MORTALITY AND ITS PREDICTORS AMONG CHILDREN ADMITTED IN THE GENERAL PAEDIATRIC WARD, MUHIMBILI NATIONAL HOSPITAL FROM OCTOBER 2017 TO APRIL 2018

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By

Diana Kaletwaki Damian

A Dissertation Submitted in (Partial) Fulfilment of the Requirements for the Degree of Master of Medicine (Paediatrics and Child Health) of

Muhimbili University of Health and Allied Sciences
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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled: **‘‘Mortality and its predictors among children admitted in the general paediatric ward, Muhimbili National Hospital from October 2017 to April 2018’’,** in (partial) fulfilment of the requirements for the degree of Master of Medicine (Paediatrics and Child Health) of the Muhimbili University of Health and Allied Sciences.

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Dr. Francis F. Furia

(Supervisor)

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Date

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Dr. Germana H. Leyna

(Co – Supervisor)

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Date

DECLARATION AND COPYRIGHT

I, **Diana Kaletwaki Damian,** I declare that this **dissertation** is my original work and it has not been presented and shall not be presented to any other University for a similar or any other degree award.

Signature..... **Date**…….....

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Special thanks to my supervisor Dr Francis F. Furia and Dr Germana H.Leyna for their support from the design of this study to report writing.

I am grateful to the department of paediatrics at Muhimbili National Hospital for allowing me to conduct this study. I will always be indebted to the parents and guardian who agreed to participate in this study.

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Finally, I would like to say thanks to my husband, my two sons Fredrick and Giovanni for their support and love during the entire time of my studies.

DEDICATION

This work is dedicated to my lovely husband Dr Benjamin Kamala and my children.

ABSTRACT

Background

Child mortality is one of the sensitive indicators of a country's development. Global under 5-mortality is still high especially during the neonatal and infant period. Globally, annual under-five mortality has declined from 91 to 43 per 1000 live births from 1990 to 2015. In Tanzania, under-five and infant mortality rates declined from 147 to 67 and 99 to 43 deaths per 1,000 live births in the same period, respectively. There is variation in the causes of death among different age groups. More interventions are needed during these periods to reduce mortality. Objective of this study was to determine mortality rate and its predictors among children admitted in the general paediatric wards, Muhimbili National Hospital from October 2017 - April 2018.

Methodology: A prospective cohort study was designed to investigate the predictors of deaths occurring among children aged from 1-59 months admitted in the paediatric department wards from October 2017 to April 2018. Nine hundred and twenty-five (response rate 94.9%) consecutively admitted children were recruited and followed up until discharge or death. The cumulative incidence rate of mortality was calculated. Causes of death were identified and risk factors associated with mortality were assessed. Multivariate analysis was conducted to determine and quantify the relationship between different predictors of deaths. P-value of <0.05 was considered statistically significant.

Result: A total of 925 children aged 1-59 months with a median age (IQR) of (13 (6, 26) months, male: female ratio of 1.5:1 participated in the study. The overall mortality rate was 12.2% (95% CI: 10.2%-14.5%). The leading underlying causes of death were septicaemia (27%), malnutrition (12%), congenital heart disease (12%), pneumonia (11%) and HIV (9%). More deaths were observed at night, during the first 24 hours of admission and weekends. Predictors of mortality were found to be low wealth quintiles (lowest quintile (AOR=4.0; 95%CI: 1.19-13.51), second quintile (AOR=5.2; 95%CI: 1.65-16.69) and middle quintile (AOR=3.6; 95%CI: 1.14-11.33)), unconsciousness on admission (AOR = 18; 95%CI: 6.70-56.82), inability to feed (AOR = 5.7; 95%CI: 1.97-16.51), lethargy (AOR = 4.9; 95%CI: 2.32-

10.40), severe wasting (AOR = 4.5; 95%CI: 2.49-8.10) and respiratory distress (AOR = 2.6; 95%CI: 1.40-4.97).

Conclusion: Mortality rate is still high compared to the WHO target. More deaths were observed during the first 24 hours of admission. Infectious diseases and malnutrition were the leading causes of death. Low household wealth, unconsciousness, inability to feed, lethargy, severe wasting and respiratory distress were significant predictors of deaths.

Recommendation: Care of the children should be improved in the first 24 hours of admission, during the nighttime and weekends. Clinicians should closely monitor children with predictors of mortality as they have a higher risk of dying.

MUHTASARI

Utangulizi: Vifo vya watoto chini ya miaka mitano ni vingi hasa kipindi cha mwezi mmoja na mwaka mmoja, vinazidi kupungua kadri mtoto anavyokuwa. Takwimu ulimwenguni zinaonyesha kuwa vifo vya wototo chini ya miaka mitano vimepungua kutoka watoto 91 mpaka 43 kati ya watoto 1000 wanaozaliwa kuanzia mwaka 1990 mpaka 2015. Tanzania inaonyesha idadi ya vifo vya watoto chini ya miaka mitano ni; watoto 67 wanakufa kati ya watoto 1000 wanaozaliwa. Sababu za vifo zinatofautiana kulingana na rika. Mikakati mingi inatakiwa kipindi hiki ili kupunguza idadi ya vifo.

Lengo la utafiti: Kutambua sababu za vifo vya watoto chini ya miaka mitano waliolazwa wodi za watoto katika hospitali ya taifa ya muhimbili kuanzia mwezi Octoba 2017 mpaka Aprili 2018.

Mbinu: Uchunguzi ulifuatilia watoto kuanzia mwezi 1 mpaka miezi 59 waliolazwa wodi za watoto hospitali ya taifa Muhimbili kati ya mwezi Oktoba 2017 had April 2018. Watoto wote waliokidhi vigezo vya kushiriki walikaribishwa kushiriki kwenye utafiti. Jumla ya watoto 925 (sawa na asilimia 94.4%) walishiriki kwenye utafiti na kufuatiliwa toka siku walipolazwa hadi kifo au kuruhusiwa. Vifo vilihesabiwa. Visababishi vya vifo zilichunguzwa na mchango wake kwa kifo kutathiminiwa.

Ukokotoaji wa takwimu: Tulitumia mchanganuo mbali mbali kukokotoa takwimu. ikiwa namba za kujirudia, na asilimia katika kutoa taarifa za idadi za vifo na sababu za vifo. Tulitumia kiwango cha uwiano kutambua viashiria vya vifo watoto chini ya miaka mitano kwa kutumia SSPS.

Matokeo: Asilimia hamsini na zaidi ya watoto walioshiriki walikuwa na umri wa miezi 13 na uwiano wa watoto wa kiume na kike ilikuwa (1.5:1). Vifo vya watoto vilikuwa ni asilimia 12.2. Sababu kuu za vifo zilikuwa ni maambukizi ya kwenye damu (27%), utapiamlo (12%), magonjwa ya moyo ya kuzaliwa (12%), homa ya mapafu (11%) na kuwa na maambukizi ya virusi vya ukimwi (VVU) (9%). Viashiria vya vifo vilikuwa ni umaskini, kutokuwa na

fahamu, kushindwa kula, kulegea sana, unyafuzi, maambukizi ya VVU, kuhema kwa shida na kuharisha.

Hitimisho: Vifo vya watoto bado ni vingi ukilinganisha na takwimu za dunia. Magonjwa yanayoambukizwa na utapiamlo vinaongoza kwa kuua watoto chini ya miaka mitano. Viashiria vya vifo ni umaskini, mtoto kutokuwa na fahamu, kushindwa kula, kulegea sana, unyafuzi, maambukizi ya VVU, kuhema kwa shida na kuharisha.

Mapendekezo: Viashiria vilivyotajwa hapo juu vitumike kutambua mtoto aliyeko kwenye hatari ya kufa, ili aweza kupewa matibabu stahili kwa uharaka na kufanyiwa ufuatiliaji wa karibu. Pia utawala wakishirikiana na madaktari wapitie upya miongozo ya matibabu hasa yale magonjwa yanayo sababisha sana vifo.

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LIST OF ABBREVIATIONS

ACU	Acute Care Unit
AIDS	Acquired Immunodeficiency
APCU	Acute Paediatric Care Unit
BCS	Blantyre coma score
CI	Confidence Interval
CRP	C - reactive protein
FBP	Full blood Picture
GCS	Glasgow coma score
HIV	Human Immunodeficiency Virus
IMR	Infant Mortality Rate
MDGs	Millennium Development Goals
MNH	Muhimbili National Hospital
MoHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children
MoHSW	Ministry of Health and Social Welfare
MUAC	Mid Upper Arm Circumference
NBS	National Bureau of Statistics
NCDs	Non-communicable diseases
NMR	Neonatal Mortality Rate
PIM	Paediatric Index of Mortality

PRISM	Paediatric Risk of Mortality
RBG	Random Blood Glucose
SPSS	Statistics Package of Social Science
TDHS	Tanzania Demographic Health Survey
UN	United Nation
WHO	World Health Organization

DEFINITION OF TERMS

WHO defines underlying cause as disease or injury that initiated the train of events leading directly to death or circumstance of the accident or violence, which produce the fatal injury (1)

The immediate cause of death is a final disease or injury causing the death (1).

Multiple causes of death include both underlying and immediate causes of deaths with other intermediate contributory condition of deaths (1)

Infant mortality rate is the probability of dying before the age of one year (2).

The under-five mortality rate is the probability of dying before the fifth birthday (2).

1.0 INTRODUCTION

1.1 Background

Under-five mortality is the probability of dying before the fifth birthday. Child mortality is one among the indicators of child health and well-being. There are different causes of deaths among different age groups. Globally, annual under-five mortality has declined from 91 to 43 per 1000 live births from 1990 to 2015. In Tanzania, under-five and infant mortality rates declined from 147 to 67 and 99 to 43 deaths per 1,000 live births from 1990 to 2015 respectively, neonatal and infant mortality account for 45% and 75% of all under-five deaths respectively (3). This decline was after the introduction of Millennium Development Goals (MDGs). Worldwide under-five cause of deaths is pneumonia, preterm birth complication, birth asphyxia, diarrhoea and malaria (3). Almost half of these deaths were attributed with malnutrition (3). Most of these child deaths could be prevented or treated with simple and affordable interventions. Children in low-income countries are ten times more likely to die before the age of five years than children in high-income countries (3,4)

In Sub-Saharan Africa, the under-five mortality rate has declined by 54% from 180 to 83 deaths per 1000 live births from 1990 to 2015. Common causes of death in the under-five in Sub-Saharan Africa are infectious and malnutrition (5).

Tanzania is among the countries that reached millennium development goal (MDG4) on child mortality. Under-five mortality rates declined from 147 to 67 deaths per 1,000 live births from 1990 to 2015, a decline of 54% (2). The decline rates for males and females were 73 and 60 deaths per 1,000 live births respectively. Infant mortality (IMR) has decreased from 99 to 43 deaths per 1000 live birth and declined by 56% (3) whereby the decline between males and females were 51 and 41 deaths per 1,000 live births respectively. Some of the strategies to reduce mortality were immediate and exclusive breastfeeding, skilled attendant during prenatal, natal and post-natal care, family knowledge on identifying danger sign, improve access to water, sanitation and hygiene, access to nutrition and micronutrients and immunization (6)

Under-five mortality rates are important on decision-making and planning process. Studies showed that causes of death may be preventable through improving health services and strengthening prevention programs (7,8). Knowledge of mortality trend is also important in improving survival and extending life for all population. Comparable information about deaths and mortality rates broken down by age, sex, cause, year and geography provides a starting point for informed health policy debate (7,8). These data may be useful in health policies for disease prevention and control (9,10)

1.2 Problem of statement

In Tanzania mortality rate of under-five is still high (67 deaths per 1000 live birth). The causes of under-five death are preventable and may be differently distributed globally, regional and country-wise as has been shown in population-based demographic health surveys.

However, most of the studies relied on retrospective data collected routinely where it is uncertain if all factors were investigated and its quality has raised concern. We thus do not know if the mortality rate and predictors of death among under-five children reported in the general population apply to predictors that would be recorded at a tertiary health facility setting.

Therefore, using a prospective cohort study we aimed at estimating the mortality rate and describe the cause of death among under-five children admitted in a general paediatric ward MNH. Our findings are expected to provide more insight to predictors of mortality, immediate and underlying causes of deaths.

1.3 Rationale of the study

Findings from this study will provide information on the under-five mortality burden, the pattern of infant and child mortality, causes of deaths as well as predictors of mortality at MNH.

