UNDERNUTRITION AND RELATED RISK FACTORS AMONG UNDERFIVE CHILDREN IN LUNGWENA, MANGOCHI, SOUTHERN MALAWI

ANDREWS WONGANI GUNDA

Supervisor:
Professor Gerd Holmboe-Ottesen
The institute of General Practice and Community Medicine, Faculty of Medicine, University of Oslo, Norway

Co-supervisor:
Dr Kenneth Maleta
The University of Malawi

University of Oslo
Faculty of Medicine
Institute of General Practice and Community Medicine
Section for International Health
June 2007

Thesis submitted as a part of the Master of Philosophy Degree in International Community Health
ABSTRACT

Background
Undernutrition is unacceptably high in developing countries, with Sub Saharan Africa featuring second to South-east Asia. Malawi, like many other countries, is experiencing unacceptably high undernutrition levels, especially in poor communities in the rural areas. Our study was conducted in the rural community of the southern region of Malawi, where the majority of the people speak Yao. This study is carried out under the large collaborative study of the University of Malawi and the Universities in Norway supported by the Norwegian Programme for Development, Research and Education (NUFU). Data analysis was based mostly on secondary data collected under this collaboration. However, I collected some community level data to help explain why there is undernutrition in the community.

Main objective
The main objective is to describe health services, socio-economic, infrastructure, educational services and the agricultural factors at individual, household and community level and assess their association with the nutritional status of the under five in different villages of Lungwena community.

Methods
A cross sectional household study was conducted in which only 6 villages were sampled out of the total 26 villages spread across the community. Four of the sampled villages are along the lake and the other two are close to the mountainous area. Villages were also subdivided into intervention and control groups for prevention activities. Using the household listings in the census data collected earlier before the baseline surveys, households were selected for interviews. In the analysis, only the baseline data sets have been used. However, the households in the baseline study did not match with the under five nutritional data: 186 children from 424 households and 78 children in the merged file. Sample sizes varied for the baseline data sets but these differences are sorted out in a merged file, which aimed at associating nutritional status with other variables of potential influence.
Results
Of the 186 under five children, 31.7%, 21.5% and 8.1% were stunted, underweight and wasted, respectively. Severe forms were also alarming: 9.1%, 10.8% and 2.7% in the same order. About 79% of the children had low Hb status (Hb < 11g/dl). Children in the mountain group had a higher percentage of undernutrition than their counterparts along the lake. Similarly, children in the intervention group had a higher percentage of undernutrition than in the control group. Households in Milombwa village had less access to services available and a higher proportion of undernourished children in the community. Social services were in general lacking in villages and those services accessed outside their villages were far away. A child whose household head was a farmer, exclusive breast feeding period was 6 months or longer and being a female child was associated with more risks of undernutrition (p<0.05).

Conclusion
Levels of undernutrition are in general not unusual but severe forms of undernutrition are threatening. Due to small sample size, many socio-demographic independent variables did not have any effects on nutritional status as expected. The study would rather be considered exploratory, which suggests a follow up study with sufficient sample size.
ACKNOWLEDGEMENTS
I gratefully acknowledge the continuous support provided to by Gerd Holmboe-Ottesen, my main supervisor, on a wide range of viewpoints regarding protocol development through report writing. She has been so patient with my endless questions.

My sincere thanks also go Kenneth Maleta, my co-supervisor for the bright insights he brought into my paper. He was so instrumental in providing an enabling environment during field work.

I also remain to be thankful to the Norwegian Project for the Higher education and development (NUFU) management team. I would also be very unthankful if I do not register my appreciation to NUFU data enumerators for the profound data on which my reporting is based.

Special thanks should go to Loeb Mitch, a staff at SINTEF here in Norway for helping me to understand some special technique in handling quantitative secondary data. Many thanks should go to Lien, the statistician, for some statistical guidance. Edwin Siyame and Penjani Kamudoni for proof reading my work. I also extend thanks to Temwani Winnie Kumwenda, my fiancée, for her tender love and for keeping me hoping always.

