Child Death (0-59 months)

2. Objectives

2.1 Overall

To make a database available on the cause of death amongst under-fives (including newborns) in Myanmar, using standard verbal autopsy tools.

2.2 Specific

1. To identify the leading causes of death in children under five years of age, disaggregated by age group.
2. To explore variations in the cause of death by rural / urban areas and state / region.
3. To assess the health seeking behaviour and any associated factors, which can be targeted for improved outcomes.

3. Methodology

3.1. Study Design

The study used a cross-sectional descriptive design with a stratified multi-stage cluster sampling;1) townships selected from the list of all townships from each State/Region, using a stratified random sampling as the first stage, 2) selection of villages/wards (clusters)from each selected township by PPES(Probability Proportionate to Estimated Size) as second stage and 3) households were selected in clusters from the list of all HH(Households) that had experienced an under-five death during the preceding year, by systematic random sampling as the third stage. In order to estimate the sampling weights and make necessary adjustments, probability sampling methods were to be applied in every stage of sampling.

3.2. Sample Size

Sample size determination

Calculation of the required number of total sample size households with an under-five death was made to fulfill the objective of identifying the leading cause of death. The calculation was made as described below.

Calculation of total number of final sampling units[7];

$n = \{z^2 \times p \times (1-p) \times f \times k\}/d^2$

z = 1.96 (for level of confidence 95%)

p = 0.5 (maximum for proportion of death due to a specific cause as a key indicator)

f= Design Effect (to be calculated)

k = 1.15 (a multiplier for 15% non-response rate)

d = 0.07 (margin of error for the key indicator proportion)

To be able to feed the required numbers (design effect and cluster size) in the formula, the following steps were taken;

[7] Lecture Guide on Research Methodology, DMR-LM, 2010, p72

Determining cluster size[8] (number of interviews in each cluster)

To estimate the optimal cluster size; transport costs to each cluster, cost for interviewing each respondent and intra-cluster correlation were considered.

Optimum cluster size (b) = Square root [(C 1/C2) x {(1-roh) / roh}]

C1 = estimated cost of travel to each cluster (average 25000 kyats per MO x 3 MOs for Central to township + 40000 kyats for the team from township to cluster villages) = 115000 kyats

C2 = estimated cost for interviewing each HH in chosen clusters (per diem for MO and BHS divided by number of HHs interviews per day + incentives for interviewee) = 6000 kyats
roh = intra-cluster correlation = 0.4
b = number in each cluster = [Square root of (115000/6000)] x [(1-0.4)/0.4] = 6.5 (~7)
Thus, number of HHs with an under-five death in each cluster will be 7.

Calculation of Design Effect (DE)[9];

Design Effect = 1+(cluster size-1)*roh
roh = 0.4 (Intra-cluster correlation)
cluster size = 7 (number of HH with history of child death in a village cluster)
Thus,
DE = 1+ (7-1) x 0.4 = 3.4 (~ 4)

Thus total number of HHs was;
$n = \{z^2 \times p \times (1-p) \times f \times k\}/d^2 = \{1.96^2 \times 0.5 \times 0.5 \times 4 \times 1.15\}/0.07^2$
n = 900

Thus;
A minimum total of 900 HHs with under-five deaths across the whole country will be required.

[8] Applied Sampling by Seymour Sudman, 1976. Academic Press, Inc p78-79

[9]Research Methods for Developing Countries, WHO EPI, (HSERV / EPI 539)

Number of townships or Primary Sampling Unit (PSU)[10]

To be able to describe countrywide proportions of the cause-of-death aggregate, the number of PSUs were determined as following procedure.
Maximum number of clusters per township = 10
Cluster size (number of HH in each cluster) = 7
Thus, total HHs to be interviewed per township = 10 x 7 = 70
Total number of HHs for the study (sample size) = 900
Thus, total number of PSUs (number of townships) = 900/70 = 12.9 (~13)

However, to be able to cover all States and Regions over the country 14 PSUs (townships) will be selected.

To be able to describe proportions of the cause of death by State and Region aggregate, the number of PSUs is divided by 7 townships separately in States and Regions.
Actually 7 HHs in each cluster and 10 clusters per township (49/7= 7) number, accounting total of (7 x 10 x 14 = 980) HHs was investigated.

3.3. Sampling

Inclusion of both States and Regions strata in sampling

Differences in the cause of death may occur in different ecological units due to various factors e.g. climate, social and economic.Since the study aimed to get national representative sample, all townships in all 7 states and 7 regions were included in the sampling frame.

Exclusion of townships

Although all townships are included in the frame, some of those townships were not secure and some were located in inaccessible areas during the survey period, due to transportation constraints, which could have the consequence of affecting data quality and administration constraints.

Sample townships

At the first stage one primary township (and one secondary township for substitution or expansion) in each States/Regions was selected by stratified random sampling based on the list of all townships.

[10] Applied Sampling by Seymour Sudman, 1976. Academic Press, Inc p78-79

Sample Townships List

Sr.	State/Region	Sample Township
1	Kachin	Myitkyinar, Moekaung, Waimaw
2	Kayar	Loikaw, Demawso
3	Kayin	Pa Aan
4	Chin	Hakhar, Htantalan, Phalam
5	Sagaing	Kathar, Inntaw
6	Tanintharyi	Myeik, Pulaw
7	Bago	Thanatpin, Bago
8	Magwe	Natmauk
9	Mandalay	Sintkaing, Tadaoo, Amarapura
10	Mon	Thanbyuzayat, Mudon
11	Rakhine	Thantwe, Taungoat
12	Yangon	Htandabin, Hlaingthayar
13	Shan	Nyaungshwe
14	Ayeyarwaddy	Daedaye

Fourteen townships were initially selected. However, if the required number of qualifying HHs were not available in the township, adjacent townships were included in order to fulfill the sample size required in that area (Region/State). A total of 27 townships were included once the field survey was completed.

Sampling Frame

A modified version of the cluster survey was adapted to identify cause of death for the two geographic areas disaggregated by rural/urban residence. At the first stage, all townships in each State/Region were listed. Fourteen primary and 14 secondary townships were selected with stratified random sampling to cover all areas (States/ Regions).

In each township, 70 HHs that experienced under-five deaths were selected from 10 clusters. For the second stage (sampling of clusters in each township), all wards or village tracts (including estimated size of the under-five population) in selected townships were listed. PPES sampling was done to obtain 10 clusters from each township.

The list of all households in the selected wards and village tracts that experienced death events of under-fives in the preceding 12 months was the sampling frame for

third stage sampling. Seven households with under-five deaths in a cluster were selected by systematic random sampling.

Sample Allocation

Sample allocation between two main strata (State/Regions) as well as among townships/wards/village tracts was undertaken and the distribution of under-five death events occurred in second and third stages.In case there was any one township that could not fulfill the required number of HHs with under-five deaths, the survey was extended to the second township selected in this State/Region.

The following table outlines the allocation of clusters:

Stratum		No. of Sample Townships (SRS)	No. of Clusters per Township (PPES)	Place of Residence		
				Urban (Clusters)	Rural (Clusters)	Total (Clusters)
1.	State	7	10	Distribute in accordance with existing ratio		70
2.	Region	7	10	Distribute in accordance with existing ratio		70
Total		14	10	Distribute in accordance with existing ratio		140

Data Collection Tools

Trained interviewers used the WHO-proposed standard verbal autopsy questionnaire[11] in all identified under-five deaths occurring in the stratified randomly selected areas within the specified time period.

Overview of Verbal Autopsy Questionnaire

A standard verbal autopsy questionnaire has been developed by WHO and was adapted to a Myanmar-specific setting. Standard instructions for the interviewer and an explanation of the terms used in the questionnaire ensured accuracy of data collection and avoided inter-observer variations.The questionnaire consists of ten sections;

Section 1- Background Information on Child and Household

Section 2- Background Information on Interview

[11] WHO.A Standard Verbal Autopsy Method for Investigating Causes of Death in Infants and Children. WHO/CDS/CSR/ISR/99.4. http://www.who.int.emc

Section 3- Information about Caregiver/Respondent

Section 4- Information about the Child

Section 5- Open History Question

Section 6- Accident

Section 7- Age Determination and Reconfirmation

Section 8- Neonatal Deaths

Section 9- Age 28 days to 5 years Deaths

Section 10- Treatment and Records

Adaptation and Pre-test of the Questionnaire:

The questionnaire was translated into the Myanmar language by an expert fluent in not only English and Myanmar but also local lay medical terminology. The intent of each question rather than exact words were used. Alternative local terms for medical conditions as well as symptoms/signs were reinforced and agreed during the interviewer training. The interviewer demonstrated some of the terms in the questionnaire, such as wheezing or stridor. This adapted questionnaire was quickly pre-tested in PyinOoLwin Township.

3.4. Field Operation Details and Workload Analysis:

The data collected from midwives on the identified under-five deaths in the village was retrospective and listed in descending order of duration after death. The HH of the most recent death within the preceding year was selected for sampling. If the number was large enough for the determined cluster size (i.e.7) in all 140 clusters, the time period was restricted to six months to minimize recall bias. Data was collected between May 2013 and February 2014. Since the cases were limited to the preceding year only, this study reflects the causes of death from May 2012 to Feb 2013.

The completeness of the reported death in the village was verified by a key informant e.g. traditional birth attendants and AMWs (Auxiliary Midwives), local authorities and local NGO (Non-Government Organization)/MMCWA (Myanmar Maternal and Child Welfare Association) members as well as elders of the village. Any other unreported under-five deaths identified in the process were also included for verbal autopsy. To avoid any possibility of courtesy bias,the participation of the local midwife was discouraged in the data collection process.

The investigating team consisted of one doctor to conduct the questionnaire and a BHS from the selected RHC (Rural Health Centre)to identify qualifying households and facilitate the interviews.

There were a total of three interview teams (each with one senior medical doctor, two junior medical doctors and two health staff coming from a different cluster area). Each team was assigned five selected townships, working 10-14 days in each township. Three investigators were assigned to conduct supervision visits during the data collection phase, with the aim of quality control and coordination support for the teams.

3.5. Data Quality and Analysis

The study supervisor/technical group for any omissions or inconsistencies first checked all entries made in the questionnaire. These were verified and corrected before data entry. Data were entered and a random check for verification of entries was undertaken followed by cleaning of the database. Data analysis was carried out at Department of Medical Research (Upper Myanmar) using SPSS software version 20.

A total of 958 cases (of the deaths of children under five years old) were interviewed. Sample households were selected from 14 States/Regions. The interview period started in May 2013 and ended in February 2014. Although the survey period was fixed for two months in 2013, data collection in Kachin and Chin States could not be started within the expected period because of local security concerns(in Kachin State) and local transportation constraints(in Chin State). Field activities in those two States could only be started in 2014. Under-five deaths included in the study from these two States happened no longer than one year preceding the interviews. A senior researcher supervised the teams for quality control and coordinated the teams and the local health authorities. Most of interviews were conducted in Myanmar language (95%). A few (5%) were conducted in a local ethnic language (i.e. Kayin, Kayar, Mon, Shan and Kachin) and translated by locals. See Table 1 for the languages used in the interviews.