This baseline information will be used by the clinician in improving patient care by targeting on causes of deaths and predictors of mortality; this will help to reduce under-five mortality.

Data on the cause of death will be used by the administrator in cooperation with clinicians for decision making on resources allocation and strategies to prevent and manage childhood illnesses that cause more deaths in under-five.

1.4 Conceptual framework of under-five mortality

The causes of under-five mortality were assumed to be infectious such as bacteria, virus or parasite and non-infectious like poisoning or genetics. An infectious agent causes damage to different organs directly or via a release of chemical mediators and progress to form diseases. Factors such as age, sex, missed vaccine, poor nutrition, illiteracy and poverty may predispose them or increase the risk of disease progression. Thereafter, the child presents with signs and symptoms accompanied by physiological and biochemical derangement. If a child presents early at the health facility with good intervention may result in recovery and if presents late with poor intervention may lead to death.

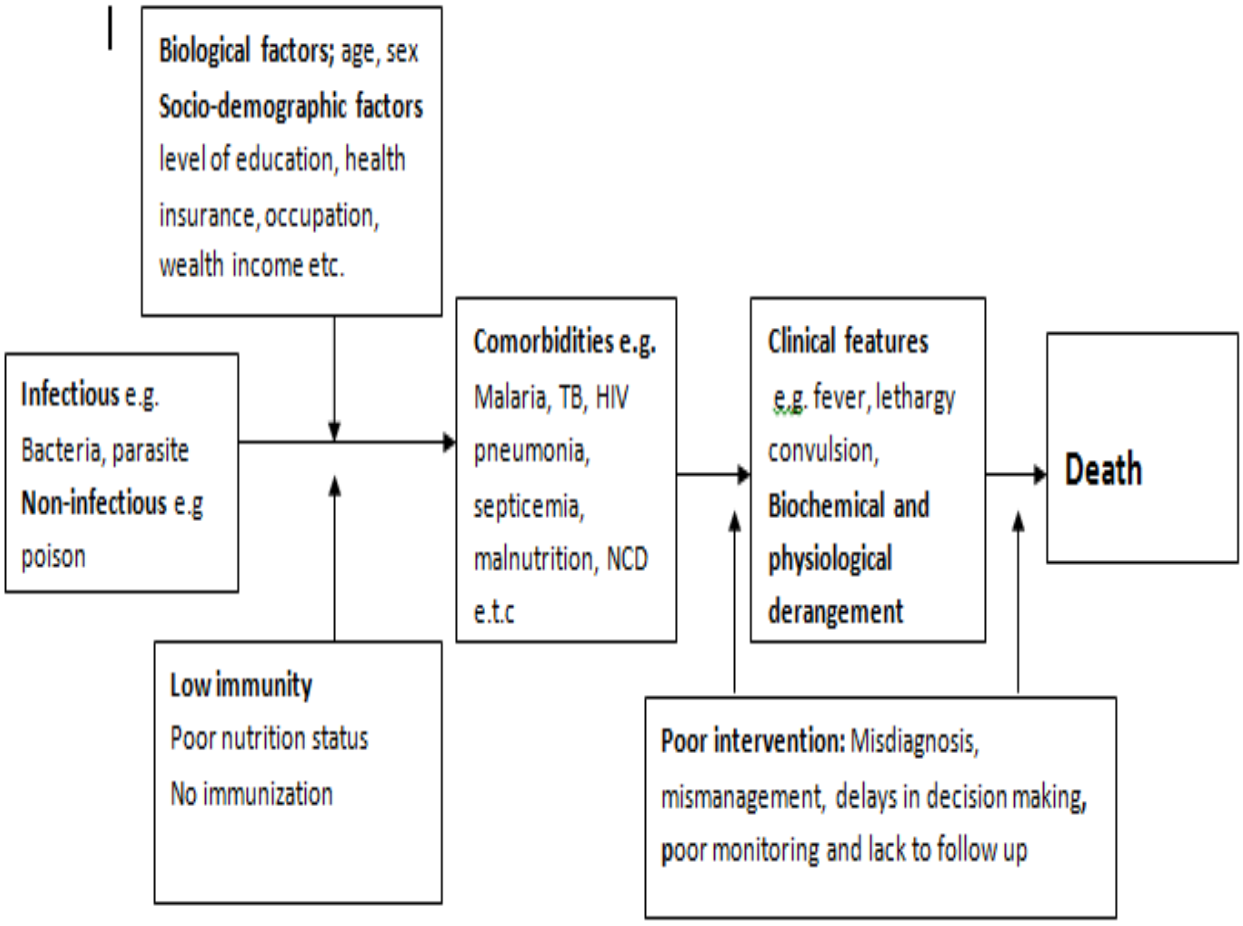

Figure 1: Conceptual framework of under-five mortality

1.5 Research questions

- What is the proportion of children dying in the general paediatric wards at MNH?
- What is the cause of death among children admitted in the general paediatric wards at MNH?
- What is the relationship between patient characteristics (social demographic and clinical profile) and deaths?

1.6 Objectives

1.6.1 Broad objectives

To determine mortality and its predictors among children aged 1-59months admitted in the general paediatric wards MNH.

1.6.2 Specific objectives

1. To estimate mortality rate among children aged 1-59 months admitted in the general paediatric wards at MNH.
2. To describe causes of death among children aged 1-59 months admitted in the general paediatric wards at MNH.
3. To determine the association between patient characteristics (social demographic and clinical profile) and death among children aged 1-59 months admitted in the general paediatric wards at MNH.

2.0 LITERATURE REVIEW

2.1 Mortality burden

Globally under-five mortality rate declined from 91 to 43 deaths per 1000 live birth from 1990-2015. This is equivalent to a decrease of 53% and annual reduction rates increased from 1.8% (1990-2000) to 3.9% (2000-2015). Worldwide, Sub Saharan Africa is the leading region with high mortality where an estimated 1 in 12 children dies before their fifth birthday (3). Despite the high estimates, SSA has also seen a decline in mortality rate from 180 to 83 deaths per 1000 live birth from 1990-2015. The second region with high mortality rate is Southern Asia where trend shows a decline from 126 to 51 deaths per 1000 live birth in 1990-2015, which means 1 in 19 children died before 5 years. Overall, in low-income countries mortality rate declined from 100-47 deaths per 1000 live births while high-income countries observed a decline from 15 to 6 deaths per 1000 live births (3,4)

In Africa, mortality rates vary from different regions, for example, by 2015 under-five mortality rate was still high in the west and central Africa like Chad, Mali, Burkina Faso, Central African Republic and Nigeria where deaths were higher than 170 per 1000 live births. At the same time under-five mortality rates were reported to be low in North Africa countries Libya (13 per 1000 live births), Tunisia (14 per 1000 live birth) Algeria and Egypt 24 per 1000 live births each) (3), other sub Saharan country was Botswana (15.6 per 1000 live births) (3). But the WHO African region under-five mortality rate is still high at 76.5 per 1000 live births. This is 8 times higher to that of WHO European region of 9.6 per 1000 live births in 2016 (3)

Variation in under-five mortality rate is also evident within countries depending on the geographic area of the study and whether it is hospital-based or community-based. For example, hospital-based studies from Nigeria report the mortality rate of 11.2% (11), while others reported a mortality rate of 3.7% - 5.8% from the emergency unit (12,13). A child hospital at Accra Ghana reported a mortality rate of 6.8% in 2013 (14), whereas in 2014 Mulago hospital study in Uganda among patient admitted at acute care unit reported a mortality rate of 4.7% (15)

TDHS 2015, reported a population-based mortality rate of under-five of 67 per 1000 live births (2) while a study done at referral hospital Kilimanjaro Christian Medical Centre reported death rate among admitted children of 7.3% (16)

The differences can be validly explained by the differences in the study population, individuals who seek health services are different from those who do so in terms of urban/rural residence, access to health services, cultural factors as well as education and income factors. But, to get a true picture of the actual mortality rate from these countries, both hospital-based and community-based estimates need to be assessed in tandem.

2.2 Causes of deaths

WHO reports that the main causes of under-five deaths globally are pneumonia, diarrhoea, congenital anomalies and non-communicable disease, injuries and malaria (3) in the figure below

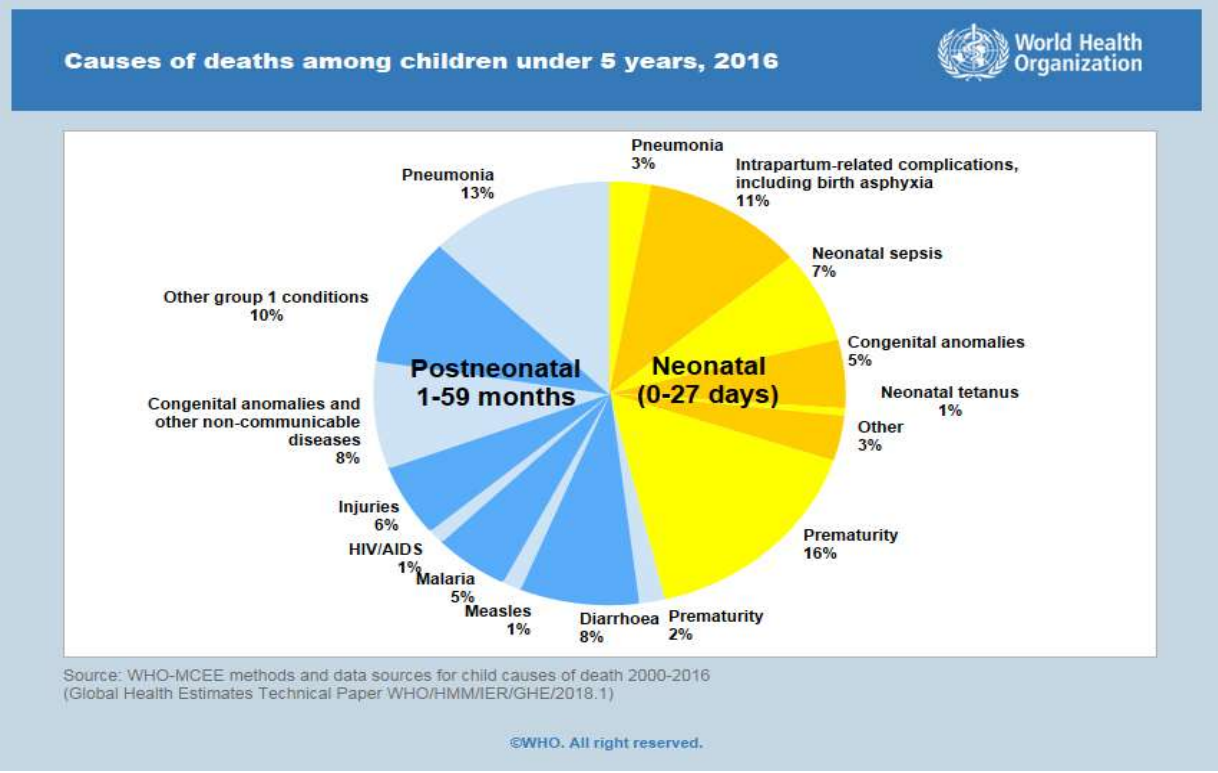

Figure 2: Global causes of deaths among under-five years, in 2016

There is a difference in the distribution on the causes of death by region. Causes of under-five mortality for high-income countries have changed for the past three decades from communicable to non-communicable diseases (7,8). In low-income countries, infectious diseases and malnutrition are still the main cause of deaths and illness, although declines in their contributions have been observed in the last two decades (7). This was reported to be a result of more effective treatments, vaccination and improving the care of critical patients to the poor population (17). The Global Burden of Diseases (GBD) reports showed that diseases such as diarrhoea due to rotavirus and measles continue to kill more than 1 million children under the age of 5 every year, despite effective vaccines against those diseases being available (8).

A systematic review of child mortality in China conducted from 1996 to 2015 showed the leading causes of under-five deaths were injuries, congenital anomalies, and pneumonia (15). Similarly, other systematic reviews done globally from 2000 to 2015 have reported similar findings on the shift of cause of death, but variation across the regions and countries have remained. For example, pneumonia is the most common cause of death in Sub Sahara Africa while congenital anomalies are high in high-income countries (5). Some studies have reported similar trends, such as the study from Italy in children up to 14 years, they found that most patients who died had underlying diseases like malignancies, heart and liver diseases and the main causes of deaths were sepsis, pneumonia, congestive heart failure and hepatic encephalopathy (18).