Finally, I would like to record my deep appreciation to the Almighty God for making everything possible in my whole work.
DEDICATION

To my late father; Phillip Mughandira Gunda and late mother; Williness Mukwala
### ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC/SCN</td>
<td>Administrative Committee on Coordination/Sub-Committee on Nutrition</td>
</tr>
<tr>
<td>AIDS</td>
<td>Acquired immunodeficiency virus</td>
</tr>
<tr>
<td>BCG</td>
<td>Bacillus Calmette-Guerin vaccine against tuberculosis</td>
</tr>
<tr>
<td>DPT</td>
<td>Vaccine against Diphtheria, Pertussis and Tetanus</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographical Information System</td>
</tr>
<tr>
<td>HAZ</td>
<td>Height for age Z score</td>
</tr>
<tr>
<td>HIV</td>
<td>Human immunodeficiency virus</td>
</tr>
<tr>
<td>LDHS</td>
<td>Lungwena Demographic and Health Survey</td>
</tr>
<tr>
<td>LHC</td>
<td>Lungwena health centre</td>
</tr>
<tr>
<td>MDHS</td>
<td>Malawi Demographic and Health Survey</td>
</tr>
<tr>
<td>MoA</td>
<td>Ministry of agriculture</td>
</tr>
<tr>
<td>MoH</td>
<td>Ministry of Health</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-governmental Organization</td>
</tr>
<tr>
<td>NSHS</td>
<td>National Centre for Health Statistics</td>
</tr>
<tr>
<td>NUFU</td>
<td>Norwegian Programme for Development, Research and Education</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Package for Social Science</td>
</tr>
<tr>
<td>TA</td>
<td>Traditional Authority</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
</tr>
<tr>
<td>WAZ</td>
<td>Weight for age Z score</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>WHZ</td>
<td>Weight for height Z score</td>
</tr>
</tbody>
</table>
## TABLE OF CONTEXT

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>2</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>4</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>5</td>
</tr>
<tr>
<td>ABBREVIATIONS</td>
<td>6</td>
</tr>
<tr>
<td>CHAPTER 1: INTRODUCTION</td>
<td>10</td>
</tr>
<tr>
<td>1.1 UNDERNUTRITION OF THE UNDER FIVE</td>
<td>10</td>
</tr>
<tr>
<td>1.2 THE NUFU PROJECT</td>
<td>11</td>
</tr>
<tr>
<td>1.3 COUNTRY PROFILE-MALAWI</td>
<td>11</td>
</tr>
<tr>
<td>1.3.1 Geography</td>
<td>11</td>
</tr>
<tr>
<td>1.3.2 Climate</td>
<td>12</td>
</tr>
<tr>
<td>1.3.3 Administration</td>
<td>12</td>
</tr>
<tr>
<td>1.3.4 Population growth</td>
<td>12</td>
</tr>
<tr>
<td>1.3.5 Economy</td>
<td>13</td>
</tr>
<tr>
<td>CHAPTER 2: BACKGROUND</td>
<td>14</td>
</tr>
<tr>
<td>2.1 POVERTY SITUATION IN MALAWI</td>
<td>14</td>
</tr>
<tr>
<td>2.2 MALNUTRITION</td>
<td>14</td>
</tr>
<tr>
<td>2.3 FACTORS ASSOCIATED WITH UNDERNUTRITION</td>
<td>16</td>
</tr>
<tr>
<td>2.4 EXCLUSIVE BREAST FEEDING IN MALAWI</td>
<td>17</td>
</tr>
<tr>
<td>2.5 COMPLEMENTARY FOODS</td>
<td>17</td>
</tr>
<tr>
<td>2.6 INFECTIONS AND MALNUTRITION</td>
<td>18</td>
</tr>
<tr>
<td>2.7 WATER AND SANITATION</td>
<td>19</td>
</tr>
<tr>
<td>2.8 COMMUNITY FACTORS</td>
<td>19</td>
</tr>
<tr>
<td>2.9 HAEMOGLOBIN</td>
<td>20</td>
</tr>
<tr>
<td>CHAPTER 3: RATIONALE OF THE STUDY</td>
<td>21</td>
</tr>
<tr>
<td>3.1 RESEARCH QUESTION</td>
<td>22</td>
</tr>
<tr>
<td>3.2 OBJECTIVES OF THE STUDY</td>
<td>22</td>
</tr>
<tr>
<td>CHAPTER 4: DISTRICT PROFILE: MANGOCHI</td>
<td>23</td>
</tr>
<tr>
<td>4.1 STUDY SETTING PROFILE: LUNGWENA AREA</td>
<td>23</td>
</tr>
<tr>
<td>CHAPTER 5: METHODS AND MATERIALS</td>
<td>26</td>
</tr>
<tr>
<td>5.1 SECONDARY DATA: NUFU</td>
<td>26</td>
</tr>
</tbody>
</table>
CHAPTER 1: INTRODUCTION