Table 1. Language used in interview

Language	Frequency	Per cent
Bamar	912	95.2
Kayin	15	1.6
Kayar	11	1.1
Mon	11	1.1
Shan	7	.7
Kachin	2	.2
Total	958	100.0

Distribution of sample HHs by States/Regions and by Urban/Rural areas is described in Table 2.

Table 2. Sample size by State/Region and Urban/Rural

States/Regions		Urban/Rural		Total
		Urban	Rural	
Yangon	Count	42	28	70
	%	60.0%	40.0%	100.0%
Bago	Count	21	49	70
	%	30.0%	70.0%	100.0%
Ayeyarwaddy	Count	7	67	74
	%	9.5%	90.5%	100.0%
Kayar	Count	15	56	71
	%	21.1%	78.9%	100.0%
Chin	Count	14	25	39
	%	35.9%	64.1%	100.0%
Magway	Count	7	63	70
	%	10.0%	90.0%	100.0%
Mon	Count	14	56	70
	%	20.0%	80.0%	100.0%
Kayin	Count	14	56	70
	%	20.0%	80.0%	100.0%
Kachin	Count	14	59	73
	%	19.2%	80.8%	100.0%
Tanintheri	Count	14	56	70
	%	20.0%	80.0%	100.0%
Shan	Count	0	70	70
	%	0.0%	100.0%	100.0%
Mandalay	Count	7	63	70
	%	10.0%	90.0%	100.0%
Sagaing	Count	20	49	69
	%	29.0%	71.0%	100.0%
Rakhine	Count	15	57	72
	%	20.8%	79.2%	100.0%
Total	Count	204	754	958
	%	21.3%	78.7%	100.0%

All administrative areas were included and the sample size was equally distributed, except in Chin State, which did not meet the required number due to the small number of households across the selected townships.

Although the study protocol planned to get 70 HHs with under-five deaths in each Region/State in order to achieve a total of 980 HHs,some states/regions could not complete the intended number, even after extending the area to adjacent townships (especially in Chin State). In Shan State, there were no cases in urban areas of the sample-selected township. Total HHs involved in the study was thus 958/980, or 97.8% of the target number. However, this did not impact upon the results because the number met the minimum requirement of the sample size (i.e. 900). Most of the interviewees were the mothers of the dead child.

Background characteristics of the interviewees are as shown in **Table 3** below.

Table 3. Background characteristics of interviewees

Background characteristic	Interviewees	
	No	%
Relationship to dead child		
Mother	764	97.7
Grandmother	76	7.9
Father	72	7.5
Aunt	26	2.7
Grandfather	12	1.3
Neighbour	6	0.6
Uncle	2	0.2
Education		
Primary	388	40.5
Middle	246	25.7
High School	126	13.2
No Schooling	107	11.2
Monastery	57	5.9
Graduate	26	2.7
University	8	0.8
Age		
Mean (SD):	33.3 years(10)	
Youngest age:	16 years	

Table 3 shows that 11% of respondents were illiterate, the majority (40%) had primary level education and 77% were educated below high school level. Mean (SD) age of respondents was 33.3 (10) years, with the youngest respondent being 16 years of age.

Five hundred and twenty two out of 958 (54.5%) interviews had single respondents. Four hundred and thirty six interviews were carried out in front of more than one respondent. Relationship characteristics of other respondents are shown in Table 4.

Table 4. Relationship Characteristics of Other Respondents Present During Interviews

Relationship characteristic	Interviewee (%)
Relationship to the dead child (n= 436)	
Father	30.5
Grandmother	29.6
Other female relative	29.1
Mother	16.1
Aunt	14.7
Other male relative	11.5
Grandfather	10.3
Uncle	6.4
Present while the child was sick (n = 293)	
Father	49.5
Grandmother	39.9
Other female relative	29.7
Mother	17.4
Aunt	15.0
Other male relative	6.1
Grandfather	6.1
Uncle	5.1

As shown in Table 4, fathers (30%), grandmothers (30%) and other female relatives (28%) were commonly among those present during the interviews. Among those people present during interview, 67% were also present at the time of any illness and death of the child. Thus, their presence during the interviews was considered important in order to complement and validate the information given by the key informants.

A diagnosis consultation meeting was held after the checking and coding of record forms. Twenty paediatricians were invited. They were grouped into three teams for group discussions to decide the cause of death, based on verbal autopsy findings. Every case was separately reviewed by different teams, twice. Disagreements on diagnoses between two teams were then reviewed and finalized by a third team, which was formed by senior paediatricians including a professor and the Head of the Child Health Department of the University of Medicine. Having confirmed a final diagnosis (made by the paediatricians at the consultation meeting), a complete list of the causes of death was compiled, using the most common categories first and then amalgamating the more rare reasons into sub categories.

4. Findings

4.1. Leading Causes of Death in Children Under Five Years Old

The most frequent causes of death are shown below in Table 5.

Table 5. Most frequent cause of deaths among under-fives

Cause	Total	
	No.	%
Prematurity/LBW	167	17.4
Birth asphyxia	119	12.4
ARI/Pneumonia	125	13.0
Diarrhoea	74	7.7
Neonatal jaundice	68	7.1
Neonatal sepsis	56	5.8
Congenital anomaly	60	6.3
CNS infections	59	6.2
Beriberi	57	5.9
Septicaemia	47	4.9
Accident and poisoning	39	4.1
Malaria	16	1.7
Malnutrition	10	1.0
DHF	6	0.6
Hematological disorders	5	0.5
Epilepsy	5	0.5
Measles	3	0.3
HIV	2	0.2
Other infections	13	1.4
Other non-specific causes	27	2.8
Total	958	100.0%

Note: Other infections include infections other than Malaria and HIV, such as TB, Rabies, Cellulitis, Diphtheria and Viral Hepatitis.

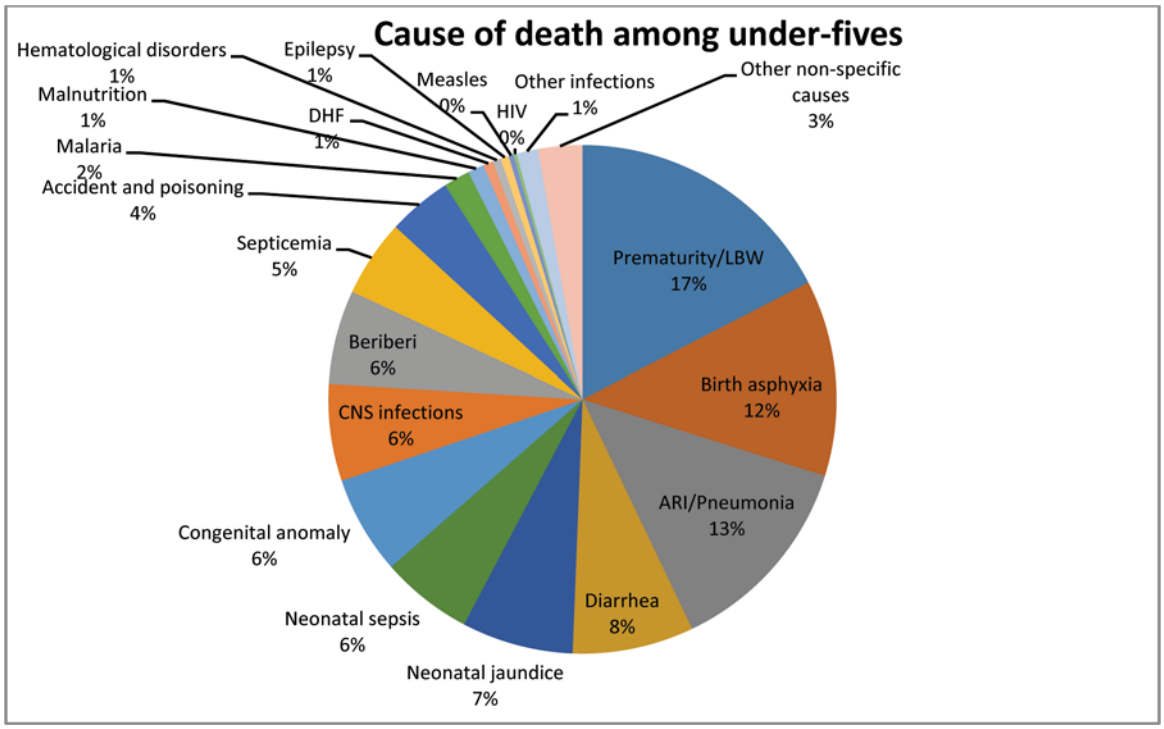


Figure 1. Cause of Death Among Under-fives.

4.2. Demographic Characteristics of the Child

Age of the children

Table 6. Age distribution

Age group (days)	Frequency	Per cent	Cumulative Per cent
<= 28	463	48.3	48.3
29 – 365	325	33.9	82.3
366+	170	17.7	100.0
Total	958	100.0	

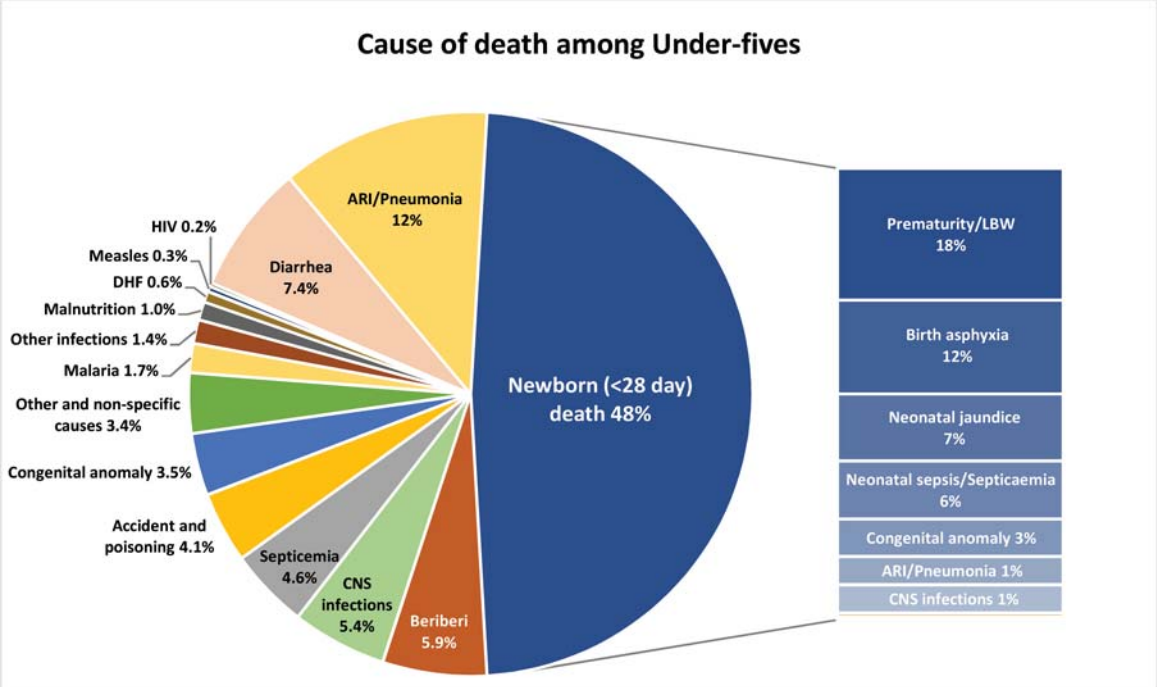


Figure 2. Cause of death among under-fives disaggregated by age group, less than/equal to 28 days old and more than 28 days old to less than/equal to 5 years old.