In sub-Saharan Africa, the leading cause of early deaths is communicable diseases such as HIV/AIDS, malaria, lower respiratory tract infection or diarrhoea diseases (19) whereby infectious diseases contribute to 70% of the child mortality burden in low-income countries (20,21). Other studies done in different countries in Africa showed the same trend whereby the most common cause of death among under-five was infectious in origin i.e. pneumonia, septicaemia and malaria reported among the leading cause of death (11,13,15,22–24), gastroenteritis (12,13,23–25), malnutrition (23) and HIV (25)

Tanzania's countdown analysis 2015 of two decades reported that pneumonia, malaria, and diarrhoea together account for 55% of under-five deaths, the rate of stunting was about 45% (26).

2.3 Socio-demographic characteristics associated with mortality

The socio-demographic determinant of mortality operates through a common set of biological mechanisms. Biological factors, environmental (housing, water source, sanitation), nutritional and health care seeking behaviours both contribute to the well-being of the child. Child factors associated with mortality include the age of five years with high frequency during the neonatal period, followed by infant period and later declined slowly (13,15,17,18). Some of the studies showed males were at higher risk of dying than female children (2,27).

Other child factors predictors of mortality included low birth weight (2,28,29), no breastfeeding (2,29,30) and low immunization coverage (2,21,31). Maternal factors were the birth interval of less than 24 months (2,28,29,32), large families size with children more than five (27), maternal education; more deaths observed in illiteracy people (27,31). With regard to wealth quintile; low wealth quintile had high mortality in some areas (27,29) in contrary to Tanzania wealth index did not have an effect on under-five mortality (2). With regard to maternal age, mortality rate observed to be high among young and old mothers <20 and >40 years respectively (2) and maternal age at first pregnancy less than 15 years (27,29). Delayed health-seeking behaviours were associated with high mortality (21,29).

Housing with the inadequate material e.g. floor made of mud or sand had high mortality rate compare to housing with good material, sanitation and media exposure (24,32,33). With regard to the living settings more deaths are reported to be high in a rural area (27,34) in contrary to TDHS 2015-16 reported high infant mortality in urban compared to the rural area (2).

2.4 Clinical characteristics associated with mortality

Clinical features these are indicators of the disease process which resulted from physiological or biochemical derangements. Paediatric Risk of Mortality (PRISM III) score used physiological variables as a predictor of mortality; variables are recorded at the maximum or minimum value in the first 12 and 24 hours of admissions. Variables include systolic blood pressure, maximum heart rate, maximum or minimum of temperature, CO_2, PH, white blood cell count, platelets, glucose, maximum PT and PTT. Using these scores can over or under predict the outcome. (35). Most low resource income countries use IMCI sign and symptoms to assess very sick child: Gathara *et al* reported clinical features used in the assessment of severely ill patient were associated with mortality (36). A study by Berkley *et al* in one of Kenya district hospital used the score of seven indicators; neurological status, respiratory distress, nutritional status (wasting or kwashiorkor), severe anaemia, jaundice, axillary temperature and length of history to predict immediate, early and late deaths (37). Other clinical features reported in predicting death were lethargy, febrile convulsion, respiratory distress, altered sensorium, severe wasting, inability to feed or breastfeed (16,38,39)

3.0 METHODOLOGY

3.1 Study design

A prospective cohort study was designed to analyse deaths occurring to children admitted in the general paediatric wards at MNH. This study design was selected to determine predictors of mortality.

3.2 Study setting

A study was conducted at Muhimbili National Hospital (MNH) paediatric department, a teaching hospital for Muhimbili University of Health and Allied Sciences (MUHAS). It is the largest hospital in the country situated in Dar es Salaam region. It receives referrals from different hospitals around Dar es Salaam mainly from regional referral hospitals namely Amana, Temeke and Mwananyamala hospital as well as other private health facilities in the city. It also receives the referral from different regions due to lack of advanced diagnostics tools and expertise. The department has different specialized units namely neurology, nephrology, haematology, endocrinology, Acute Paediatric Care Unit (APCU), oncology, gastroenterology, infectious unit and malnutrition ward. It admits children from 0 days to 14 years. On a regular day, the different units within the department can admit 3 to 15 children per day depending on the time of the year. Each unit has interns, residents, registrar and specialists; both have responsibility to take care of the children.

3.3 Study population

Children aged 1-59 months admitted in general paediatric wards at MNH were eligible for this study.

3.4 Inclusion criteria

Children aged 1- 59 months admitted in general paediatric wards were included in the study.

3.5 Exclusion criteria

All children who were admitted with surgical/trauma condition, died within thirty minutes of admission and had no any information taken especially socio demographic and **household** characteristics were excluded from the study. Children whose parents/guardians refused consent were also excluded.

3.6 Sample size

Sample size was calculated from OpenEpi using Fleiss Methods for Rates and proportions (40). The death rate due to respiratory tract infection was 2% from the study done by Ezeonwu *et al* at Asaba (13) was used for estimating sample size.

Whereby:

Two-sided confidence level (1-alpha): 95

Power (% chance of detecting): 80

The ratio of sample size, unexposed/exposed: 4

Percentage of exposed with an outcome (patient who died with respiratory tract infection) 2%

Percentage of unexposed with an outcome (patient who died with no respiratory tract infection) 7%

Odds ratio: 0.27

- Sample size - exposed: 185
- Sample size - unexposed: 737
- Total sample size: 922

❖ The minimum sample size is 922

After adjusting for a 5% non-response a final sample size of 975 was reached.

3.7 Sampling procedure

We enrolled all participants meeting inclusion criteria consecutively until sample size was reached. Information about the study was provided to parents/guardians and informed written consent was sought prior to recruitment.

3.8 Data collection

3.8.1 Data collection tool

A standard questionnaire was used to collect information (Appendix 1). The tool was developed after reviewing the different literature on causes of mortality in different countries. Also, WHO report on the global burden of disease and their causes among children was used(4). Baseline socio-demographic characteristics were adopted from TDHS(2). One paediatrician and one epidemiologist for accuracy and capture of important information reviewed the final tool. Questionnaire was pre-tested and refined it before actual data collection started. The questionnaire had four sections: social demographic characteristics, clinical presentation, laboratory investigation and causes of deaths.

Study variable

Dependent variables (outcome): Death or survival was the primary outcome measured as a binary variable where death = 1, discharge = 0.

Cause of death was defined as the primary underlying illness; for a patient with multiple diagnoses both underlying cause of death, the immediate cause of death and co-morbid conditions were recorded. The immediate cause of death was reported as the immediate cause of death as recorded in the patient file after a mortality audit, which is done by more than one clinician in the respective unit. Causes of death were discussed in a review clinical presentation, and any supportive laboratory findings if any as well as circumstance around that death is taken into consideration when reporting the cause of death. Finally, causes of death were documented in the file after a consensus is reached. Mortality audits were done weekly or once in two weeks depending on the unit. Comorbid conditions are those related to the

cause of death or complication of underlying disease for example malnutrition in a patient with cerebral palsy or congenital heart disease, anaemia, diarrhoea.

Independent variable

Social demographics: Age was recorded in terms of months as a continuous variable. Sex and primary caregiver were recorded as a nominal variable. The primary caregiver, occupation, level of education and wealth quintiles were recorded as an ordinal variable. Health insurance and vaccination status were recorded as a dichotomous categorical variable.

The wealth index was generated using 11 items on asset ownership, having a bank account, housing material used to construct roof, wall and floor, the main source of drinking water and cooking fuel. All the items converted into dichotomous variable 1= wealth and 0=poor. (eg housing material floor; made of mud or sand=0, cement/tile/polished wood=1). Principal component analysis was done to reduce the data. The first factor was then extracted and used to construct a household wealth index that was summarized as quintiles – highest, rich, middle, poor and lowest quintile.

Clinical features: cough, fever, convulsion, vomiting, diarrhoea, inability to feed, reduced urine output, lethargy, unconscious and respiratory distress was recorded as a dichotomous variable.

Biochemical markers relevant to the diagnosis were recorded include white blood cell count, haemoglobin level, platelet counts, C - reactive protein, electrolyte, serum creatinine recorded as a continuous variable and blood culture as a nominal variable

Nutrition status: assessment was done on admission; weight was measured using weighing scale (Seca beam balance) calibrated before measurement and weight recorded to nearest 10gm. The length was taken for children who were not able to stand using length board while the child was lying supine on a flat surface with the head touching the top board and the soles of the feet touching the footboard. Children who were able to stand had their height measured using a height board while the child was standing and the head touching the top board. Weight for height was calculated and interpreted using WHO standard growth chart Z scores where

moderate wasting was defined as weight for height between (-2SD to -3SD) and severe wasting (< -3SD).

HIV status was extracted from the patient file. Every child's HIV status was checked on admission as per local paediatric protocol**.** HIV exposure was defined as children below 18 months born with HIV positive mother but had a DNA PCR negative test at 6 weeks of life and the child was still breastfeeding. HIV infection was defined as children confirmed HIV positive by DNA PCR if they were below 18 months. Children above 18 months HIV infection was diagnosed using two rapid tests; Bioline then confirmed by Unigold test, manufacture of these tests are Standard Diagnostic, Inc., 65, Borahagal-ro, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea.

Respiratory distress: These are children presented with lower chest wall in drawing, nasal flaring or grunting

Anaemia: This study categorise anaemia into very severe anaemia - Hb < 5g/dl, severe anaemia - Hb 5.0-6.9g/dl, moderate anaemia Hb 7.0-9.0g/dl, mild anaemia- Hb 9.1-11.0g/dl and normal is >11.0g/dl.

Fever was defined as the temperature above 37.5^{o}C.

Admission diagnosis: This was a confirmed diagnosis after being reviewed by team of the unit either resident or specialist or both with laboratory and radiological confirmation as per protocol. Provisional diagnosis was used if a child died before the diagnosis was confirmed.

3.8.2 Data collection process

Principle investigator and two research assistants collected data for this study, research assistants were intern doctors who had been trained on the tool and criteria for recruitment into the study. Participants were recruited within 24 hours of admission. Information was collected from parents/caregivers and from participants' case notes. Participants were followed up every two days until discharge or death, confirmed diagnoses and laboratory findings were recorded on follow up.

3.9 Data Management and analysis

Questionnaires were checked for consistency on daily basis by PI and were entered into the computer system using Statistical Package for Social Sciences version 16 (SPSS Inc., Chicago, IL, USA). Data was cleaned before the analysis and all analysis were done using SPSS.

Mortality rate was calculated as the cumulative proportion of total numbers of deaths divided by the total number of admissions during the study period. Kaplan-Meier curves are presented showing the overall mortality rate and by select characteristics. Mean ± SD and median (IQR) were calculated for continuous normally distributed and skewed variables, respectively. The wealth index was constructed after component factor analysis (data reduction procedure).

Bivariate analysis was done to determine the association between patient characteristics and mortality. Statistical significance was assessed using chi-square tests and Fisher's exact test for categorical variables. Differences between continuous (normally distributed) variables were analysed using independent sample t-test. Variable was considered statistically significant if the p-value was < 0.05. Factors associated with mortality in bivariate analysis with a p value <0.1 were entered in the multivariable logistic regression model to identify and quantify predictors of deaths while controlling for potential confounder. Crude and adjusted odds ratio with 95% confidence intervals were calculated and factors with P-value <0.05 were considered significant after analysis.

3.10 Ethical consideration

Ethical clearance was obtained from MUHAS Institution Review Board and permission to conduct the study at the paediatric department was obtained from Muhimbili National Hospital administration. Informed consent was obtained from parent or caregiver of the patient. The participants had identification during the study in order to make the follow-up but during analysis participants were de-identified.