1.1 Undernutrition of the under five

About half of the under five year old population in Malawi is undernourished (1). Immediate causes of undernutrition are inadequate dietary intake of various nutrients and frequent infections due to household food insecurity, as well as poor access to good quality health care and the environment (2). Childhood and maternal undernutrition is currently the single underlying leading cause of the global burden of disease (3). In Malawi, levels of undernutrition have remained constant over years with prevalence of stunting pegged at 48% in 2004 compared to 49% observed in the year 2000 (4). This constant trend explains why under five mortality is high (189 per 1000 live births)(5). Supporting evidence on the contribution of undernutrition on deaths in young children is available (6). Globally, undernutrition has been unacceptably high and regional efforts to reduce it has been slow(7). Overall, significant progress has been made in the reduction of child malnutrition with underweight prevalence declining in the developing world (8). Locally, few studies done in the community have looked at individual and household based studies (9-11). Conceptually, there is a link between community factors and undernutrition. Considering the multiplicity of the causes and the levels at which they work, it is important to design intervention that address all causes. Lungwena just like most local communities has a big problem of undernutrition and we plan to look at the local causes of undernutrition which could inform interventions. To this end, we believe analysing data at three levels would provide information that would help program implementers solve nutritional problems better(3). Further, geographical variables have oftentimes not been evaluated. Previous authors identified infant feeding practices and parental literacy, maternal HIV infection, home delivery, gestation length, size at birth and morbidity during infancy as household and/ or individual factors contributing to undernutrition in Lungwena(1;9). In the first instance therefore, the study will provide a detailed description of the nutritional status of children less than five years old. Furthermore, the study will consider some community associated factors such as health services, infrastructure, socio-demographics, education services, and agricultural practices and also individual factors such as exclusive breast feeding, and water and sanitary practices with the nutritional status of under five years olds.
This report has utilised 2004 baseline data extracted from the Norwegian programme for Development, Research and Education (NUFU) collaborative study between the University of Malawi and Life Sciences University in Norway. Presently, some community based data were collected to help explain but also complement the secondary data covered under NUFU Project.

1.2 The NUFU Project

The Lungwena Health, Nutrition and Agricultural Multidisciplinary Project, funded by the Norwegian Programme for Development, Research and Education (NUFU), is a multidisciplinary project which aims at addressing the problems of poverty, food insecurity and ill-health through a multi-sectoral approach which involves initiatives aimed at improving agricultural productivity, better nutrition and food safety, more focused health service delivery, and income generating activities. The project is being implemented in the catchment area for the Lungwena Health Centre which is on the eastern bank of Lake Malawi in Mangochi. The area extends for a distance of 20 kilometres length-wise from the South to the North and a maximum of 5 kilometres width in the east-west direction. The area has 26 villages with a total of 5,174 households.

1.3 COUNTRY PROFILE-MALAWI

1.3.1 Geography

Malawi is a land locked country south of the equator of sub-Saharan Africa. It is bordered to the north and northeast by the united Republic of Tanzania; to the east, south and southwest by the People’s Republic of Mozambique; and to the west and northwest by the republic of Zambia.

The country is 901 kilometres long and ranges in width from 80 to 161 kilometres. The total area is 118484 sq kilometres, which 94276 sq kilometres is land area. The remaining area is mainly composed of Lake Malawi, which is about 475 kilometres long and runs down Malawi eastern boundary with Mozambique. The north-south rift valley is flanked by mountain ranges and high plateau areas.
1.3.2 Climate

Malawi has a tropical, continental climate with maritime influences. Rainfall and temperature vary depending on altitude and proximity to the lake. From May to August, the weather is cool and dry. From September to November, the weather becomes hot. The rainy season begins in October or November and continues until April (4).

1.3.3 Administration

The country is divided into three regions: the northern, the central and southern regions. There are 28 districts in the country. Six districts are in the northern region, nine are in the central region and 13 are in the southern region. Administratively, the districts are subdivided into traditional authorities, presided over by chiefs. Each Traditional Authority (TA) is composed of villages, which are the smallest administrative units and are presided over by village headmen. Lungwena community has two TAs, TA Chowe and TA Makanjira. The latter has more villages than the first. It also follows that constituencies are divided following the traditional authority area divisions. Thus, we have two political divisions for which two Members of Parliament preside over(4).