As shown in Figure 2, deaths during the neonatal period contribute to 48% of under-five mortality with prematurity/LBW, birth asphyxia and neonatal jaundice/sepsis the leading cause of death. In the age group between above 28 days old and less than 5 years old, ARI/pneumonia, diarrhoea and beriberi stood out as the main cause of death.

Table 7. Cause of Death Disaggregated by Age

Diagnosis	Age group (days)					
	<= 28		29 - 365		366+	
	Freq	%	Freq	%	Freq	%
Prematurity/LBW	167	36%	0	0%	0	0%
Birth asphyxia	119	26%	0	0%	0	0%
ARI/Pneumonia	10	2%	91	28%	24	14%
Diarrhoea	3	1%	52	16%	19	11%
Neonatal jaundice	68	15%	0	0%	0	0%
Neonatal sepsis	56	12%	0	0%	0	0%
Congenital anomaly	26	6%	24	7%	10	6%
CNS infections	7	2%	34	10%	18	11%
Beriberi	0	0%	55	17%	2	1%
Septicaemia	3	1%	31	10%	13	8%
Accident and poisoning	0	0%	5	2%	34	20%
Malaria	0	0%	6	2%	10	6%
Malnutrition	0	0%	5	2%	5	3%
DHF	0	0%	3	1%	3	2%
Hematological disorders	1	0%	3	1%	1	1%
Epilepsy	0	0%	0	0%	5	3%
Measles	0	0%	1	0%	2	1%
HIV	0	0%	2	1%	0	0%
Other infections	0	0%	3	1%	10	6%
Other non-specific causes	3	1%	10	3%	14	8%
Total	463	100%	325	100%	170	100%

Note: Other infections include infections other than Malaria and HIV, such as TB, Rabies, Cellulitis, DHF, Diphtheria and Viral Hepatitis.

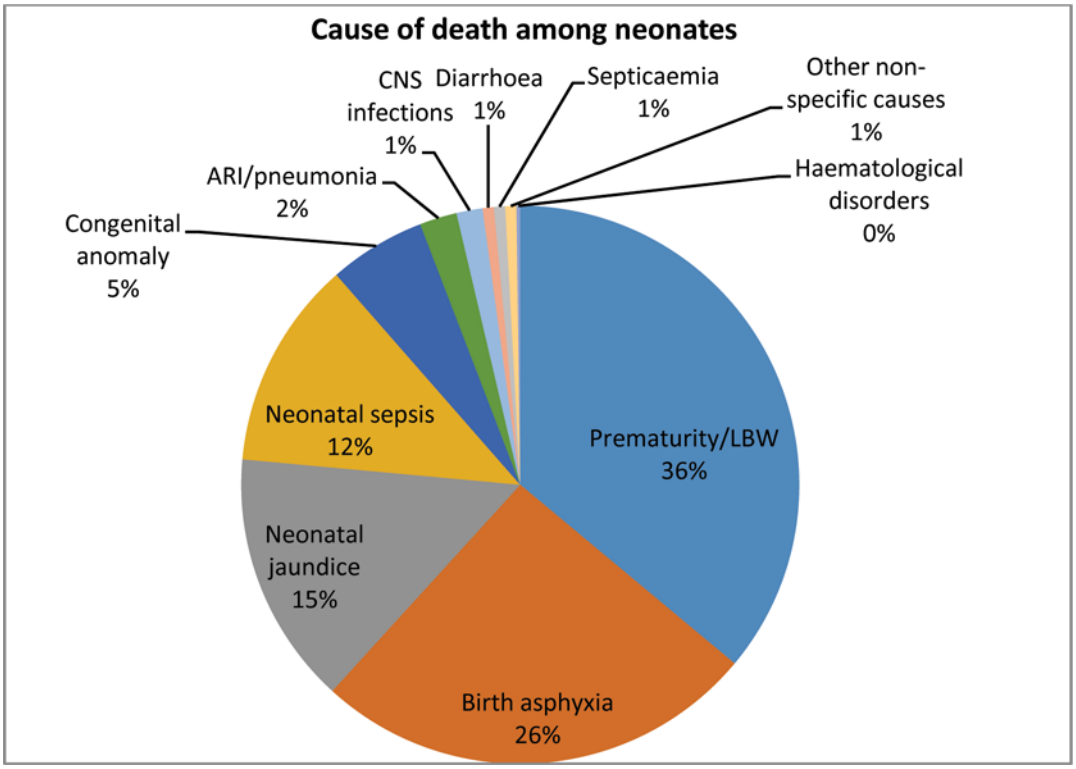


Figure 2A. Cause of Death (age group <=28days)

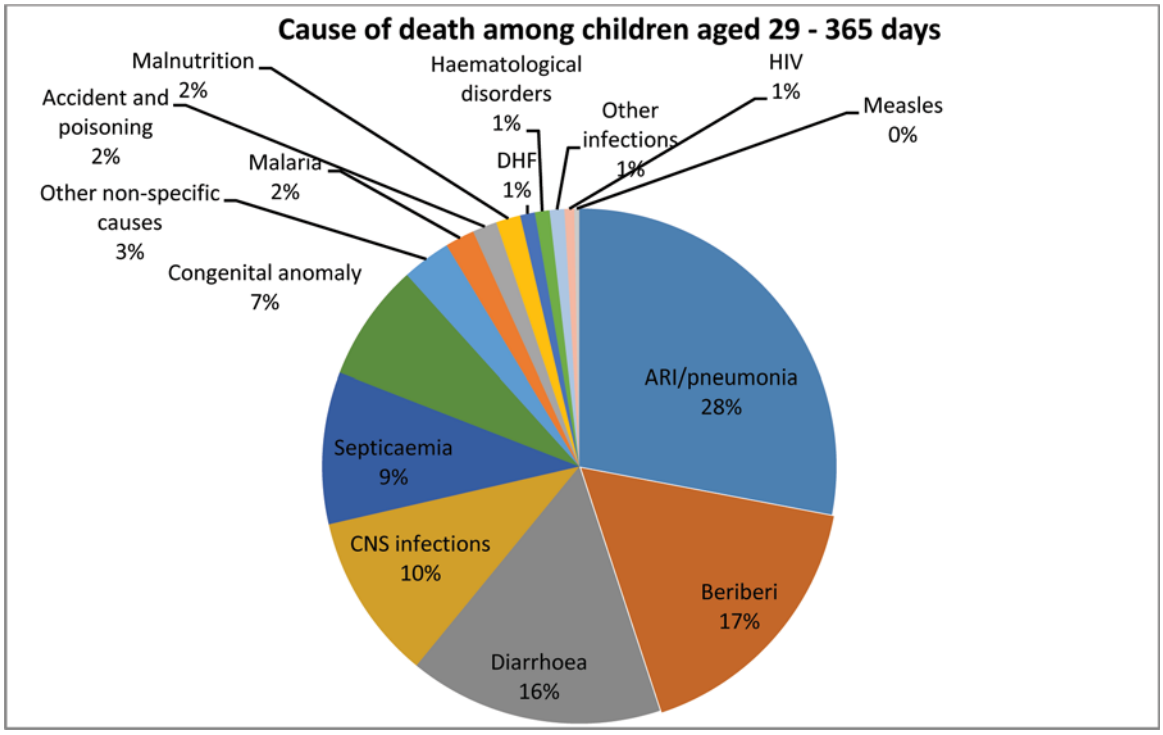


Figure 2B. Cause of death (age group 29-365 days)

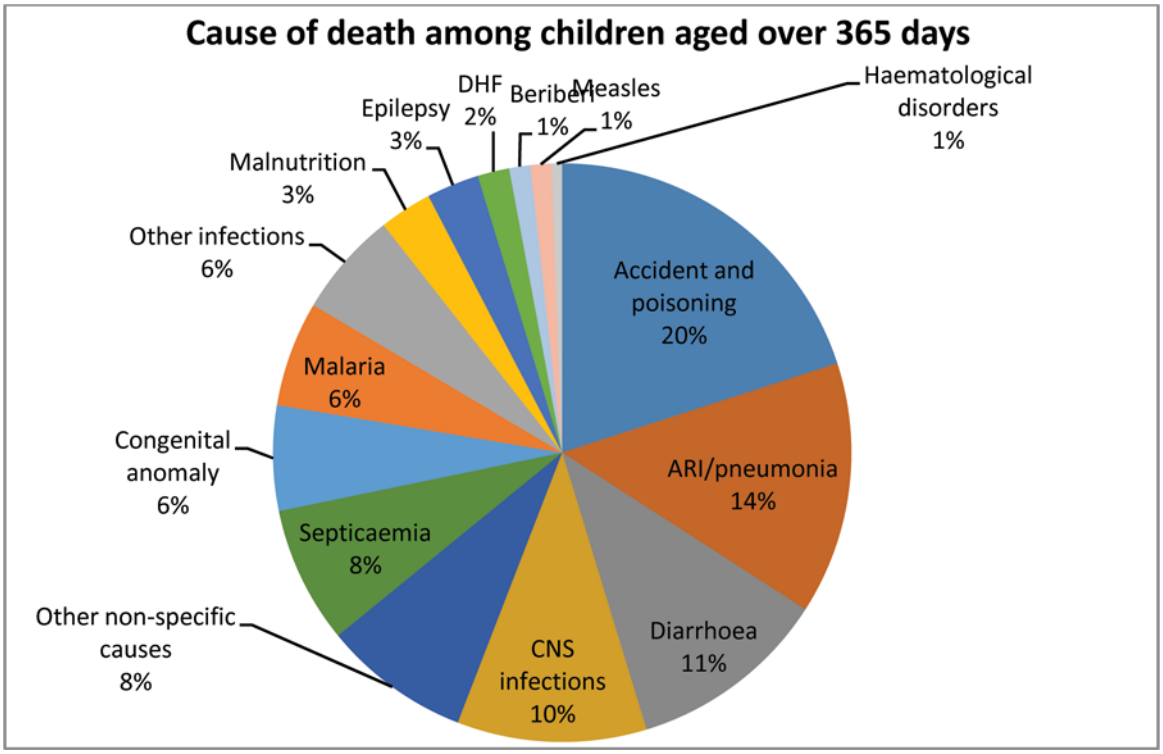


Figure 2C. Cause of Death (age 366 days old and over)

Among neonates, prematurity and birth asphyxia were the most common cause of death. Among the age group 29-365 days old, nutrition problems including beriberi are found to be the most frequent cause of death. At age 366 days old and over, accident and poisoning constitute the most frequent cause of death.