4.0 RESULTS

A total of 975 children aged 1-59 months were admitted during the study period. Out of that 925(94.9%) children participated in the study. A total of 50 (5.1%) children were exclude in the study as shown in the flow diagram (**Figure 3**)

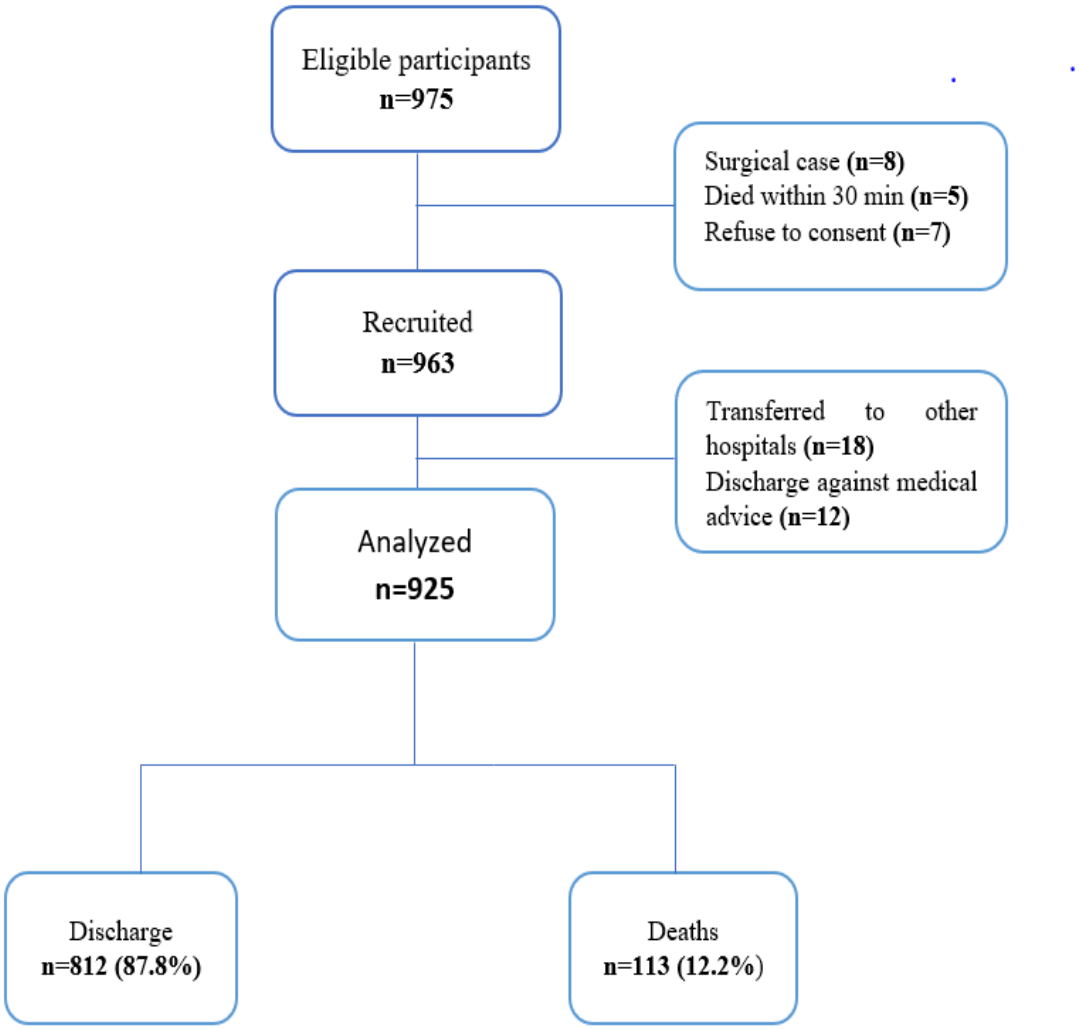

Figure 3: Flow chart showing enrollment of study participants

4.1 Baseline characteristics of study participants

The median age of participants (Inter-Quartile Range) was 13 (06, 26) months. In Table 1, nearly half of all participants 46.8% (433) were infants. Male children accounted for 59.2% (548) of the study population. Fathers were the main source of income in most of the families 72.9% (674) and a little over a third 39.6% (366) of the caregivers had primary education followed by a quarter with secondary 25.3% (234) and higher level of education 26.9% (249) while only 8.2% (76) had no formal education. One out of three of the caregivers was the petty traders 36.6% (339) or employed 31.8% (294). Only a quarter of the children 27.1%; (251) had health insurance. Half of the admissions were referred from district hospitals 50.9% (471), and one third from home 35.6% (329).

Table 1: Baseline and socio-demographic characteristics of study participants

Variables	Categories	n (%)
Age of the children (months)	Median (IQR)	13 (06,26)
	1-11	433 (46.8)
	12-23	233 (25.2)
	24-59	259 (28.0)
Sex of participant		
	Male	548 (59.2)
	Female	377 (40.8)
Primary Caregiver		
	Father	674 (72.9)
	Mother	173 (18.7)
	Others	78 (8.4)
Maternal age (years)		
	<20	57 (6.2)
	20-34	668 (72.6)
	≥35	195 (21.2)
Education level		
	No formal education	76 (8.2)
	Primary	366 (39.6)
	Secondary	234 (25.3)
	Higher level	249 (26.9)
Occupation of caregiver		
	Employed	294 (31.8)
	Peasant	109 (11.8)
	Petty trader	339 (36.6)
	Unemployed	183 (19.8)
Health insurance		
	Insured	251 (27.1)
	Not insured	674 (72.9)
Origin of referral		
	Home	329 (35.6)
	District facility	471 (50.9)
	Private facility	81 (8.8)
	Other health facilities	44 (4.8)
Wealth index (quintiles)		
	Lowest (poor)	184 (19.9)
	Second	186 (20.1)
	Middle	184 (19.9)
	Fourth	207 (22.4)
	Highest (rich)	164 (17.7)

4.2 Mortality rate

Overall mortality rate was 12.2% (113). Most deaths occurred during the night shift 66.4% (75). In all ages, mortality was high in the first 25 days of admissions. More deaths were observed in children below 2 years of age compared to children aged above 2 years (p-value=0.059). The rate of death was high among females compared to males, but the difference observed was not statistically significant (p-value=0.2). Mortality rate was high among children admitted from district hospital and home, though it was noted admission from district hospital mortality rate was high for the first 10 days of admission compared to other sources of admission. (p=0.003)

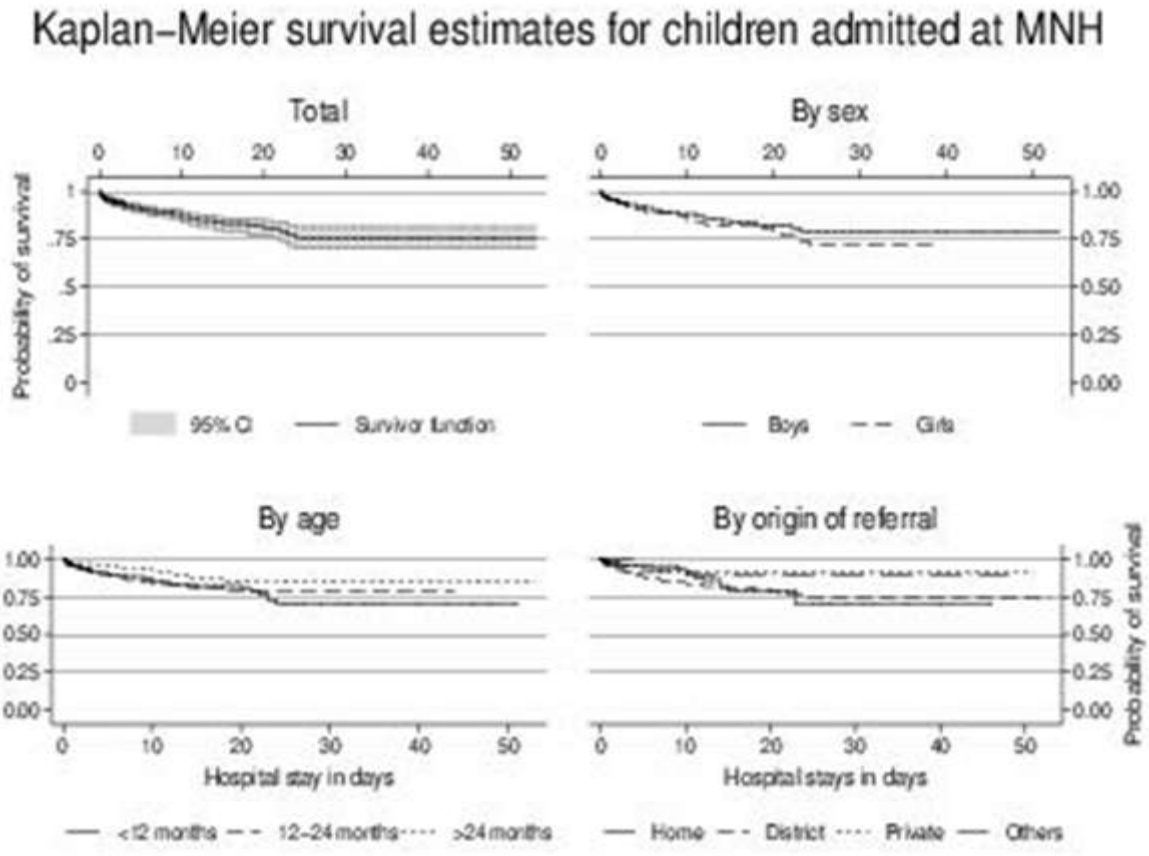

Figure 4: Kaplan-Meier survival curves of study participants

4.3 Causes of death among study participants

Children admitted had the following diagnosis as the cause of admission: Pneumonia 28% (260), septicemia 25% (228), malnutrition 23% (211), and gastroenteritis 17% (152). Other diagnoses are as shown in figure 4.

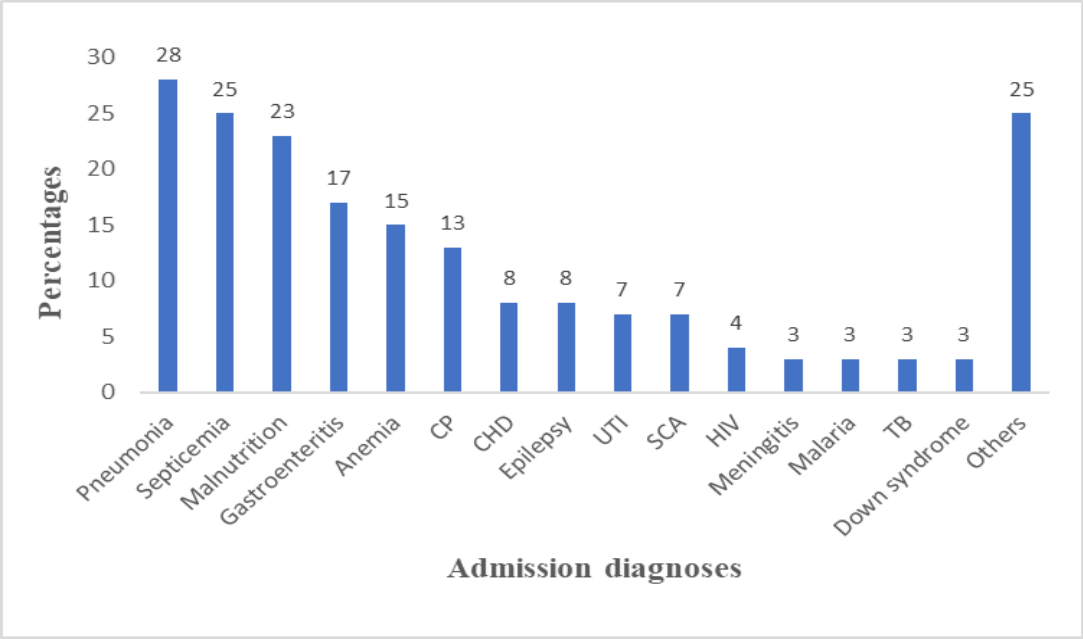

Figure 5: Admission diagnoses among study participants

CHD: Congenital heart disease, SCA: Sickle cell disease, UTI: Urinary tract infection, HIV: Human Immunodeficiency Virus, TB: Tuberculosis, CP: Cerebral palsy

4.3.1 Immediate causes of death

The main immediate causes of death in the study population were septicemia (26%), pneumonia (12%), heart failure (10%), multi-organ failure (8%) and hypoglycemia (6%). Other causes are as shown in Figure 5