1.3.4 Population growth

The population of Malawi has experienced growth over the years with an intercensal population growth rate of 2% per year. Population grew from 8 million to 9.8 million, representing a 24% increase from 1978 to 1998. The population of the country comprise nearly half of young people with 17% of the total population being the under five year population. (12). The infant mortality rate is 104 per 1000 live births while the maternal mortality rate is 1120 per 100000. Population density increased from 85 persons per square kilometre in 1987 to 105 persons per square kilometre in 1998. Notably, there is a varying degree of population density across the three regions in Malawi with Southern region having 144 persons per square kilometre, followed by central region occupying 114 persons per square kilometre and then the lowest density being in the North with 46 persons per square kilometre.(13) The comparable advantage in the southern region on the socioeconomic development explains the high density (14).
1.3.5 Economy
Malawi has a predominantly agricultural economy. Agricultural produce accounted for 70% of Malawi exports in 2004, tobacco, tea, and sugar being the major export commodities. The country is largely self-sufficient with regard to food, but due large cost of fertilizer coupled with erratic rains for the past three years, Malawi is experiencing food insecurity, making it highly dependent on imported maize from South Africa(4).
CHAPTER 2: BACKGROUND

2.1 Poverty situation in Malawi

Poverty is a dominating feature in Malawi. Most poor people cite perpetual food shortage as their major problem. Of late, Malawi has been facing its largest food crisis in the living Malawian memory. About 65% of Malawians live below the poverty line (15), where food insecurity is basically considered a poverty problem (16). The ongoing famine in Malawi can be explained by both bad weather and poor policies and governance. The underlying vulnerability factors make the present famine more serious than ever before (17). The vulnerability factors include declining soil fertility and restricted access to agricultural inputs in the early 1990s; deepening poverty, which has eradicated assets which the poor could exchange for food to bridge the food gaps; the erosion of social capital and informal social support in poor communities; the demographic and economic consequences of HIV/AIDS; and the many years of relative neglect of the small holder of the Agricultural sector. One possible problem resulting from food insecurity is malnutrition.

2.2 Malnutrition

Malnutrition is defined as the disturbance arising from the deficiency or excess of one or more nutrients (18) whereas under nutrition can be defined as lack of adequate energy, protein and micronutrients to meet basic requirements for body maintenance, growth and development (19), a condition that affects many people on a continuous basis (18). This paper will limit the meaning of malnutrition to undernutrition.

Undernutrition in children is a world wide problem; both the impact on public health and its clinical form are seriously considered in the communities. Previous literature report unacceptably high levels of undernutrition, indicating that approximately 27% of preschool children less than five years old in developing countries are underweight (7).

Overall, significant progress has been made in the reduction of child malnutrition with underweight prevalence declining in the developing world. The greatest decline was achieved in East Asia and the pacific where underweight levels decreased by a third. Half of the undernourished children live in south Asia and more than one fifth in sub-Saharan Africa (8). An overview from the WHO global database on child growth
indicate that while 80 percent of all affected children live in Asia, 15 percent live in Africa (20). At regional level, Asia has registered more undernourished children than Africa (20;21). The effort to reduce undernutrition levels has not been achieved (22). Estimated figures of underweight among children indicated that while worldwide figures show a declining trend, Africa is however showing the worst situation in Sub Saharan and West Africa. On the other hand, a declining trend is promising in North Africa (23)

Children often suffer from marginal deprivation or mild chronic deficiency of certain macro- and micronutrients resulting in growth retardation, loss of weight and proneness to infections (24). Undernutrition has continued to pose a health problem especially in the developing countries. Inadequate dietary intake and infection account for much of the high morbidity and mortality. When children do not eat enough or adequate food to ensure sufficient energy and/or nutrients, their immune system defences are lowered, resulting in greater incidence, severity and duration of disease. Disease speeds nutrient loss and suppresses appetite, so sick children tend not to eat as they should and the cycle continues (25)

With an increased HIV epidemic in Malawi, reaching the prevalence of 15% in 2003 (26), an increasing number of children are left orphaned. These orphans stay with their grand parents. This leads to a significant reduction in the quality of care accessed by orphaned children, especially in giving them food that can meet the necessary nutrients and also the health care. Infections such as Malaria, cholera, diarrhoea, acute respiratory infections and tuberculosis have also been reported to have an impact on the nutritional status of infants (27).