Sex Differential by Cause of Death

Table 8. Cause of Death by Sex of Child

Diagnosis	Sex of child				Z test
	Male		Female		
	Freq	%	Freq	%	
Prematurity/LBW	95_a	18%	72_a	17%	NS
Birth asphyxia	69_a	13%	50_a	12%	NS
ARI/Pneumonia	63_a	12%	62_a	14%	NS
Diarrhoea	35_a	7%	39_a	9%	NS
Neonatal jaundice	41_a	8%	27_a	6%	NS
Neonatal sepsis	37_a	7%	19_a	4%	NS
Congenital anomaly	33_a	6%	27_a	6%	NS
CNS infections	34_a	6%	25_a	6%	NS
Beriberi	34_a	6%	23_a	5%	NS
Septicaemia	27_a	5%	20_a	5%	NS
Accident and poisoning	23_a	4%	16_a	4%	NS
Malaria	8_a	2%	8_a	2%	NS
Malnutrition	6_a	1%	4_a	1%	NS
DHF	2_a	0%	4_a	1%	NS
Haematological disorders	2_a	0%	3_a	1%	NS
Epilepsy	1_a	0%	4_a	1%	NS
Measles	2_a	0%	1_a	0%	NS
HIV	1_a	0%	1_a	0%	NS
Other infections	5_a	1%	8_a	2%	NS
Other non-specific causes	12_a	2%	15_a	4%	NS
Total	530	100%	428	100%	

Pearson Chi-Square=15.226, df=19, p value=0.708

NS= z test for comparison of proportion of each diagnosis for male and female showed no statistical significance.

There were no statistically significant differences regarding the cause of death between male and female children.

Place of death

Table 9.Number of Deaths by Place of Death

Place of Death	No.	%
Home	505	52.7
Government hospital/maternity home	390	40.7
On the way to health centre	44	4.6
Private hospital/clinic/maternity home	16	1.7
RHC/Sub-RHC	3	0.3
Total	958	100.0

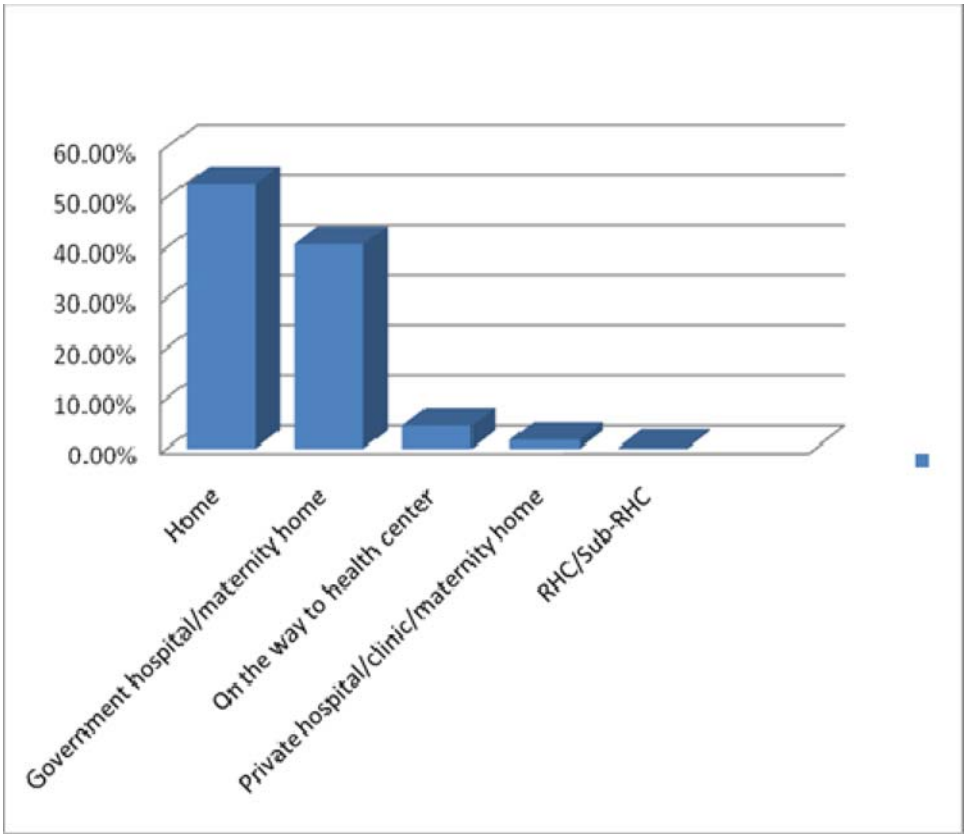


Figure 3. Place of Death

Most deaths occurred at home (53%) or at a government hospital/maternity home (41%). About 5% died on the way to health care services.

Table 10. Place of Death Disaggregated by Age Group

Place of death	Age group					
	<= 28		29 - 365		366+	
	Freq	%	Freq	%	Freq	%
Home	192	41%	203	62%	99	58%
Hospital	251	54%	99	30%	48	28%
Others	13	3%	20	6%	22	13%
Health center/Clinic	7	2%	3	1%	1	1%
Total	463	100%	325	100%	170	100%

Chi-squared=76.37, df=6, p<0.001

If age stratification was made for different places of death, more than half of neonatal deaths occurred in hospital (54%). Deaths for remaining age groups were found to occur more commonly at home than in hospitals. Death in hospitals and health centres was more common at an earlier age. Death at home and other places, rather than hospitals or health centres, was more common at a later age. The rate of death at home was higher in the second age group.

Illness history before death

Mean duration of illness before death (total days) was 9.6 (41.9) days. Median duration was 2 days. Many deaths occurred during the1-7days of illness. A stratified analysis of the duration of illness was made for the five most frequent causes of death.

Table 11. Duration of Illness Before Death

Duration (day)		Frequency	Per cent
	1 – 7	779	81.3
	8 – 30	111	11.6
	31+	34	3.5
	<= 0	29	3.0
	Total	953	99.5
Missing	System	5	.5
Total		958	100.0

It was found that 81% of deaths occurred within 7 days of the onset of illness whereas 11.6% of deaths occurred on days 8-30 of the illness.

Duration of illness before death for the five most frequent causes of death (N=544) was analyzed by using survival analysis and log-rank testing for comparisons between different strata of children. Mean and median duration (in days) and their Standard Errors (SE) and 95% Confidence Interval (CI) were described by groups of children such as different age groups, different causes of death and different places of death. The Kaplan-Meier Survival Curve was shown for each analysis.

Table 12. Duration of Illness Before Death Stratified by Age

Age group	Mean				Median			
	Estimate	SE	95% CI		Estimate	SE	95% CI	
			Lower Bound	Upper Bound			Lower Bound	Upper Bound
<= 28(n=359)	3.6	0.7	2.2	5.0	1.0	0.1	0.8	1.2
29 – 365(n=143)	10.5	2.2	6.2	14.8	3.0	0.2	2.6	3.4
366+ (n=42)	5.9	1.5	2.9	8.8	3.0	0.2	2.6	3.4
Overall	5.6	0.8	4.1	7.1	2.0	0.1	1.8	2.2

Log Rank (Mantel-Cox) p value = 0.000

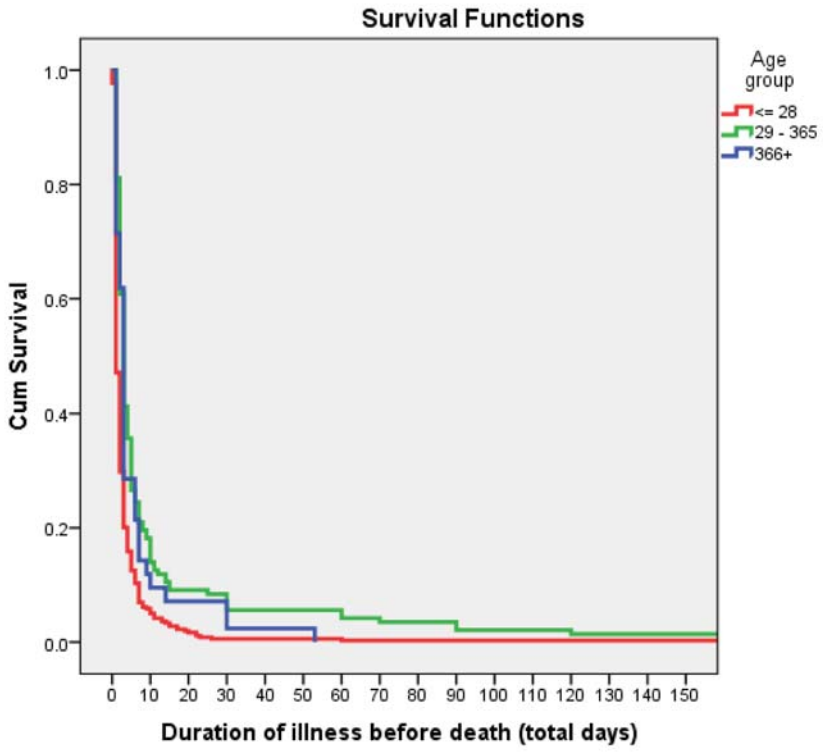


Figure 4. Duration of Illness by Different Age Strata

Younger children had a shorter duration of illness before death (p<0.001). These findings reflect the fact that the younger the child, the less time to survive in general. Thus the younger child is more vulnerable to death at a shorter interval. Although

more in-depth examinationis needed, especially since the data in this study do not have enough cases for this analysis, the provider should still prioritize the younger age child during their illness, since they are more vulnerable and at risk.

4.3. Variations in the Cause of Death by Rural,Urban and States/Region

Cause of death by States/Region

Most frequent cause of death among the children listed by States and Region.