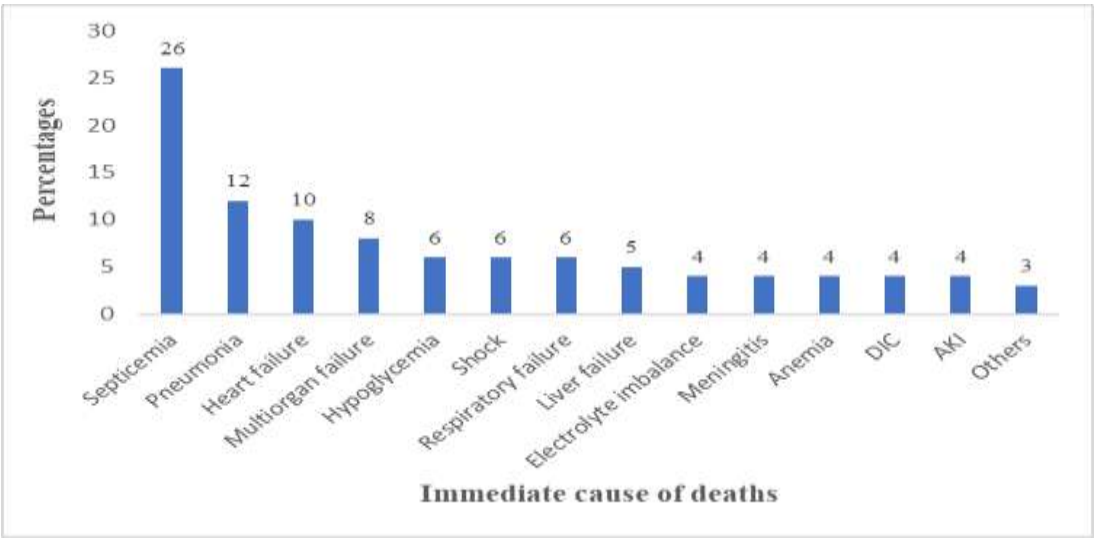

Figure 6: Immediate causes of death among study participants

DIC: Disseminated intravascular coagulopathy, AKI: Acute kidney injury

4.3.2 Underlying causes of death

The top five underlying causes of death were septicemia (27%), malnutrition (12%), congenital heart disease (12%), pneumonia (11%), and HIV (9%) as shown in Figure 6

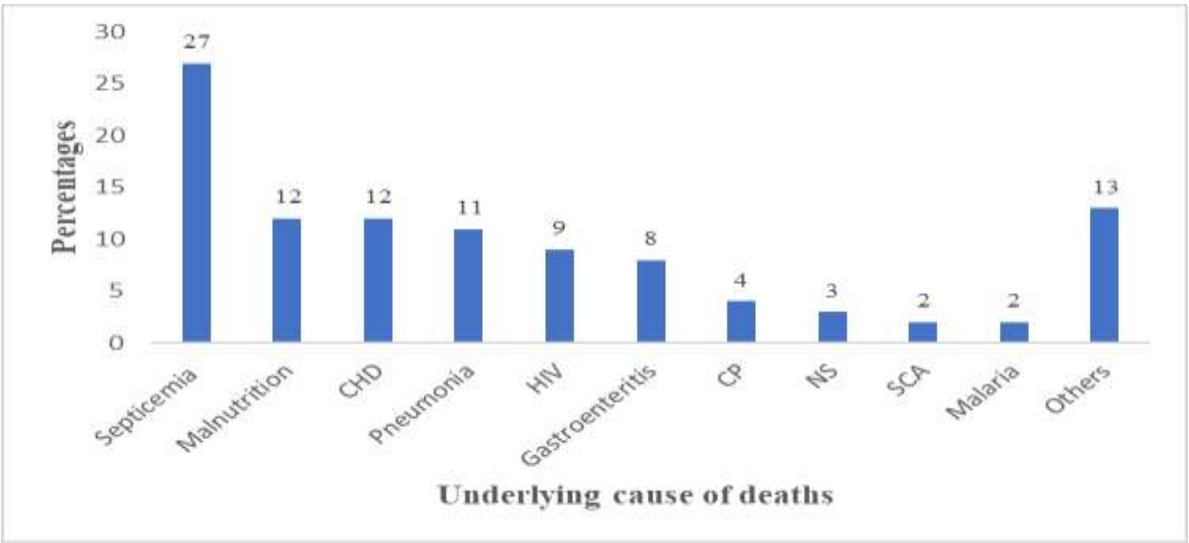

Figure 7: Underlying causes of death among study participants.

CHD: Congenital heart disease, CP: Cerebral palsy, SCA: Sickle cell anaemia, NS: Nephrotic syndrome

4.3.3 Co-morbidity conditions among study participants who died

Among the children who died 75.2% (85/113) had multiple diagnoses i.e. more than one diagnosis. Common co-morbid conditions were malnutrition (39%; 33/85), anemia (38%; 32/85), septicemia (24%; 20/85) and gastroenteritis (22%; 19/85). Other diagnoses are presented in Figure 7 below.

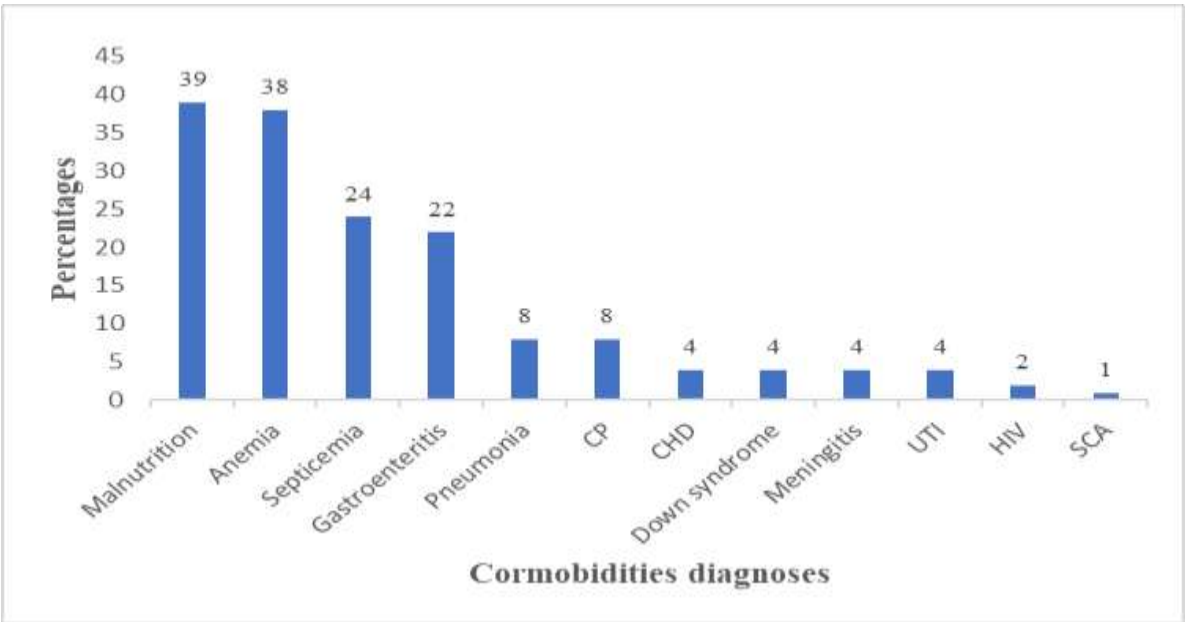

Figure 8: Co-morbidity conditions among study participants who died with multiple diagnoses.

CHD: Congenital heart disease, SCA: Sickle cell disease, UTI: Urinary tract infection, HIV: Human Immunodeficiency Virus, CP: Cerebral palsy.

4.4 Factors associated with under-five mortality

4.4.1 Socio-demographic characteristics in relation to mortality

Table 2 shows bivariate analysis of select socio-demographic characteristics in relation to the occurrence of death. More deaths occurred among children aged below 2 years compared to children older than 2 years (13.9% vs. 8.7%; P = 0.059). More girls died (13.8%) than boys (11.1%) though the difference was not statistically significant (P = 0.22). Having the main

caregiver as a father (12.8%), mother (12.7%) or another family member (6.4%) did not have an influence on mortality. The patient whose caregiver had no formal education had higher mortality compared to those with primary, secondary and higher level of education (21.1% vs. 14.8% vs. 9.8% vs. 8.0%; $p = 0.005$). There was a trend in decline of mortality as the level of education increased ($p<0.001$). We observed that patient with no health insurance had significantly higher mortality compared to those with health insurance (14.4% vs. 6.4% $p = 0.001$). More deaths were observed in children whose caregivers were petty traders (17.7%) compared to the peasant (11%), unemployed (9.4%) and employed (8.4%) caregivers and the difference was statistically significant ($p = 0.001$). Children from households in the lowest, second and middle wealth quintiles had more deaths compared to the highest wealth quintiles (15.8%, 18.8%, 13.0%, respectively vs. 3.7%; $p<0.001$). Deaths decreased with increase in household wealth (p for trend <0.001)

Table 2: Socio-demographic characteristics associated with mortality among study participants

Variables	Death n (%)	Survival n (%)	P-value
Age (months)			
01-11	60 (13.9)	373 (86.1)	
12-23	32 (13.7)	201 (86.3)	
24-59	21 (8.7)	238 (91.9)	**0.059**
Sex			
Male	61 (11.1)	487 (88.9)	
Female	52 (13.8)	325 (86.2)	0.22
Caregiver			
Father	86 (12.8)	588 (87.2)	
Mother	22 (12.7)	151 (87.3)	
Others	5 (6.4)	73 (93.6)	0.27
Maternal age			
<20	7 (12.3)	50 (87.7)	
20-34	90 (13.5)	578 (86.5)	
≥35	16 (8.2)	179 (91.8)	0.143
Education level			
No formal education	16 (21.1)	60 (78.9)	
Primary	54 (14.8)	312 (85.2)	
Secondary	23 (9.8)	211 (90.2)	
College/ University	20 (8.0)	299 (92.0)	**0.005**
Occupation of caregiver			
Employed	24 (8.4)	270 (91.8)	
Peasant	12 (11.0)	97 (89.0)	
Petty trader	60 (17.7)	279 (82.3)	
Unemployed	17 (9.3)	166 (90.7)	**0.001**
Health insurance			
Insured	16 (6.4)	235 (93.6)	
No insurance	97 (14.4)	577 (85.6)	**0.001**
Wealth quintiles			
Lowest (poorest)	29 (15.8)	155 (84.2)	
Second	35 (18.8)	151 (81.2)	
Middle	24 (13.0)	160 (87.0)	
Fourth	19 (9.2)	188 (90.8)	
Highest (Richest)	6 (3.7)	158 (96.3)	**<0.001**

4.4.2 Clinical characteristics associated with mortality

Table 3 shows the distribution of mortality by clinical characteristics of the study population. Children referred from district hospitals had significantly higher mortality (16.1%) compared to admissions from home (8.2%), private hospital (7.4%) and from other health facilities (9.1%) (p = 003). More deaths occurred on weekends compared to weekdays (19.4% vs. 10.4%; p=0.001) and the risk of death was highest within 24 hours of hospital stay (38.7%) compared to those who stayed more than 72 hours (7.7%; p<0.001). Other clinical features associated with mortality in the bivariate analysis were convulsions (p=0.015), unconsciousness (p<0.001), lethargy (p<0.001), diarrhoea (p=0.001), inability to feed or breastfeed (p=0.001), respiratory distress (p=<0.001) and HIV infection or exposure (p=0.001). Children with severe wasting had higher mortality compared to those with moderate wasting and mild or normal nutritional status (24.4% vs. 10.8% vs. 9.0; p= <0.001).

Table 3: Clinical characteristics associated with mortality among study participants

Clinical characteristics	Death	Survival	P-value
	n (%)	n (%)	
Origin of referral			
Home	27 (8.2)	302 (91.8)	
District hospital	76 (16.1)	395 (83.9)	
Private hospital	6 (7.4)	75 (92.6)	
Other health facilities	4 (9.1)	40 (90.9)	**0.003***
Day of death occurrence			
Weekdays	76 (10.4)	658 (88.6)	
Weekends	37 (19.4)	154 (80.6)	**0.001**
Duration of hospital stay (hours)			
<24	36 (38.7)	57 (61.3)	
24-72	24 (16.8)	119 (83.2)	
>72	53 (7.7)	636 (92.3)	**<0.001**
Clinical features			
Convulsion			
Yes	33 (17.4)	157 (82.6)	
No	80 (10.9)	655 (89.1)	**0.015**

Unconscious			
Yes	18 (64.3)	10 (35.7)	
No	95 (9.5)	651 (90.3)	**<0.001**
Lethargy			
Yes	26 (38.8)	41 (61.2)	
No	87 (10.7)	771 (89.9)	**<0.001**
Cough			
Yes	29 (9.7)	270 (90.3)	
No	84 (13.4)	542 (86.6)	0.1
Diarrhoea			
Yes	33 (22.8)	112 (17.2)	
No	80 (10.3)	70 (89.7)	**<0.001**
Vomiting			
Yes	19 (12.8)	129 (87.2)	
No	94 (12.1)	683 (87.9)	0.8
Inability to feed			
Yes	9 (33.3)	18 (66.7)	
No	104 (11.6)	794 (88.4)	**0.001**
Respiratory distress			
Yes	35 (26.9)	95 (73.1)	
No	78 (9.8)	717 (90.2)	**<0.001**
Fever (temperature)			
$<37.5^0$C	55 (10.5)	468 (89.5)	
$>37.5^0$C	58 (14.4)	344 (85.6)	0.072
Nutritional status (weight/height)			
Normal	52 (9.0)	525 (91.0)	
Moderate wasting	19 (10.8)	157 (89.6)	
Severe wasting	42 (24.4)	130 (75.6)	**<0.001**

**Fisher exact test*

4.4.3 Biochemical markers associated with mortality

Some of the patients had laboratory investigation as requested by the attending clinician. Mortality increased with a decrease in hemoglobin level. Children with very severe anaemia (18.2%), severe anaemia (16.2%) and moderate anaemia (15.8%) had higher mortality compared to children with mild or no anaemia (8.5%) (p=0.007). More deaths were observed in children with leucopenia (20.0%) and leukocytosis (14.9%) compared to those with normal white cell count (7.9%) (p=0.002). Deaths increased in children with high serum creatinine compare to those with normal values (45.2% vs. 12.5%; p<0.001). Also, more deaths were observed in children with hypernatremia (38.8%) and severe hyponatremia (33.3%) compared to children with normal serum sodium and the difference was statistically significant

(p<0.001). Almost half of the children admitted with severe hypokalemia died (52.1%) compared to those admitted with normal potassium levels (12.7%; p <0.001). Other biomarkers were not significantly associated with mortality as shown in Table 4.