Nationally, the 2004 Malawi Demographic and Health Survey (MDHS) reported stunting, wasting and underweight of under five children to be 48%, 5% and 22% respectively (4). Previous national MDHS(5) and a prospective study done in the Lungwena showed similar results(1).

Protein Energy Malnutrition (PEM) is present mostly in preschool children, particularly in the ages between 6 months and 5 years. However, the conditions go
back to early foetal life, to low birth weight and sometimes to inadequate growth in
the first 6 months of life particularly when bottle feeding is attempted by the mother
(10). It is also closely linked to socioeconomic development of a community and is
most common in the poorest countries with a large population living in poverty in
rural areas and urban slums. Malnutrition is found to be endemic and often seasonal in
rural areas of the developing countries. This is related to the period of the year when
food for the whole family is in short supply and the child’s food intake is diminished
by frequent infections such as measles. The prevalence of malnutrition varies but
severe forms are frequently found in 2-3% of the child population, with up to 60%
suffering from various degrees of stunting (28).

2.3 Factors associated with undernutrition

In Malawi, Maleta (2003) found maternal HIV infection, home delivery, and gestation
length, size at birth, male sex and morbidity during infancy as factors associated with
malnutrition in Malawi (10). However, some factors such as ‘male sex’ could be
country or community specific hinged on culture because other studies in other
regions might present ‘female sex’ as a factor. Furthermore, socioeconomic variables
and feeding patterns were not associated with under nutrition (10), contradicting an
earlier study on the determinants of the prevalence of under nutrition done by Espo et
al (29) in 2002 where he showed that infant feeding practices and parental literacy
independently predicted the prevalence of severe stunting at 12 months of age. Igbal
(1999) found parental illiteracy, low monthly income and absence of BCG
vaccination to be associated with protein energy malnutrition (PEM) among the under
five year old children (30).

In Nigeria, poor weaning and food supplementation, frequent illness and poverty were
found to be strong factors causing under nutrition (31). A comparative rural-urban
study done in Mexico indicated that extreme family poverty is a determinant of
stunting among the under five. The family was looked at in different dimensions like
family income, family characteristics, resource allocation and family organization,
social networks and child health care. These were studied in relation to nutritional
status but the effect of family income showed no significant differences between the
urban and the rural (32). A study done in Bangladesh by Giashuddin (33) revealed
that malnutrition rate was two times higher among the poorest than that of the richest. He also stated that children living in poverty were more likely to be malnourished than children of higher income families (34). Furthermore his study findings showed inconsistent underweight figures with Madusolumuo (31) on gender.

In Zambia, children with complete immunizations and those from parents with better education showed good nutritional status compared to those who did not complete their immunizations and those from parents with low education respectively (35).

2.4 Exclusive breast feeding in Malawi

It is noted that data on practice and duration of breast feeding is reported differently. For instance, the 2004 MDHS reported 2.5 months as the mean duration for exclusive breast feeding in Malawian babies (4). The 2000 MDHS however reported 63% of babies to have been breast feeding exclusively for 4 months (36). However, the present recommendation is to exclusively breast feed for 6 months (19;36). In Lungwena, Kamudoni (2005 masters thesis), however, observed that only 0.6% of the mothers exclusively breast fed their infants for up to 6 months (37). About 4 percent of mothers in the north of Malawi, on the other hand, were reported to exclusively breast feed their babies for 6 months (38), a study where they assessed the age of the child at which foods other than breast milk were introduced. Vaaltera’s (2001) findings explain why there is low exclusive breast feeding rate and it was reported that as many as 30% of all infants were receiving complementary porridges during their first month of life (39). Most infants received water and complementary foods before the age of 4-6 months. Breast feeding has recently become a debatable issue with the advent of HIV/AIDS. The WHO/UNICEF (1992) recommended that where infections and malnutrition are the main cause of child deaths and the infant mortality rate is high, exclusive breast feeding should be the usual advice to pregnant women, including those who are HIV positive (19).

2.5 Complementary foods

The most common type of complementary food in Malawi is a thin gruel made of water and maize flour to which is added salt and sugar (40). This food is low in energy and protein; a 200 ml cup contains 80 calories compared to 150 calories in
200ml in breast milk. Madise et al (41) reported that preparing food for the child separately requires time and extra firewood, so the frequency of the child’s feeding depends on the number of times the family has its meals.