Table 13.Causes of death disaggregated by States/Region

State/Region		Frequency	Per cent
Yangon	Prematurity/LBW	12	17.1
	Birth asphyxia	8	11.4
	ARI/Pneumonia	10	14.3
	Neonatal sepsis	5	7.1
	Diarrhoea	4	5.7
	CNS infection	4	5.7
	Beriberi	3	4.3
	Congenital anomaly	7	10.0
	Neonatal jaundice	2	2.9
	Septicaemia	3	4.3
	Others	12	17.2
	Total	**70**	**100**
Bago	Prematurity/LBW	13	18.6
	Neonatal jaundice	9	12.9
	Birth asphyxia	7	10.0
	Diarrhoea	7	10.0
	ARI/Pneumonia	7	10.0
	Beriberi	5	7.1
	Septicaemia	5	7.1
	Neonatal sepsis	4	5.7
	CNS infection	4	5.7
	Congenital anomaly	4	5.7
	Others	5	7.2
	Total	**70**	**100.0**
Ayeyarwaddy	Beriberi	13	17.6
	CNS infection	12	16.2
	Prematurity/LBW	9	12.2
	ARI/Pneumonia	8	10.8
	Diarrhoea	6	8.1
	Birth asphyxia	5	6.8
	Neonatal sepsis	5	6.8
	Neonatal jaundice	3	4.1
	Septicaemia	2	2.7
	Congenital anomaly	3	4.1
	Others	8	10.6
	Total	**74**	**100.0**

State/Region		Frequency	Per cent
Kayar	Diarrhoea	16	22.5
	ARI/Pneumonia	11	15.5
	Birth asphyxia	8	11.3
	Prematurity/LBW	7	9.9
	Neonatal jaundice	5	7.0
	Neonatal sepsis	4	5.6
	Septicaemia	6	8.5
	Congenital anomaly	3	4.2
	Beriberi	1	1.4
	CNS infection	1	1.4
	Others	9	12.7
	Total	**71**	**100.0**
Chin	ARI/Pneumonia	9	23.1
	Diarrhoea	9	23.1
	Prematurity/LBW	5	12.8
	Birth asphyxia	4	10.3
	CNS infection	3	7.7
	Beriberi	2	5.1
	Congenital anomaly	3	7.7
	Neonatal sepsis	1	2.6
	Septicaemia	1	2.6
	Others	2	5.0
	Total	**39**	**100.0**
Magway	Birth asphyxia	13	18.6
	ARI/Pneumonia	9	12.9
	Neonatal sepsis	9	12.9
	Beriberi	9	12.9
	Septicaemia	7	10.0
	Neonatal jaundice	6	8.6
	CNS infection	5	7.1
	Diarrhoea	3	4.3
	Prematurity/LBW	2	2.9
	Congenital anomaly	2	2.9
	Others	5	7.1
	Total	**70**	**100.0**
Mon	Prematurity/LBW	13	18.6
	ARI/Pneumonia	10	14.3
	Birth asphyxia	9	12.9
	Neonatal jaundice	9	12.9
	Beriberi	5	7.1
	Congenital anomaly	9	12.9
	Diarrhoea	2	2.9
	CNS infection	2	2.9
	Neonatal sepsis	1	1.4
	Septicaemia	2	2.9
	Others	8	11.2
	Total	**70**	**100.0**

State/Region		Frequency	Per cent
Kayin	Prematurity/LBW	20	28.6
	ARI/Pneumonia	9	12.9
	Diarrhoea	7	10.0
	Congenital anomaly	8	11.4
	Neonatal jaundice	6	8.6
	Neonatal sepsis	5	7.1
	Birth asphyxia	4	5.7
	Beriberi	1	1.4
	CNS infection	1	1.4
	Others	9	12.9
	Total	**70**	**100.0**
Kachin	Prematurity/LBW	16	21.9
	Neonatal jaundice	9	12.3
	ARI/Pneumonia	7	9.6
	Birth asphyxia	7	9.6
	Diarrhoea	6	8.2
	Neonatal sepsis	6	8.2
	CNS infection	4	5.5
	Beriberi	3	4.1
	Congenital anomaly	5	6.8
	Septicaemia	1	1.4
	Others	9	12.4
	Total	**73**	**100.0**
Tanintheri	Prematurity/LBW	8	11.4
	Diarrhoea	6	8.6
	Congenital anomaly	8	11.4
	CNS infection	5	7.1
	ARI/Pneumonia	5	7.1
	Birth asphyxia	4	5.7
	Neonatal jaundice	4	5.7
	Neonatal sepsis	1	1.4
	Beriberi	2	2.9
	Septicaemia	3	4.3
	Others	24	34.4
	Total	**70**	**100.0**
Shan	Birth asphyxia	17	24.3
	Prematurity/LBW	16	22.9
	ARI/Pneumonia	11	15.7
	Neonatal jaundice	6	8.6
	Diarrhoea	4	5.7
	Neonatal sepsis	1	1.4
	Septicaemia	3	4.3
	Beriberi	1	1.4
	CNS infection	1	1.4
	Congenital anomaly	2	2.9
	Others	8	11.4
	Total	**70**	**100.0**

State/Region		Frequency	Per cent
Mandalay	Prematurity/LBW	17	24.3
	Birth asphyxia	9	12.9
	Septicaemia	7	10.0
	ARI/Pneumonia	7	10.0
	Beriberi	6	8.6
	Neonatal jaundice	5	7.1
	Neonatal sepsis	3	4.3
	Diarrhoea	2	2.9
	CNS infection	2	2.9
	Congenital anomaly	3	4.3
	Others	9	12.7
	Total	**70**	**100.0**
Sagaing	Prematurity/LBW	17	24.6
	ARI/Pneumonia	11	15.9
	Birth asphyxia	8	11.6
	CNS infection	8	11.6
	Neonatal sepsis	4	5.8
	Septicaemia	4	5.8
	Neonatal jaundice	2	2.9
	Beriberi	2	2.9
	Diarrhoea	1	1.4
	Congenital anomaly	2	2.9
	Others	10	14.6
	Total	**69**	**100.0**
Rakhine	Birth asphyxia	16	22.2
	Prematurity/LBW	12	16.7
	ARI	11	15.3
	Neonatal sepsis	7	9.7
	CNS infection	7	9.7
	Beriberi	4	5.6
	Neonatal jaundice	2	2.8
	Septicaemia	3	4.2
	Diarrhoea	1	1.4
	Congenital anomaly	1	1.4
	Others	8	11.0
	Total	**72**	**100.0**

Cause of Death by State/Region

Table 14. Cause of Death Disaggregated by State/Region

Diagnosis	State/Region				Z test
	States		Regions		
	Freq	%	Freq	%	
Prematurity/LBW	89_a	19.1%	78_a	15.8%	NS
Birth asphyxia	65_a	14.0%	54_a	11.0%	NS
ARI/pneumonia	68_a	14.6%	57_a	11.6%	NS
Diarrhoea	45_a	9.7%	29_b	5.9%	S
Neonatal jaundice	37_a	8.0%	31_a	6.3%	NS
Neonatal sepsis	25_a	5.4%	31_a	6.3%	NS
Congenital anomaly	31_a	6.7%	29_a	5.9%	NS
CNS infections	19_a	4.1%	40_b	8.1%	S
Beriberi	17_a	3.7%	40_b	8.1%	S
Septicaemia	16_a	3.4%	31_b	6.3%	S
Accident and poisoning	18_a	3.9%	21_a	4.3%	NS
Malaria	9_a	1.9%	7_a	1.4%	NS
Malnutrition	4_a	.9%	6_a	1.2%	NS
DHF	2_a	.4%	4_a	.8%	NS
Hematological disorders	4_a	.9%	1_a	.2%	NS
Epilepsy	1_a	.2%	4_a	.8%	NS
Measles	0_a	0.0%	3_a	.6%	NS
HIV	0_a	0.0%	2_a	.4%	NS
Other infections	5_a	1.1%	8_a	1.6%	NS
Other non-specific causes	10_a	2.2%	17_a	3.4%	NS
Total	465	100.0%	493	100.0%	

S= z test for comparison of proportion of each diagnosis for States and Regions showed statistical significance.

NS= z test for comparison of proportion of each diagnosis for States and Regions showed no statistical significance.

The pattern of the top three causes of death; Prematurity/LBW, Birth Asphyxia, ARI/ Pneumonia, was not much different between States and Regions. ARI/Pneumonia seemed to occur relatively more frequently among deaths in the State rather than in the Region but was statistically not significant. However, statistically significant differences were found in between State and Region for diarrhoea, CNS infection, beriberi and septicaemia. Among reported deaths, death due to diarrhoea was higher in the States while CNS infection, beriberi and septicaemia were higher in the Regions.

Table 15. Cause of Death Disaggregated by Urban and Rural Areas

Diagnosis	Urban/Rural				Z test
	Urban		Rural		
	Freq	%	Freq	%	
Prematurity/LBW	37_a	18.1%	130_a	17.2%	NS
Birth asphyxia	26_a	12.7%	93_a	12.3%	NS
ARI/pneumonia	26_a	12.7%	99_a	13.1%	NS
Diarrhoea	23_a	11.3%	51_b	6.8%	S
Neonatal jaundice	14_a	6.9%	54_a	7.2%	NS
Neonatal sepsis	13_a	6.4%	43_a	5.7%	NS
Congenital anomaly	17_a	8.3%	43_a	5.7%	NS
CNS infections	11_a	5.4%	48_a	6.4%	NS
Beriberi	8_a	3.9%	49_a	6.5%	NS
Septicaemia	12_a	5.9%	35_a	4.6%	NS
Accident and poisoning	9_a	4.4%	30_a	4.0%	NS
Malaria	0_a	0.0%	16_b	2.1%	S
Malnutrition	1_a	.5%	9_a	1.2%	NS
DHF	0_a	0.0%	6_a	.8%	NS
Hematological disorders	0_a	0.0%	5_a	.7%	NS
Epilepsy	0_a	0.0%	5_a	.7%	NS
Measles	0_a	0.0%	3_a	.4%	NS
HIV	1_a	.5%	1_a	.1%	NS
Other infections	4_a	2.0%	9_a	1.2%	NS
Other non-specific causes	2_a	1.0%	25_a	3.3%	NS
Total	204	100.0%	754	100.0%	

S= z test for comparison of proportion of each diagnosis for urban and rural showed statistical significance.

NS= z test for comparison of proportion of each diagnosis for urban and rural showed no statistical significance.

Among the top three causes of reported deaths; Prematurity/LBW, Birth Asphyxia and ARI/Pneumonia, there was no statistically significant difference found between urban and rural areas. However, a statistically significant difference was noted for diarrhoea and malaria. Death due to diarrhoea was relatively more common in urban areas, whilst malaria was more common in rural areas (Z test p value<0.05).

4.4. Health Seeking Behaviour and AnyAssociated Factors which can beTargeted for Improved Outcomes

Table 16. Socio-demographic Characteristics of Families Included in the Study

(n = 958)

Socio-demographic characteristic	No	%
Mother's Education		
No schooling	103	10.8
Monastery	41	4.3
Primary	380	39.7
Middle	256	26.7
High school	129	13.5
University	12	1.3
Graduate	30	3.1
Missing	7	0.7
Father's Education		
No schooling	56	5.8
Monastery	120	12.5
Primary	303	31.6
Middle	301	31.4
High school	146	15.2
University	8	0.8
Graduate	21	2.2
Missing	3	0.3
Mother's Occupation		
Dependant	159	16.6
Farmer	155	16.2
Manual Labourer/ Wood &Bamboo Cutter	145	15.1
Seller	65	6.8
Professional	24	2.5
Works Abroad	15	1.6
Fishery	14	1.5
Factory Worker	12	1.3
Rubber Farm	11	1.1
Business Owner	10	1.0
Employee	9	0.9
Livestock	3	0.3
Others	8	0.8
No response	328	34.2
Father's Occupation		
Manual Labourer/ Wood &Bamboo Cutter	204	21.3

Farmer	176	18.4
Fishery	44	4.6
Professional	43	4.5
Driver	37	3.9
Seller	27	2.8
Employee	17	1.8
Business Owner	16	1.7
Works Abroad	16	1.7
Rubber Farm	15	1.6
Factory Worker	10	1.0
Dependant	5	0.5
Livestock	3	0.3
Others	10	1.0
No Response	335	35.0
Family income level per month (in Kyat)		
Less than 10,000	27	2.8
10,000-50,000	295	30.8
50,001-100,000	346	36.1
100,001-150,000	170	17.7
150,001-200,000	55	5.7
>200,000	59	6.2
No response	6	0.6

Mean parity of the mothers was 1.8 (1.7). Median number of the parity was 2.