Table 4: Biochemical markers associated with mortality among study participants.

Biochemical markers	**Died n (%)**	**Survival n (%)**	**P value**
Hb (g/dl)			
<5.0	8 (18.2)	36 (81.8)	
5.0-6.9	18 (16.2)	86 (82.7)	
7.0-9.0	41 (16.3)	210 (83.7)	
9.1-11.0	31 (9.9)	282 (90.1)	
>11.0	8 (5.9)	127 (94.1)	**0.007**
WBC ($x10^3$/l)			
<4	7 (20.0)	28 (80.0)	
4-11	30 (7.8)	355 (92.2)	
>11	67 (14.9)	383 (85.1)	**0.002**
Platelets ($x10^3$/l)			
<150	35 (16.7)	175 (83.3)	
150-450	52 (10.7)	435 (89.3)	
>450	17 (9.8)	156 (90.2)	0.052
Serum creatinine (mmol/l)			
<88	50 (12.5)	351 (87.5)	
>88	14 (45.2)	17 (54.8)	**<0.001**
CRP (ng/l)			
<10	26 (8.20	290 (91.8)	
>10	38 (13.0)	254 (87.0)	0.055
Serum sodium (mmol/l)			
<125	14 (33.3)	28 (66.7)	
125-135	39 (16.2)	201 (83.8)	
136-145	28 (10.3)	245 (89.7)	
>145	5 (38.8)	8 (61.5)	**<0.001**
Serum Potassium (mmol/l)			
<2.5	25 (52.1)	23 (47.9)	
2.5-3.5	11 (9.6)	104 (90.4)	
3.5-5.0	41 (12.7)	282 (87.3)	
>5.0	7 (9.2)	69 (90.8)	**<0.001**
Blood culture			
Gram positive cocci	6 (9.7)	56 (90.3)	
Gram negative bacilli	2 (14.2)	12 (85.7)	
No growth	26 (20.2)	103 (98.8)	0.2*

Hb - Hemoglobin, WBC- White blood cell count, CRP- C-reactive protein

**Fisher's exact test*

4.4.4 Multivariable logistic regression of mortality in relation to socio-demographic and clinical characteristics among study participants

Multivariable logistic regression model of mortality by socio-demographic and clinical characteristics of the study participants to ascertain independent contributing factors of death were built (Table 5). Socio-demographic characteristics that predict mortality were being infants, household wealth, duration of hospital stay, clinical characteristics and nutritional status. Children from households with low income had a 4-5-fold increase in the risk of dying compared to children from households in the highest wealth quintile. Infant had 2-fold risk of dying compared to children above two years. The odds of dying of children who stayed less than 24 hours was 8 times than those who stayed more than 72 hours. Also, odds of dying during the weekend were 2 times compared to the weekdays. Clinical characteristic that significantly predict mortality were unconscious (AOR = 18; 95%CI: 6.70-56.82), inability to feed (AOR = 5.7; 95%CI: 1.97-16.51), lethargy (AOR = 4.9; 95%CI: 2.32-10.40), severe wasting (AOR = 4.5, 95%CI: 2.49-8.10) and respiratory distress (AOR = 2.6; 95%CI: 1.40-4.97)

Table 5: Multivariable logistic regression of mortality in relation to socio-demographic and clinical characteristics among study participants

Variables	Crude OR (95%CI)	Adjusted OR (95%CI)	P-value
Sex			
Male	1.0	1.0	
Female	1.28 (0.86-1.90)	1.10 (0.67-1.82)	0.698
Age (months)			
1-11	1.8 (1.08-3.08)	2.1 (1.03-4.19)	**0.042**
12-23	1.8 (1.01-3.23)	1.9 (0.91-4.07)	0.089
24-59	1.0	1.0	
Level of education of caregiver			
No formal education	3.05 (1.50-6.25)	1.27 (0.38-4.22)	0.695
Primary	1.98 (1.15-3.40)	0.84 (0.33-2.10)	0.704
Secondary	1.25 (0.67-2.34)	0.66 (0.28-1.55)	0.338
Higher level	1.0	1.0	

Occupation of caregiver			
Employed	1.0	1.0	
Peasant	1.39 (0.67-2.89)	0.53 (0.17-1.60)	0.258
Petty trader	2.42 (1.46-3.99)	1.26 (0.59-2.68)	0.550
Unemployed	1.15 (0.60-2.21)	0.69 (0.27-1.74)	0.430
Health insurance			
Yes	1.0	1.0	
No	2.47 (1.42-4.29)	1.40 (0.65-2.98)	0.389
Wealth quintiles			
Lowest (poorest)	4.9 (1.99-12.20)	4.0 (1.19-13.51)	**0.025**
Second	6.1 (2.50-14-93)	5.2 (1.65-16.69)	**0.005**
Middle	4.0 (1.57-9.92)	3.6 (1.14-11.33)	**0.029**
Fourth	2.7 (1.04-6.83)	2.4 (0.82-7.16)	0.111
Highest (richest)	1.0	1.0	
Origin of referral			
Home	1.0	1.0	
District hospitals	2.15 (1.35-3.42)	1.3 (0.69-2.25)	0.424
Private	0.89 (0.36-2.25)	1.3 (0.42-3.81)	0.680
Others	1.19 (0.37-3.36)	1.4 (0.40-5.07)	0.580
Day of death occurrence			
Weekdays	1.0	1.0	
Weekends	2.1 (1.35-3.20)	1.9 (1.07-3.30)	**0.028**
Hospital stay (hours)			
<24	7.6 (4.58-12.52)	7.9 (4.05-15.25)	**<0.001**
24-72	4.1 (2.06-8.06)	3.7 (1.95-7.18)	**<0.001**
>72	1.0	1.0	
Clinical features, (%Yes)			
Inability to feed	3.8 (1.67-8.70)	5.7 (1.97-16.51)	**0.001**
Respiratory distress	3.4 (2.15-5.23)	2.6 (1.40-4.97)	**0.003**
Convulsion	1.72 (1.11-2.67)	0.9 (0.44-1.79)	0.728
Lethargy	5.6 (3.20-9.64)	4.9 (2.32-10.40)	**<0.001**
Diarrhea	2.6 (1.64-4.05)	1.7 (0.89-3.07)	0.108
Unconscious	15.2 (6.8-33.9)	18 (6.70-56.82)	**<0.001**
Fever	1.43 (0.90-2.10)	1.4 (0.80-2.27)	0.258
Cough	0.7 (0.44-1.08)	0.6 (0.35-1.15)	0.135
Nutritional status			
Normal	1.0	1.0	
Moderate wasting	1.22 (0.70-2.12)	1.6 (0.78-3.14)	0.210
Severe wasting	3.26 (2.08-5.11)	4.5 (2.49-8.10)	**<0.001**

* *Odds Ratio (95% Confidence Interval)*

5.0 DISCUSSION

The aim of this study was to estimate mortality rate and determine predictors of mortality in children aged 1-59 months admitted in the general pediatric wards at MNH. We observed an overall mortality rate of 12.2%. Significant predictors of mortality were household wealth, duration of hospital stay, clinical characteristics inability to feed, respiratory distress, lethargy, being unconscious and severe wasting.

5.1 Mortality burden

This under-five mortality rate observed in this study was high compared to global estimates of 4.3%. In comparison to high-income countries of 0.5-1.5%(3) our observed mortality rate was high. However, the mortality rate in this study is comparable to what was observed in Nigeria among children aged 1 month to 12 years, where they report a mortality rate of 11.2% (11). Lower mortality rates have been reported in studies conducted in several sub Saharan Africa countries such as Gathara *et al* reported a crude mortality rate of 6.2% (range 2.1% to 11%) among children aged 2 to 59 months admitted to different hospitals in Kenya (36) and Romer *et al* reported a mortality of 4.7% among children under-five years admitted in acute care unit in Uganda (15). Other studies from this region report a mortality rate between 2.7% to 3.7% in newborns to children 17 years of age. (12,14,24) The observed high mortality rate could be attributed to a number of challenges facing resource-limited setting including differences in availability of resources, limited access to health services, high patient-to-doctor ratio, poor equipment and infrastructure, poor quality of care, which have been documented in low-income countries(41). Poor health literacy and cultural beliefs leading to delayed health-seeking behaviour may also explain the high mortality observed. Also, the differences in mortality rates could be explained by different study design used, in which most have used retrospective studies that rely on routinely collected data that may have resulted in underreporting due to missing or incomplete data. (36)

The mortality rate reported in this study is higher than the average national mortality rate of 6.7% as reported by the Tanzania Demographic and Health Survey of 2015-16 (2). This could be attributed to the fact that MNH is a national referral hospital and receives very sick patients from other hospitals including district and regional hospitals who may present with challenges in their management after receiving multiple treatments at the lower level facilities. Some of the children are admitted with advanced diseases increasing their probability of dying above what is observed in the general population. The retrospective nature of TDHS could also partly explain the difference in mortality with our findings. DHS involves recall of past five-year events where in some cultures, one is not allowed to discuss previous deaths of family members hence leading to underreporting of deaths and hence low mortality rates (2).

It was observed that, the rate of deaths was highest in infants and the rate of death decreased with increase in age, similar to what has been reported elsewhere (12,15,42,43). This could be explained by the immaturity of immune system among younger children and predispose them to the severe forms of infection.

Costa *et al* reported gender difference in mortality where male children died more during infancy and female children died more from 1 to 4 years due to the biological difference (44). We observed a sex difference in death, but the difference was not significant after adjusting for other potential factors that may influence death.

The risk of a child dying in the first 24 hours of admission was 9-folds higher compared to those who stayed more than 72 hours. This signifies that the first 24 hours of admission are very crucial for child survival. Guidelines should thus ensure clinical preparedness and availability of responsive emergency services to support management of children that may contribute to mortality reduction. Our findings are similar to what has been reported in other studies where 96.6% of the deaths occurred in the first 24 hours in children admitted to acute care units in Nigeria (12)

More than two-thirds of deaths in this study occurred during the night shift similar to what was observed in another study (15). A possible explanation for this pattern of timing of death occurrence could be due to a smaller number of staffs working during the night shift as compared to daytime, which may compromise the level of care for patients at night. Tette *et al* reported better engagement of specialists during the day as compared to nighttime (14). This is contrary to what Ijezie *et al* reported where more deaths were observed during the daytime (at 15 hours) that was explained by changes of nurse shift, which compromised patient care (22)

5.2 Causes of deaths

The leading cause of admission in this study was pneumonia (28%), septicemia (25%), malnutrition (23%) and gastroenteritis (17%) Similar to other studies that reported infectious diseases were the leading causes of admission although patterns in actual diseases differ. For example, in Nigeria, although the infectious disease was the main cause of admission, the disease pattern showed malaria as the leading cause of admission followed by diarrhoea and respiratory tract infection (13,24).