Treatment-seeking Practices

It was found that; 221 out of 958 respondents (23%) used home treatments. There was an association between parents' level of education and the proportion of home treatment practices (p=0.027 for mother's education and p=0.003 for father's education). It was observed that parents with a lower level of education used home treatments more. Of those who used home treatments, only 62 mentioned a valid duration (of home treatments) before seeking treatment in other places. Of those 62 valid cases, 39 (63%) were found to use home treatments for not more than 48 hours. Thus, only 37% relied on home treatment for more than 48 hours. Distance to the nearest health centre, duration and routes to travel were not significantly associated with home treatments.

Table 17. Treatment-seeking Practices

Treatment-seeking Practice	No	%
Home care practices (n = 196)		
Self-medication	104	53.1
Herbal medicine	66	33.7
Medicine from shop	18	9.2
Consult friends/relatives	5	2.5
Medication prescribed by shop	3	1.5
Reason for delay in seeking treatment (n = 290)		
Illness is not so severe	75	31.5
Assume that illness is self-limiting	65	27.3
Don't know	36	15.1
Nobody to help	12	5.0
Symptoms of little concern, quite usual	11	4.6
Event time not convenient for travel	10	4.2
Too far to travel (to Health Centre)	10	4.2
Financial problems	5	2.1
Busy with other tasks	5	2.1
Provider did not refer	5	2.1
Sudden onset	4	1.7
Reason for seeking treatment		
Illness became severe/seemed severe	196	76.9
Other people came to help	44	17.3
Other people insisted on going to clinic	8	3.1
Provider referred	5	2.0
Time became appropriate	2	0.8
Reason for deciding the last place for treatment-seeking	83	58.5
Symptoms worsened	48	33.8
Provider referred	6	4.2
Thought care would be better	4	2.8
Another person advised	1	0.7
Travel route appropriate		
Source of awareness of the last place	54	41.2
Provider directed	51	38.9
Self-aware	23	17.6
Another person directed	3	2.3
Close to the residence		

Two hundred and twenty one cases (23%) had used some home treatments before seeking outside care. Of those, 53% acquired medication, with some medicines already at home. Thirty four per cent acquired herbal medicines.There were many

reasons for delay. However, most of the reasons for delay were a lack of awareness or knowledge of the importance of the symptoms(80%). Reasons for seeking treatment were also explored and it was found that an awareness of the severity of the illness was a major factor for seeking treatment. The mean delay before seeking treatment was 4.9 (17.4) days. There was also sometime between the first site (where treatment was sought) and the last site of treatment. The mean delay was 8.7 (19.8) days. Median duration was two days. Awareness of the severity of symptoms/signs was the main factor for deciding the last place to seek treatment (59%). Referral of the provider was the second most frequent reason. Awareness of the last place to seek treatment was mainly due to providers (41%) and self-awareness (39%).

Health Knowledge of the Respondents

Table 18.Knowledge of theDanger Signs for Children

Danger Signs for Neonate	Per cent of respondents who said "yes" (n=732)
Refuse feeding	54.8%
Fits	72.1%
Rapid breathing	49.9%
Chest in-drawing in inspiration	31.0%
High fever	87.4%
Hypothermia	22.7%
Weak movement of extremities	28.7%
Yellowish discoloration of palm and sole	44.1%
Pus from umbilicus	33.5%
Discharge from eyes	26.1%
Pustules all over the body	30.5%
Average per cent who have knowledge about danger signs of neonate	43.7%
Danger signs for under-fives	**Per cent of respondents who said "yes"(n=663)**
Refuse feeding	67.1%
Vomiting	64.1%
Fits	79.5%
Drowsiness	52.3%
Average per cent who have knowledge ofdanger signs of under-fives	65.8%

The most known life-threatening signs among neonates were high fever(87%) and fits (72%). Awareness of other important signs and symptoms were much lower, at not more than 50%. However, the caretaker knowledge of the danger signs for under-fives is much higher in comparison to neonates (65.8% vs. 43.7%, p value<0.001).

5. Discussion

The target for MDG4 is to reduce the U5MR (Under-five Mortality Rate) by two-thirds between 1990 and 2015. Of the almost 7 million children under the age of five still dying every year in the world, more than 95 per cent are clustered in just two regions of the world: Africa and Asia[12].

Under-five mortality levels are influenced by poverty and education, particularly of mothers; by the availability, accessibility and quality of health services; by environmental risks including access to safe water and sanitation; and by nutrition. Although the major causes of under-five mortality remain the same globally, their relative importance varies across regions of the world. In low-income countries, infectious diseases account for a large proportion of under-five deaths. Forty three per cent of these deaths occur among babies aged 0-28 days (newborn babies) and are mainly due to preterm birth complications, birth asphyxia and trauma, and sepsis. After the first 28 days until the age of five years, the majority of deaths are attributable to infectious diseases such as pneumonia (22%), diarrhoeal diseases (15%), malaria (12%) and HIV/AIDS (3%)[13]. Poor nutritional status in a child[14] is strongly correlated with vulnerability to diseases and to an increased risk of dying[15]. Low birth weight is closely associated with increased risks of neonatal mortality and, every year, more than 20 million babies are born with LBW worldwide, the majority of them in Africa and South-East Asia[16].

[12]United Nations Population Division (2012).World Population Prospects: The 2012 Revision(ST/ESA/SER.A/336).

[13]World Health Organization Global Health Observatory (2015). Available from http://apps.who.int/gho/data/node.main.CODWORLD?lang=en (accessed 15 February 2015).

[14]The nutritional status of under-five children is usually assessed through three standard indicators: stunting, wasting and underweight. A stunted child is a child who is too short for his/her age. Stunting is usually a result of nutritional deprivation over a lengthy period of time. A child is considered wasted when the weight is too low for the child's height. Wasting usually reflects an acute nutritional deficiency, due either to reduced food consumption or to acute weight loss during an illness. Finally, a child is said to be underweight if his/her weight is too low for his/her age, as a consequence of wasting, stunting, or both.

[15]R.E. Black and others, "Maternal and child under-nutrition and overweight in low-income and middle-income countries", Lancet, published online 6 June 2013. Available at http://dx.doi.org/10.1016/S0140-6736(13)60937-X.

[16]United Nations Children's Fund/World Health Organization. Low Birth Weight: Country, Regional, and Global Estimates (UNICEF, New York, 2004).

According to a U5MR survey report in 2003, Myanmar's U5MR was estimated at 66.1[17]. In regards to the age period of the under-five deaths, 73% took place in infancy, 33% of the infant deaths in the first month of life and over 66% of all neonatal deaths in the first seven days of life. Cause of death was; prematurity/LBW (31%), sepsis (26%) and birth asphyxia (25%).

The estimated rate, based on Myanmar's U5MR in the 2011 Multiple Indicator Cluster Survey Report (2009-2010), was 46,17.The Myanmar Health System Review reported that Myanmar has shown a notable progress over the past two decades in attaining MDG4 (child mortality)[19]. The report also indicated that Myanmar still remains unlikely to achieve the MDG4 U5MR target of 38 or lower by 2015.

This study was therefore conducted to identify causes of deaths amongst under-five children in Myanmar using standard verbal autopsy tools.

Under-five mortality in Myanmar has been declining over the past couple of decades. Estimates[20]indicate that the U5MR in Myanmar is reducing at an annual rate of 3.3%, from 109 deaths per 1,000 live births in 1990, to 51 in 2013. This reduction has likely been due to a decline in deaths due to infectious diseases. This is evident by comparing the findings of this study with that of a similar study done in 2003. When comparing data from 2003 with data from 2013 it is evident that most infectious diseases, as a cause of under-five mortality and neonatal mortality, has reduced both in terms of proportion and in terms of ranking, whereas the proportion of non-infectious conditions like prematurity/LBW, birth asphyxia and congenital anomalies (as a cause of death) have increased, as per Tables 19 and 20 below. Though this is a very positive trend it also highlights the need for the health systems to have a greater focus on reducing deaths due to non-infectious, preventable causes like prematurity/LBW and birth asphyxia, while continuing the progress made inpreventing infectious diseases. The top five causes of death among under-fives in 2013, compared to results of a similar survey in 2003, are provided in Figure 5.

[17]Ministry of Health, Myanmar and UNICEF (2003). Overall and cause specific under-five mortality survey 2002-2003, Women and child health development project 2003, Yangon.

[18]Ministry of National Planning and Economic Development, Ministry of Health and UNICEF (2011). Myanmar Multiple Indicator Cluster Survey (2009-2010)

[19]Asia Pacific Observatory on Health Systems and Policies (2014). The Republic of the Union of Myanmar Health System Review, Health Systems in Transition, Vol. 4 No. 3 2014 available at http://www.wpro.who.int/asia_pacific_observatory/en/

[20] United Nations Inter-agency Group for Child Mortality Estimation (UN IGME) 2014

Table 19.Cause of under-five mortality, comparing 2003 and 2013 studies:

2003			2013	
Percentage	**Cause of death**		**Cause of death**	**Percentage**
21.0	ARI		Prematurity/LBW	17.4
14.0	Brain infections		Birth asphyxia	12.4
13.4	Diarrhoea		ARI	11.9
13.4	Prematurity/LBW		Diarrhoea	7.7
10.5	Septicaemia		Neonatal jaundice	7.3
9.3	Unknown		Neonatal sepsis	6.4
5.7	Malaria		Congenital anomaly	6.3
5.5	Beriberi		CNS infections	6.2
1.5	Accident & poisoning		Beriberi	5.9
1.3	Congenital anomaly		Septicaemia	4.2
0.8	DHF		Accident & poisoning	4.1
0.8	Measles		Other non-specific causes	2.8
0.8	Others		Malaria	1.7
0.8	TB		Other infections	1.4
0.5	Malnutrition		Pneumonia	1.1
0.4	Heart failure		Malnutrition	1.0
0.2	Whooping cough		DHF	0.6
0.1	Rabies		Hematological disorders	0.5
			Epilepsy	0.5
			Measles	0.3
			HIV	0.2

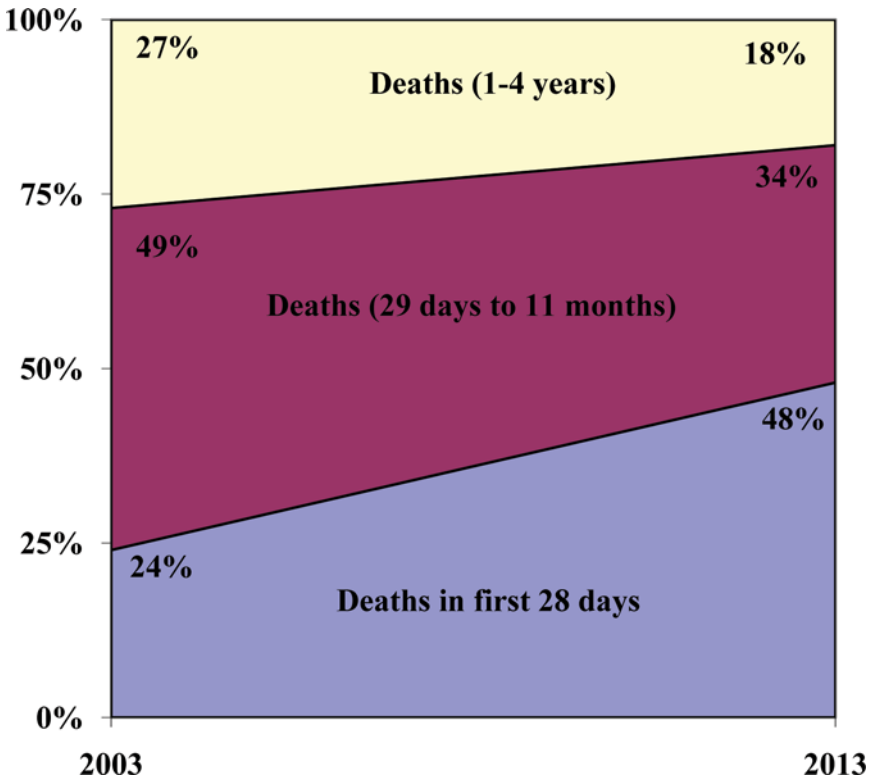
Table 20. Cause of neonatal mortality, comparing 2003 and 2013 studies:

2003			2013	
Percentage	**Cause of death**		**Cause of death**	**Percentage**
30.9	Prematurity/LBW		Prematurity/LBW	36
25.5	Sepsis		Birth asphyxia	26
24.5	Birth asphyxia		Neonatal jaundice	15
11.7	Unknown		Neonatal sepsis	12
4.3	Brain infections		Congenitalanomaly	6
2.7	Congenital anomaly		Septicaemia	1

The U5MR occurring in the age groups 1 to 5 years and 29 days to 1 year is low (18% and 34% respectively) and has reduced compared to that of 2003 (27% and 49% respectively). Thus, neonatal deaths as a proportion of under-five mortality have increased in 2013 (48%) when compared to 2003 (24%). The changes are illustrated in Figure 5. This is reflective of the global trend where neonatal deaths as a proportionof under-five mortality have been increasing over the past decade as deaths in the 1 to 5 year category have been reduced[20]. Given the fact that most neonatal deaths are preventable, additional efforts and resources are needed to strengthen interventions that reduce neonatal mortality. With the recent evidence around a greater focus on facility-based interventions to reduce neonatal mortality[21]coupled with the fact that most neonatal deaths occur around delivery and labour, Myanmar needs to focus on strengthening facilities to provide quality services for newborns and mothers during childbirth, in order to reduce neonatal mortality. Since most of the high impact interventions to reduce neonatal mortality are effectively provided at health facilities compared to at community level, it is essential for Myanmar to reverse the current proportion of home (63.8%[3]) and facility (36.2%[3]) based deliveries.

[21] Zulfiqar A Bhutta, et al. Can available interventions end preventable deaths in mothers, newborn babies, and stillbirths, and at what cost? The Lancet Vol 384 July 26, 2014

Figure 5. Proportion of neonatal deaths among under-fives



The above findings (for both overall and age-group-related causes) indicate a need for special attention to be paid to the environmental and socioeconomic factors leading towards these health outcomes. The infectious nature of some causes of death highlights the need for timely diagnosis and appropriate treatments to be given at health service delivery points.

For Myanmar, improvements in access to safe water and adequate sanitation have been reported[22, 23, 24]. On the other hand, diarrhoea remains among the top five causes of death and among the top five causes of DALY (Disability-Adjusted Life Year)

[22]United Nations Children's Fund (UNICEF) (2000). The state of the world's children 2000. New York: UNICEF (http://www.unicef.org/sowc/archive/ENGLISH/The%20State%20of%20the% 20World%27s%20Children%202000.pdfaccessed 14 February 2015)

[23] United Nations Children's Fund (UNICEF) (2005). The state of the world's children 2000. New York: UNICEF (http://www.unicef.org/publications/files/SOWC_2005_(English).pdf, accessed 14 February 2015)

[24] United Nations Children's Fund (UNICEF) (2013). The state of the world's children 2013: children with disabilities. Geneva: UNICEF (http://www.unicef.org/sowc2013/files/SWCR2013_ENG_Lo_res_24_Apr_2013.pdf, accessed 14 February 2015)

in 2010[25, 26.] This is also reflected in this study, diarrhoea being among the top causes of under-five deaths, though the proportion has declined compared to 2003. This situation indicates the need for further investigation into how safe the drinking water is and how sanitary the sanitary facilities are as well as food safety[27]and the access to and knowledge of managing diarrhoea.

There are some differences in the ranking of cause of death among the various States and Regions. Some notable differences are: infectious diseases like ARI and diarrhoeastill being a predominant cause of under-five mortality in Chin and Kayah, which is contrary to the national data and therefore demand a greater focus on interventions addressing them; beriberi being a predominant cause of death in Ayeyarwaddy (ranking first, contributing to 17% of under-five deaths) and Magway (ranking 4th, contributing to 13% of under-five deaths), demanding nutrition interventions in these areas; and other states and regions where Beriberi causes more than 5% of deaths are Mandalay (8.6%), Bago (7.1%), Mon (7.1%), Rakhine (5.6%), and Chin (5.1%). The information on sub-national level causes of death will guide the national programmes to tailor their interventions focused to that particular State or Region, eventually resulting in an evidence-informed programming that could be cost efficient. This is even more important for Myanmar, given the constraints both on the financial resources and the capacity of health systems.

According to the MICS(2009-2011)Myanmar had an U5MR of 52.9 and 29.1 per 1.000 live births respectively for rural and urban areas, showing a marked difference. In spite of this marked difference, this study did not find any statistically significant difference in causes of under-five deaths between urban and rural areas. In order to reduce the burden of under-five deaths and to achieve the Global and National targets it has committed to, the country needs to invest in strengthening its rural health systems.

This study does, however, indicate a slightly higher ratio of males to females (1.2:1.0) among all under-five deaths although there is no statistical difference in U5MR between males and females as regards the cause of death. According to Myanmar's

[25]World Health Organization (WHO) Department of Measurement and Health Information (2004). Color codes for levels of evidence (http://www.who.int/entity/healthinfo/statistics/bodgbdeathdalyestimates.xlsaccessed 15 February, 2015)

[26]World Health Organization (WHO) Department of Measurement and Health Information (2009). Mortality and burden of disease estimates for WHO Member States in 2004 (http://www.scribd.com/doc/141751591/Global-Burden-Disease-Death-Estimates-Sex-Age-2008.xlsandhttp://www.who.int/entity/healthinfo/global_burden_disease/gbbdeathdalycontryestimates2004xls , accessed 15 February 2015)

[27]Asia Pacific Observatory on Health Systems and Policies (2014). The Republic of the Union of Myanmar Health System Review, Health Systems in Transition, Vol. 4 No. 3 2014 available at http://www.wpro.who.int/asia_pacific_observatory/en/

MICS Report (2009-2010), U5MR for males and females per 1,000 live births were 49.8 and 42.2 respectively[28] showing a slightly higher rate for males. Global evidence also indicates a higher U5MR among males compared to females (47 versus 44).

The majority of deaths took place at home (about 53%) followed by a government hospital/maternity home (about 41%). However, the majority of *neonatal* deaths took place at government hospital/maternity homes. Though further studies are needed to understand the reasons for this pattern of increased death at home, possible explanations could be: a delay in taking the decision to seek care (this is substantiated by the findings that in 23% of deaths medications were given at home before seeking care and 80% of the reasons given for delays was due to a lack of knowledge of the important signs and symptoms, and a mean delay of about five days before seeking treatment), the poor quality of care at government health facilities acting as a deterrent in seeking services, high out of pocket expenses for health treatments[29,30], poor transport facilities, and others.

The need for timely diagnosis and appropriate treatment to be given at health service delivery points has been highlighted earlier. In addition to raising the community's awareness of prevention strategies, providing training to health staff in the appropriate care and treatment of under-fives, ensuring that treatment protocols are adhered to and ensuring availability of relevant medicines at the health facilities, will be considered by the MOH (Ministry of Health).

Study limitations

1. There were 10 clusters (7 households in one cluster) in a township. One township represented one State or Region. Thus, a cluster effect occurred in two steps (one within each cluster and one in each township). Although the countrywide summary of cause of death was representative, the State/ Region-wise summary should be interpreted with some caution due to the cluster effect.

[28]Ministry of National Planning and Economic Development, Ministry of Health and UNICEF (2011). Myanmar Multiple Indicator Cluster Survey (2009-2010).

[29] Integrated Household Living Conditions Survey, UNDP 2011

[30] Global Health Expenditure Database, WHO, 2012

2. Cause of death is only identified based on the recall information from proxy (family members) of the dead child. Information consists mostly of symptoms and signs rather than those detected by clinicians. However, the risk of misclassification was reduced by two diagnoses for each case, by separate teams. The paediatricians were recruited in three teams to decide on cause of death based on verbal autopsy findings. Every case was reviewed, twice, by different teams. Diagnoses that were not agreed upon by the two teams were reviewed and finalized by a third team, which was formed by senior paediatricians.
3. The study could identify the differentials of geographic and socio-demographic characteristics among different causes of death. We could not determine socioeconomic correlates of the cause of death since there was no control group in the study.

6. Conclusion and Recommendations

Based on the findings of this study the following conclusions have been reached and the subsequent recommendations are being made:

- Given the fact that in 2013 infectious diseases as a cause of under-five death has reduced, compared to 2003, the health system should have a greater focus on reducing deaths due to non-infectious, preventable causes like prematurity/ LBW and birth asphyxia, while simultaneously accelerating the progress made in reducing the risk of death from infectious diseases.
- Since neonatal mortality contributes to a greater proportion of under-five deaths (48%) and the fact that it is not declining as fast as mortality among other age groups, Myanmar needs to focus on scaling up interventions that reduce neonatal mortality.
- As most of the high impact interventions to reduce neonatal mortality are effectively provided at health facilities compared to at community level, and the fact that the majority of neonatal deaths occur around childbirth, it is essential for Myanmar to strengthen health facilities and to reverse the current proportion of home-to facility-based deliveries.
- This study also highlights the sub-national level of differences in cause of death between various States and Regions, demanding a greater level of consideration for these differences in planning, financing and the geographically targeted scaling-up of health interventions in Myanmar.
- Though this study does not identify any significant difference in the cause of under-five deaths between urban and rural areas, Myanmar needs to continue to strengthen investing in its rural health systems as the U5MR is much higher in rural compared to urban areas.
- The findings of the study indicate a need to pay special attention to environmental and socioeconomic factors; improving the knowledge of caregivers in relation to danger signs and symptoms, and the need for timely diagnosis and the dispensing of appropriate treatments at health service delivery points. All these mean that multi-faceted interventions are needed that focus on strengthening the health systems for an increased supply of services, a better enabling environment, adequate knowledge among care-givers and good demand for services.

- Further evidence is needed in the following areas: to explore the association between neonatal deaths and their place of birth; the probability of beriberi in States compared to Regions; the differences in dietary patterns in States compared to Regions.