The top five causes of death in this study were septicemia (27%), malnutrition (12%), congenital heart disease (12%), pneumonia (11%) and HIV (9%). Septicemia as the leading cause of death attributes for more than a quarter of all deaths. Often children present late with septic shock leading to multi-organ dysfunction and consequently deaths (12). Malnutrition was the second commonest cause of death and a leading co-morbidity. Patients with malnutrition have decreased cell-mediated immunity and humoral immune response (45), hence predispose them to severe forms of infections. Furthermore, infections may predispose them to malnutrition and form a vicious cycle that is difficult to manage (46,47). In addition, patients with malnutrition and sepsis present with atypical feature due to low immunity, therefore a high suspicion of an index is needed to appropriately and timely diagnose sepsis.

Globally the leading causes of deaths in under-fives are infectious diseases, and these conditions contribute to high mortality in low-income countries as opposed to high-income countries in which non-communicable diseases predominate. This difference is mainly

attributed to the level of socio-economic development, hygiene, more effective treatment and improved quality of care among critically ill patients (3,17). In sub-Saharan Africa the distribution on the causes of mortality differ from one region to another, in which some studies report malaria as the leading cause of under-five deaths followed by gastroenteritis and pneumonia (12,13,24) while in another study respiratory tract infection (32.5%) followed by malnutrition (13.7%), HIV (12.5%) and malaria (10.7%) are the leading causes of death (15). In Tanzania, the situation analysis of 2015 reported pneumonia, diarrhoea and malaria contributed to 55% of under-five death, and malnutrition was attributed to 45% of under-five mortality.

5.3 Predictors of death

Several factors have been reported to increase the risk of death in children. We observed a 4- to 5-fold increase in the probability of dying in children from households in lower wealth quintiles compared to those from the highest wealth quintile. This is consistent with what was found in other studies where children from a household with highest wealth quintiles had an almost 70% higher odds of surviving than those from lowest wealth quintile (27). We postulate that low household wealth hinders households to access health care services, provide proper nutrition, hence result into food insecurity, illiteracy, poor hygiene, poor sanitation, poor infrastructure and poor housing material exposes them to recurrent infection and predispose them to high risk of dying. In contrast, the TDHS 2015-16 reports household wealth has no impact on under-five mortality (2).

Level of education of the caregiver had no effect on under-five mortality in the multivariable analysis contrary to what has been reported in other studies where mothers with at least secondary education had lower under-five mortality rate compared to mothers with no formal education. Byaro *et al* reported an increase in one unit of mothers education decreases infant mortality by 2% (31) and Izugbara C reported having at least secondary level of education decreases mortality by 70% compared to those mothers with no formal education (27). Mothers with education have better information on health and nutrition practices which results in better child survival. In our study, household wealth may have been a stronger predictor of

death than the level of education of primary caretaker, although we did not directly ask for the education level of the mother.

Clinical presentation of a patient is an indication of how advanced the disease condition is. It gives a clue to the severity and extent of organ and systems destruction caused by the disease thus guiding the clinician on how aggressive the treatment response should be. Most of the clinical features assessed were associated with mortality when outside the range considered as "normal". For example, being unconscious increased the odds of dying by 18-fold compared to a child who was alert. Presentation of these high-risk factors may suggest a problem with early access to health care services, delayed detection or diagnosis of the disease or delays in referrals. Other studies have reported that a subset of clinical signs can be used in predicting mortality. The World Health Organization's Integrated Management of Childhood Illness (IMCI) uses clinical signs to assess the severity of illness and facilitate appropriate and timely management. Gathara *et al*. reports that these clinical signs used to assess children with severe illness (IMCI) are associated with mortality(36) and Clifton *et al* using IMCI sign also reported unconsciousness, as assessed by the Blantyre coma score (BCS) of less than five and severe wasting, were independently associated with mortality (16). While, Lowlaavar *et al* reported HIV, unconscious and weight-for-age in predicting mortality in the patient admitted with infectious diseases (48).

We further analyzed data of patient who had complete laboratory investigation (Appendix 1). Biochemical markers strongly associated with mortality were high serum creatinine, very severe anemia, thrombocytopenia, and severe hypokalemia. These derangements are used as markers of organ damage or dysfunction. For instance, in this study, severe hypokalemia increased the risk of death 15 times. Other studies have reported that biochemical markers can predict mortality (49) and in high income countries they have gone further to develop algorithms (the PRISM III and PIM score) to predict child mortality where the score consists of different parameter such as systolic blood pressure, F_iO_2, P_aO_2, CO_2, PH, white blood cell count, platelets, glucose, fixed pupil, mechanical ventilation, maximum heart rate, maximum

or minimum of temperature, maximum PT and PTT (35). However, other studies have reported that biochemical markers are not good predictors of mortality (16).

5.4 Strength of the study

This study used cohort study design and thus was able to infer causality to identified risk factors associated with mortality. Also, to identify the cause of death the study used findings from mortality audit reviews rather than extracting from the death certificate, which is filled by different clinicians and might result in inter-observer bias and lack of consistency.

5.5 Limitation of the study

Our study findings should be interpreted with the following in mind: 1) Excluded patients who died within 30 minutes of admission and lost to follow up; this may have resulted in an underestimation of mortality rate although we do not think the conclusion would have changed. 2) The short duration of follow up (until death or discharge) might have led to an underestimation of mortality as death may have occurred at home with the same illness the patient presented with during admission especially those with chronic illness. 3) Even though we used causes of deaths from mortality audit it is still a challenge to accurately identify the primary cause of death for children with multiple diagnoses.

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Mortality among under-five children admitted at MNH is 12.2% and still high in comparison to the WHO target. Children had a higher risk of dying in the first 24 hours after admission, during the night and weekends. The five commonest causes of deaths were septicemia, malnutrition, congenital heart diseases, pneumonia and HIV. Children from poor households, presenting with loss of consciousness, inability to feed; lethargy, severe wasting and respiratory distress have a higher probability of dying in our setting.

6.2 Recommendation

1. Under-five mortality is still high and strategies to strengthen the provision of health care services need to be developed and/or to improve existing guidelines.

2. Children admitted to health facilities need to be closely monitored in the first 24 hours post admission to increase chances of survival.

3. Health care services provided during the night and weekend need to be improved. Administrator should discuss with health care worker to point out the problems (why more deaths at night and weekend) and outline the possible solutions and implement.

4. Development of an algorithm (as has been done in high-income countries) may be a possible strategy to help clinicians to identify children at higher risk of dying. Meanwhile, clinicians should use clinical features pointed out as a predictor of mortality to identify patients at high risk, give priority in the management and ensure close follow up of these children to reducing mortality in health facilities.

5. Further studies are recommended to assess the quality of services and guidelines used to manage diseases causing high mortality in our health facilities.

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APPENDICES

Appendix I: Multivariabe logistic regression of biochemical markers in relation to mortality while controlling other socio-demographics characteristics and clinical features

Biochemical markers	Crude OR (95%CI)	P-value	Adjusted OR (95%CI)	P-value
Hb (g/dl)				
<5.0	3.5 (1.23-10.06)	0.018	5.5 (1.49-20.30)	0.01
5.0-6.9	3.3 (1.38-7.98)	0.007	3.1 (0.99-9.62)	0.053
7.0-9.0	3.1 (1.41-6.82)	0.005	3.5 (1.29-9.39)	0.014
9.1-11.0	1.8 (0.78-3.90)	0.175	1.6 (0.59-4.33)	0.356
>11.0	1.0		1.0	
WBC ($x10^3$/l)				
<4	1.0		1.0	
4-11	0.34 (0.14-0.84)	0.019	0.5 (0.15-1.49)	0.197
>11	0.7 (0.29-167)	0.420	0.8 (0.26-2.48)	0.706
Platelets ($x10^3$/l)				
<150	1.8 (0.99-3.44)	0.054	2.8 (1.23-6.21)	0.014
150-450	1.10 (0.62-1.95)	0.704	1.34 (0.64-2.82)	0.437
>450	1.0		1.0	
Serum creatinine (mcmol/l)				
<88	1.0		1.0	
>88	5.78 (2.68-12.45)	<0.001	5.9 (1.84-18.71)	0.003
CRP (mg/dl)				
<10	1.0		1.0	
>10	1.7 (0.99-2.83)	0.057	1.78 (0.93-3.36)	0.081
Serum sodium (mmol/l)				
<125	0.80 (0.22-2.90)	0.734	0.45 (0.08-2.48)	0.358
125-135	0.31 (0.10-1.00)	0.050	0.28 (0.06-1.26)	0.097
136-145	0.18 (0.06-0.60)	0.005	0.14 (0.03-0.63)	0.011
>145	1.0		1.0	
Serum Potassium (mmol/l)				
<2.5	10.7 (4.1-28.03)	<0.001	12 (3.37-42.54)	<0.001
2.5-3.5	1.04 (0.39-2.82)	0.935	1.15(0.33-4.04)	0.829
3.5-5.0	1.43 (0.62-3.33)	0.403	1.83 (0.62-5.42)	0.278
>5.0	1.0		1.0	

Appendix II: Data Collection Tool

TITLE: MORTALITY AND ITS PREDICTORS AMONG CHILDREN ADMITTED IN THE GENERAL PAEDIATRIC WARDS MUHIMBILI NATIONAL HOSPITAL FROM OCTOBER 2017 TO APRIL 2018

S/N	**QUESTION**	**RESPONSE**
1.	ID	_____
2	Age of child *(Complete months)*	_____(Months)
3	Sex of child	1. Male 2. Female
4	Area of residence	_____ (District)
5	Where does he/she live in terms of location?	1. Urban 2. Rural area
6	Is the father alive?	1. Alive and well 2.Sick 3. Died 4.Unknown
7	Is the mother alive	1. Alive and well 2.Sick 3.Died 4.Unknown
8	How old is the father?	_____ Years
9	How old is the mother?	_____ Years
10	Who is the primary caregiver of the child?	1. Father 2.Mother 3.Grandparent 4.Aunt 5.Sibling 6.Others
11	What is the occupational of primary caregiver?	1. Employed 2.Peasant/ livestock keeping 4.Pettytrader 5. Unemployed6. Others
12	What is the highest level of education of the primary caregiver?	1. No formal education 2.Primary 3.Secondary 4.College 5. University 6.Unknown
13	Does the child have health insurance?	1. NHIF 2.NSSF 3.CHF 4.AAR 5.Strategies 6.Jubilee 7.None 8. Other……. *(mention)*

HOUSEHOLD CHARACTERISTICS TO ASSESS WEALTH		
14	Does your household have the following? *(Circle in each item)*	1. Electricity 2. Radio 3. Television 4. Non-mobile telephone 5. Refrigerator 6. Computer
15	Does any member of this household have a bank account?	1. Yes 2. No
16	What is the main material of the floor of your dwelling?	1. Earth/ dung 2. Palm/ bamboo/wood planks 3. Polished wood/ceramic tile/cements/ carpet 4. Others…….
17	What is the main material of the exterior walls of your dwelling?	1. No wall/ cane/ palm/dirt 2. Bamboo with mud/stone with mud/ plywood/cardboard/ reused wood 3. Cement/ stone with lime/ cement blocks/ wood planks/shingles 4. Others ……..
18	What is the main material of the roof of your dwelling?	1. No roof/ palm/sod 2. Rusting mat/cardboard 3. Metal/ wood/ cement/ ceramic tiles/ roofing shingles 4. Others……..
19	What type of fuel does your household mainly use for cooking? *(Select only one item)*	1. Electricity 2. Gas cooker3.Kerosene 4. Charcoal 5. Firewood.
20	What is the main water source *(select only one item)*	1. Tap water 2. Well water 3. Pond water 4. Sea /river 5. Other……

MEDICAL HISTORY		
21	Where was the referral come from?	1. From Home 2. District hospital 3. Private hospital 4. Others……..
22	What is the date of admission at MNH?	____/_____/_____ (Day/Month/year)
23	At what time was the child admitted?	____: ___ *(format of 24 hours)*
24	a) On what day of the week was the child admitted?	1. Monday 2. Tuesday 3. Wednesday 4. Thursday 5. Friday 6. Saturday 7. Sunday
	b) Was the child reviewed by senior	1. Yes 2. No
	c) If Yes, how many hours post admission	_____hours (if child admitted by resident, specialist or reviewed while intern clerking write time 00)
25	Is the child a new patient at MNH or has he/she been admitted before?	1. New patient2.Re-admission
26	Is the child received any childhood vaccination?	1. Yes.…… *(go 27)* 2. No.…… *(go 28)* 3. Unknown (no RCH card to verify) ……. *(go 28)*
27	Circle the correct box indicating if they have received the vaccination and write the date the named vaccination was received in the space provided. (*NB: Verify the information in the table with the child's RCH card*.)	