- Many children, who suffered from treatable illnesses, died after a period of illness which would have been enough time for treatment, which indicates the need to increase appropriate and timely care-seeking as well as access to quality health services when and where they are needed by children and their families. There are two tandem approaches that should be considered to address this problem:

  1) Ensuring that health facilities at all levels (i.e. Township, Station, Rural Health Center and Sub-Rural Health Center) are appropriately staffed and supplied (e.g. deploying staff to fill vacancies, providing skill-based training, supervision and monitoring as well as ensuring supply chain management to point of service delivery);

  2) Effectively expanding the health system to the community level through a rational distribution of appropriately trained, equipped, supplied and supervised AMWs and CHWs, who are able to provide integrated, preventative (e.g. health education and promotion including appropriate care-seeking; distribution of micronutrients) and curative health services (e.g. integrated community case management of common childhood illnesses) according to their defined roles and responsibilities within the health system.

- Many preventable deaths still occurred at home. Awareness of warning signs and knowledge levels were low among caregivers. To improve community education and family care practices, and to reduce clients' delay in seeking treatment, there is a need to incorporate behaviour change communication in national strategies for child health, which can be delivered through multiple communication channels from facility to community level, including BHS, AMWs, CHWs, Village Health Tract Committees and Village Health Committees.

Acknowledgement

This study was funded and technically supported by UNICEF. Under the steering and close supervision of authorities from the Ministry of Health, the research team carried out field data collection activities successfully. Field activities could not be completed without the active coordination and cooperation of the States and Regional Health authorities. With consent and understanding from respondents, the research teams were able to gain valuable and reliable information for this study.

Annex 1

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	Dr.Ni Ni Than	Dr. Mu Mu Than

Annex 2

Multivariate analysis for factors associated with different causes of death

The causes of death that were more relevant from the programme's perspective were considered in the analysis. These causes were 1) prematurity/LBW, 2) ARI/ Pneumonia, 3) birth asphyxia, 4) diarrhoea, 5) neonatal jaundice, 6) infections or sepsis including CNS infections, and 7) beriberi. Remaining causes were grouped into a single category and considered as reference category in the analysis when computing RRR (Relative Risk Ratio) in the multinomial logistic regression. Since outcome variable was a categorical variable and had more than 2 categories, multivariable analysis for associating factors was carried out using multinomial logistic regression. Variables of associating factors were 1) States/Regions, 2) parents age both below 30 years or one of them older than 30 years, 3) urban or rural residency status, 4) parity of mother less than 3 or =>3, 5) family had experience of child death previously, 6) family income less than 100000 kyats per month, 7) both parents' education below middle level, 8) both parents had no or a relatively lowwage occupation (such as *manual, casual, farmer, rubber plantation, fishery and wood cutter)*.

Sample sizes that were included in the analysis are described below, separated by categories in each variable.

Sample size consideration for multivariate analysis

Variable Categories		Sample
Cause of death	Prematurity/LBW	154
	ARI/Pneumonia	112
	Birth asphyxia	105
	Diarrhoea	67
	Neonatal jaundice	57
	Infection/Sepsis	180
	Beriberi	107
	Others	183
Urban/Rural	Urban	182
	Rural	683
State/Region	States	442
	Regions	423
Age of parents	<30 yr	268
	>30 yr	597
Parity	<= 2	443
	3+	422
Previous experience of child death	No experience	738
	Have experience	127
Family income level	<100000 kyats per month	604
	>100000 kyats per month	261

Knowledge score on warning signs	<= 6.00	602
	7.00+	263
Parents' education (below middle)	Both Low	332
	One or both high	533
Parents' occupation (low level)	Both have low wages	375
	One have higher wages	490
Included in analysis		865
Missing in analysis		93
Total		958

Since there was some missing information in income and parity, 865 cases out of 958 (90%) were included in the analysis. Backward step-wise regression method was used in the analysis. It was found that there was no statistical significance between urban and rural areas or disparities of cause of death and thus it was not included in the final model. Among other remaining factor variables, not all were statistically significant (meaning P value not less than 0.05). Significant factor variables are shown in bold in the table below.

Socioeconomic disparities of cause of death (multinomial logistic regression analysis)

Parameters	Cause of death		P value.	RRR	95% CI for RRR	
					Lower Bound	Upper Bound
States vs. Regions	"Prematurity/LBW" "other"	vs.	0.071	1.674	0.957	2.930
Both parents young (<30 yr vs. =>30 yr)	"Prematurity/LBW" "other"	vs.	0.388	1.320	0.703	2.482
Parity (<3 vs.=>3)	"Prematurity/LBW" "other"	vs.	0.610	1.173	0.634	2.170
Experience of child death ("no" vs. "yes")	"Prematurity/LBW" "other"	vs.	**0.010**	.342	0.151	.777
Low family income (<100000 vs. >100000 kyats)	"Prematurity/LBW" "other"	vs.	0.221	.679	0.366	1.261
Both parents education (below middle vs. =>middle)	"Prematurity/LBW" "other"	vs.	**0.028**	.513	0.283	.929
Both had occupation (low wages vs. higher wages)	"Prematurity/LBW" "other"	vs.	0.242	1.409	0.793	2.503

States vs. Regions	"ARI/Pneumonia" vs. "other"		0.090	1.667	0.923	3.011
Both parents young (<30 yr vs. =>30 yr)	"ARI/Pneumonia"	vs.	0.962	0.983	0.489	1.976
Parity (<3 vs.=>3)	"ARI/Pneumonia"	vs.	**0.025**	0.473	0.246	.908
Experience of child death ("no" vs.	"ARI/Pneumonia"	vs.	0.829	1.109	0.435	2.824
Low family income (<100000 vs. >100000 kyats)	"ARI/Pneumonia" vs. "other"		0.857	1.064	0.542	2.087
Both parents education (below middle vs. =>middle)	"ARI/Pneumonia" vs. "other"		0.658	0.870	0.470	1.611
Both had occupation (low wages vs. higher wages)	"ARI/Pneumonia" vs. "other"		0.967	0.987	0.538	1.813
States vs. Regions	"Birth asphyxia" vs. "other"		0.117	1.615	0.887	2.942
Both parents young (<30 yr vs. =>30 yr)	"Birth asphyxia" vs. "other"		0.721	1.130	0.576	2.216
Parity (<3 vs.=>3)	"Birth asphyxia" vs. "other"		0.194	1.554	0.799	3.023
Experience of child death ("no" vs.	"Birth asphyxia" vs. "other"		0.077	0.448	0.184	1.090
Low family income (<100000 vs. >100000 kyats)	"Birth asphyxia" vs. "other"		0.832	1.076	0.548	2.115
Both parents education (below middle vs. =>middle)	"Birth asphyxia" vs. "other"		0.269	0.700	0.371	1.318
Both had occupation (low wages vs. higher wages)	"Birth asphyxia" vs. "other"		0.271	0.705	0.378	1.314
States vs. Regions	"Diarrhoea" vs. "other"		0.062	1.923	0.968	3.818
Both parents young (<30 yr vs. =>30 yr)	"Diarrhoea" vs. "other"		0.179	0.561	0.241	1.303
Parity (<3 vs.=>3)	"Diarrhoea" vs. "other"		0.170	0.596	0.284	1.248
Experience of child death ("no" vs.	"Diarrhoea" vs. "other"		0.598	1.352	0.441	4.139
Low family income (<100000 vs. >100000 kyats)	"Diarrhoea" vs. "other"		0.103	1.985	0.870	4.528
Both parents education (below middle vs. =>middle)	"Diarrhoea" vs. "other"		0.226	0.642	0.314	1.315
Both had occupation (low wages vs. higher wages)	"Diarrhoea" vs. "other"		**0.01**	0.429	0.225	0.82
States vs. Regions	"Neonatal jaundice" vs. "other"		0.124	1.740	0.859	3.522
Both parents young (<30 yr vs. =>30 yr)	"Neonatal jaundice"	vs.	0.425	0.719	0.320	1.616
Parity (<3 vs.=>3)	"Neonatal jaundice"	vs.	0.756	1.130	0.524	2.437
Experience of child death ("no" vs.	"Neonatal jaundice"	vs.	0.452	0.659	0.222	1.956
Low family income (<100000 vs. >100000 kyats)	"Neonatal jaundice" vs. "other"		0.378	0.711	0.333	1.517
Both parents education (below middle vs. =>middle)	"Neonatal jaundice" vs. "other"		**0.029**	0.420	0.193	0.916
Both had occupation (low wages vs. higher wages)	"Neonatal jaundice" vs. "other"		0.301	0.676	0.321	1.420

States vs. Regions	"Infection/sepsis"	vs.	0.614	0.870	0.506	1.495
	"other"					
Both parents young (<30 yr vs. =>30 yr)	"Infection/sepsis"	vs.	0.190	0.655	0.347	1.234
Parity (<3 vs.=>3)	"Infection/sepsis"	vs.	0.791	0.924	0.514	1.661
Experience of child death ("no" vs.	"Infection/sepsis"	vs.	0.315	0.657	0.289	1.493
Low family income (<100000 vs. >100000 kyats)	"Infection/sepsis"	vs.	0.465	1.258	0.679	2.330
	"other"					
Both parents education (below middle vs. =>middle)	"Infection/sepsis"	vs.	0.119	0.639	0.364	1.123
	"other"					
Both had occupation (low wages vs. higher wages)	"Infection/sepsis"	vs.	0.957	0.985	0.566	1.714
	"other"					
States vs. Regions	"Beriberi" vs. "other"		0.874	0.953	0.526	1.727
Both parents young (<30 yr vs. =>30 yr)	"Beriberi" vs. "other"		0.590	0.827	0.415	1.648
Parity (<3 vs.=>3)	"Beriberi" vs. "other"		0.947	0.978	0.513	1.866
Experience of child death ("no" vs.	"Beriberi" vs. "other"		0.534	0.748	0.301	1.863
Low family income (<100000 vs. >100000 kyats)	"Beriberi" vs. "other"		0.459	0.780	0.404	1.506
Both parents education (below middle vs. =>middle)	"Beriberi" vs. "other"		0.485	0.802	0.431	1.492
Both had occupation (low wages vs. higher wages)	"Beriberi" vs. "other"		0.720	0.894	0.485	1.649

In comparison with other causes of death, **prematurity/LBW** was less likely to occurin the family that had no previous experience of child death (RRR=0.343, P value=0.01) and among both parents with low education levels (RRR=0.513, P value=0.028).Compared to other diseases, **ARI** as a cause of death was less likely among children with mothers of parity below 3 (RRR=0.473, P value = 0.025). Other factors were not associated. Death due to **birth asphyxia** was less likely for the child born to a family that had experience of a child's death previously (RRR=0.448, P value = 0.077).

Compared with other causes of death, **diarrhoea** was less likely for the child from the family where both parents' occupation were relatively low wage (RRR = 0.429, P value = 0.01). **Neonatal jaundice** was less likely to be a cause of death compared to other causes of death among parents with a low level of education (RRR = 0.42, P value = 0.029).

Study on Cause of Under-five Mortality
2014