	Yes	No	Date (mm/dd/yy
BCG	1	0	

	ORAL POLIO VACCINE (O PV) 0 (BIRTH DOSE)	1	0	
	ORAL POLIO VACCINE (OPV) 1	1		
	ORAL POLIO VACCINE (OPV) 2	1	0	
	ORAL POLIO VACCINE (OPV) 3	1	0	
	DPT-HEP.B-HIB (PENTAVALENT) 1	1	0	
	DPT-HEP.B-HIB (PENTAVALENT) 2	1	0	
	DPT-HEP.B-HIB (PENTAVALENT) 3	1	0	
	PNEUMOCOCCAL 1	1	0	
	PNEUMOCOCCAL 2	1	0	
	PNEUMOCOCCAL 3	1	0	
	ROTAVIRUS 1	1	0	
	ROTAVIRUS 2	1	0	
	MEASLES VACCINE 1	1	0	
	MEASLES VACCINE 2	1	0	
	VITAMIN A (MOST RECENT)	1	0	

CLINICAL PRESENTATION

28	Duration from onset of symptoms to health care seeking	_____ (days)	
29	Circle all the symptoms that the child was reported to have on admission	1. Fever 2. Convulsion 3. Headache 4. Cough 5. Difficulty in breathing 6. Runny nose 7. Diarrhoea	12. Abdominal pain 13. Inability to feed 14. Discomfort during micturition 15. Reduced urine output 16. Blood in urine 17. Skin rash

		8. Vomiting 9. Vomiting blood 10. Bulging fontanelle 11. Abdominal distension	18. Delayed milestone 19. Failed to thrive 20. Generalised body swelling 21. OTHERS…… …… ……
30	Circle all clinical findings reported by the doctor who first attended the child	1. Febrile 2. Lethargy 3. Unconscious (BCS) 4. Wasted 5. Tachypnea 6. Cyanosed 7. Lower chest wall indrawing 8. Nasal flaring 9. Rhonchi 10. Crepitation on chest auscultation 11. Spastic 12. Hypotonic 13. Hyperreflexia 14. Abnormal movement	15. Heart murmur 16. Pale 17. Jaundice 18. Petechial 19. Hepatomegaly 20. Splenomegaly 21. Oedema 22. Dehydrated 23. Cold extremities 24. Capillary refill > 3sec 25. Congenital anomaly 26. Others …… …… ……*(Mention)*
VITAL SIGN AND ANTHROPOMETRIC MEASUREMENT Should be taken on admission immediately within one hour			
31	Temperature (in ^{0}C)	_____	
32	Respiratory rate (breaths per min)	_____	

33	Pulse rate (beat per min)	_____
34	Oxygen saturation (%)	_____
35	Height/length (cm)	_____
36	Weight (kgs)	_____
37	Weight for length	1. Normal2.-2SD to -3SD 3. <-3SD
38	Height for age	1. Normal 2.-2SD to -3SD 3. <-3SD
39	What is the HIV status of the child?	1. Exposed 2. Infected 3. Negative……*go45* 4. Unknown……*go45*
40	Is the mother of child received treatment or any prophylaxis?	1.On treatment 2. Prophylaxis given 3.Prophylaxis not given 4. Unknown
41	What was the child given in the first 6 months of life?	1. EBF2.Artificial milk 3. Mixed feeding 4. Unknown
42	Is the child received Nevirapine?	1. Received 2. Not received 3. Unknown
43	Is the child received cotrimoxazole?	1. Received 2. Not received 3. Unknown
44	Is the child on ARV?	1. On treatment 2. Not started treatment 3.Unknown
	LABORATORY INVESTIGATION (Preferable that taken on admission)	
45	RBG	
46	WBC	
47	HAEMOGLOBIN	

48	PLATELET	
49	CRP	
50	MRDT	
51	BS FOR MALARIA PARASITE	
52	CREATININE	
53	UREA	
54	POTASSIUM	
55	SODIUM	
56	CALCIUM	
57	LDH	
58	URIC ACID	
59	URINALYSIS	1. Nitrites 2. Leucocytes 3. RBC 4. Protein
60	CSF FOR PROTEIN	
61	CSF FOR GLUCOSE	
62	CSF FOR CULTURE *(All cultures write the organism)*	1. Neisseria Meningitis 2. Haemophilus influenza 3. Staphylococcus species 5. Streptococcus species 4. E. coli 5. No growth 6. Others specify _____
63	STOOL CULTURE	1. Campylobacter species 2. E. Coli 3. Shigella 4. Vibrio Cholerae 5. Salmonella spss. 6. Yersinia 7. Clostridium 8 No growth 9. Others _____

64	BLOOD CULTURE	1. Staphylococcus 2. Streptococcous spss 3. Escherichia coli 4. Hemophilus spss 5. Listeria spss 6. Klebsiela spss 7. Pseudomonas 8. Neisseria spss9.Enterobactar spss 10. Gram positive cocci 11. Gram negative cocci 12. Gram negative bacilli 13. Others _____
65	URINE CULTURE	1. Escherichia coli 2. Proteus spss 3. Klebsiella spss 4. Enterococcus spss 5. Staphylococcus spss 6. Others _____
66	What is the diagnosis on admission?	
67	What is the final diagnosis (diagnosis on discharge or death)	
68	How many hours child started on treatment after admission	_____(hours)
69	Which medication/treatment was given to the patient	1.antibiotics 2) ant malaria 3) Anticonvulsants 4) Ant pyrexia 5) Analgesia 6) Blood transfusion 7) Fluid 8) None 9) Others……...
70	Monitored vital sign	1)Temperature 2) RR 3) PR 4) BP 5) SO_2 6) Body weight 7) RBG 8) Urine output 9) Input 10) GSC 11) Not done
71	How often vital sign was checked	1) On admission only 2) once in 24hrs 3) twice a day 4) three times or more in day.

DEATH /DISCHARGE PARTICURAL		
72	What is the child outcome	1. Death 2. Discharge no clinic 3. Discharge to attend clinic
73	Date of discharge or death	……./……../……. (day/month/ year)
74	What time did the death occur	_____: _____ *(*format of 24hours)
75	On what day of the week did the child die or was discharged?	1.Monday 2. Tuesday 3. Wednesday 4. Thursday 5.Friday 6.Saturday 7.Sunday
76	Duration of hospital stay	_____hours

77	List the cause of death in the order written on death certification	1._____ *(immediate cause of death)* *2.* _____ *(Underlying cause of death)* 3. _____ *(comorbidity)*
78	Any avoidable factors to prevent death	1._____ 2._____ 3._____

Appendix III: Informed Consent

Reg. No…….

Title: MORTALITY AND ITS PREDICTORS AMONG CHILDREN ADMITTED IN THE GENERAL PAEDIATRIC WARDS, MUHIMBILI NATIONAL HOSPITAL FROM OCTOBER 2017 TO APRIL 2018.

Introduction: I am Dr Diana K. Damian, doing my thesis on mortality pattern and associated factors among children admitted to Muhimbili National Hospital. I invite your child to participate in this study.

Description of the subject: Participant will be asked about personal identification, clinical presentation and duration of symptoms. Anthropometric measurement will be taken height and weight. Other information will be taken from a patient file such as laboratory investigation, medication give and outcome. This information will help to determine the cause of death and associated factors.

Benefits of participation: There are no individual/direct benefits to the patients. But by identifying those factors associated with death will help for future use to improve services and fill the gap, aiming at reducing child mortality by removing avoidable factors.

Risk of participation: From this study, no any risk procedure will be performed. The patient will be investigated and treated as per standard of care. There will be no difference among those who will participate and those who will not participate in the study.

Confidentiality: All information obtained will be shared with healthcare worker eg doctors; nurses etc. with the purpose of improving the care of patient only. After data collection and data entry will remove all the identification of the participant. During the publication of result will not include any information concerning the identification of the patient.

Storage of data: Data will be stored in protected computer files and paper records will be stored in the locked cabinet. Other researchers will have access to data only if they will preserve confidentiality.

Voluntary of participation: Participation in the study is completely voluntary. At any point in time, you have a right to withdraw from the study. Refusal to participate in the study will not change any management of the patient.

Contact: If you have any question on the research you may contact Dr Diana (principal investigator) 0752345348. If you have any question regarding your right as a research participant contact, Professor Said Aboud, Director of Publications and Research, the Muhimbili University of Health and Allied Sciences, Research and Publication Committee, P. O. Box 65001, Dar es Salaam, Telephone number 0222150302-6

Consent: I have read/explained to me and understood the subject. I agree to my child to participate in the study.

…….....	……	……
Name of participant	Signature	Date
……..	……..	…….
Name of Investigator	Signature	Date

Appendix IV: Ridhaa Ya Kushiriki Katika Utafiti Huu

Namba ya utambulisho ……..

UTAFITI JUU YA SABABU ZA VIFO VYA WATOTO WANAOLAZWA WODI YA WATOTO HOSPITALI YA TAIFA YA MUHIMBILI KUANZIA MWEZI OCTOBA 2017 MPAKA APRILI 2018.

Utangulizi: Mimi naitwa Dk Diana K. Damian nafanya utafiti wa shahada ya udhamili juu ya sababu za vifo vya watoto wanaolazwa hospitali ya muhimbili. Naomba ushiriki wa mtoto wako katika utafiti huu.

Utafiti huu una husisha: Mshiriki katika utafiti huu ataulizwa maswali kuhusu historia ya ugonjwa (dalili za ugonjwa), vipimo vyake urefu na uzito vitapinwa na kuandikwa. Takwimu zake nyingine zitatumika kama vipimo vya damu, choo, mkojo na matibabu yote atakayotumia. Kwa kutumia hizo taarifa zitatusaidia kujua sababu za vifo.

Faida za kushiriki: Mshiriki hatapata faida moja kwa moja, bali itasaidia kwa baadae baadaya kupata sababu za vifo itasaidia kufanya mabadiliko katika mfumo wa kutoa huduma ya afya kwania ya kupunguza zaidi vifo vya watoto vile ambavyo vinaepukika.

Hatari za kushiriki: Mshiriki hana hatari yoyote ya kushiriki katika utafiti huu. Kila kitu atakachofanyiwa ni sehemu ya matibabu yake. Hamna kitakachoongezeka wala kupunguzwa ikiwemo dawa na vipimo. Tunaangalia vitu vinavyofanyika kila siku.

Utunzaji wa siri: Maelezo yote utakayotolewa, vikiwemo: majibu ya vipimo, aina ya ugonjwa na matibabu atakayo yapata vitatunzwa kwa siri. Vitaonwa na wahudumu husika wa afya wakiwemo madaktari, wauguzi n.k kwania ya kuboresha matibabu ya mgonjwa. Baada ya kukusanya hizo taarifa na kuziingiza kwenye komputa majina ya washiriki yatafutwa. Wakati wakuchapisha majibu haitahusisha utambulizi wa mshiriki yoyote.

Kutunza kumbu kumbu: Kumbu kumbu zitatunzwa kwenye komputa, mafaili yatawekwa peke yake. Karatasi zitakazotumika kukusanyia maelezo zitafungiwa kwenye kabati. Watafiti wengine wataruhusiwa kuziona hizo nyaraka endapo wataweza kutunza siri.

Ushiriki: Ushiriki wa utafiti huu ni wa hiari, kila mtu yuko huru kuchagua kushiriki. Endapo utatakakujitoa muda wowote inaruhusiwa. Endapo hutapenda kushiriki haitabadili au kuathiri chochote katika matibabu ya mtoto.

Mawasiliano: Kama mshirirki anaswali lolote kuhusu utafili au hajaelewa vizuri anahitaji maelezo Zaidi anaweza kupiga kwa Dr Diana 0752345348 (mtafiti mkuu). Kama una swali kuhusu haki zako kwenye ushiriki wa utafifti huu wasiliana na Prof. Said Aboud, Mkurugenzi wa Kamati ya Kitengo cha Utafiti, Chuo Kikuu Cha Sayansi na Tiba Cha Muhimbili, S.L.P 65001, Dar es Salaam, Namba ya Simu 2150302-6

Ridhaa ya kushiriki: Nimesoma /nimesomewa na kuelewa juu ya utafiti huu. Nakubali kushiri kikatika utafiti huu.

…….....	…….	……
Jina la mshriki	sahihi	tarehe
……..	……	……
Jina la mtafiti	sahihi	tarehe