Children who are fed inadequate quantities of protein and energy and micronutrients for their growth and health are likely to suffer from malnutrition. The child’s energy requirements per kg body weight are higher and thus total energy requirement is half that of an adult. Unfortunately most diets in the developing world fed to young children are largely made up of dilute paps and porridges with less than one calory per gram. For this reason, the first and most common feeding frequency of 2-3 meals is not enough. Prolonged breast feeding (41), late introduction of complementary feeding, high reliance on diluted milk and delay on putting the child on the family food have been cited to contribute to low energy and nutrient intake (19;42;43).

2.6 Infections and malnutrition

Infections play a major role in the causation of malnutrition. An infection increases the energy, proteins and vitamin requirements of a child and may also affect their absorption. However, the major influence of infection is in reducing the appetite of the child (28). The interaction or synergism of malnutrition and infection is the leading cause of morbidity and mortality in children in Africa, Asia and Latin America. The simultaneous presence of both results in an interaction that has more serious consequences for children even adults than the additive effect would be if the two worked independently (19). The major causes of mortality and morbidity are mostly preventable, with malaria as the most cause of out patient visits rated at 30% in the hospitals. Diarrhoeal disease, including cholera, and acute respiratory infections also contribute significantly to out patient visits. HIV/AIDS constitutes a serious threat to Malawi as a whole as it has affected all aspects of the country’s social and economic fabric. Despite the concerted efforts of the Ministry of Health and its partners, reported cases of tuberculosis once thought to be on the decline, have recently been reported to have increased five-fold in the recent few years. Sexually transmitted infections still remain another major health problem closely associated with the spread of HIV/AIDS (27).
2.7 Water and sanitation
Improved access to safe drinking water supply has been an issue on the development agenda for decades now, but still a substantial proportion of the world’s population has not been able accesses this water. Approximately, about one billion people lacked access to safe drinking water. About 2 billion people had no access to improved sanitation (44). In Malawi, access to safe water has not changed since 1990. In Mangochi, 73% of the households have access to improved water source. Access to clean water is about 64 percent. Only 6% of the Malawi population has access to improved sanitation. About 79% have access to traditional pit latrine but 16 percent of the households in Malawi have no pit latrines. In Mangochi, about 88 percent of the households have access to some form of sanitation with traditional pit latrine (4).

2.8 Community Factors
Poor nutritional status reflects the imbalance between dietary intake and/ or infectious diseases (45), thus, it is affected by multiple factors, both environmental such as household hygiene and water and sanitary practices, and socioeconomic status such as household socioeconomic status and education (3;46). A study conducted in Brazil among children under five (47) pointed to infrastructure, healthy services and educational services as important factors determining the nutritional status of children. There is an inverse relationship between distance to social services and services such as health clinics, schools, shops and many others in which the greater the distance to reach such facilities the poorer the access and therefore a greater need (48). Consistently, Martin 2001, the decreased attendance to routine health activities deteriorated under five nutritional status(49).
An analysis of disparities in nutritional status by wealth and residence in Angola, Central Republic and Senegal demonstrated that the prevalence of undernutrition is similar for the same level socio-economic groups in rural and urban areas (50). Low urban undernutrition has been found to be due to a series of more favourable socio-economic conditions, which in turn lead to better caring practices for children and their mothers (51). Children from households which with water and sanitation facilities have lower nutritional risk than those children from households without water and sanitation facilities (52).
2.9 Haemoglobin

The World health organisation (WHO) has estimated that more than 50% of children less than 4 years are anaemic in the developing countries (53;54). International agencies claim that nutritional iron deficiency is the most common nutritional disorder in the world. Apart from nutritional anaemia, many people have increased needs because of blood loss due to hook worm and bilharzias infection, menstruation, child births, wounds and in those who get marginal quantities of iron, mainly from plant foods. The effects of iron deficiency include poor learning and decreased cognitive development (19). A cohort study in Malawi, just like earlier studies (55;56) indicated maternal anaemia during pregnancy and low birth weight as risk factors of anaemia in childhood (53). If anaemia is detected at an early stage it can be treated with iron supplementation and malaria chemoprophylaxis (57). A randomised controlled trial indicated growth improvement in anaemic children on iron supplementation than those who did not receive the supplement (58). The WHO and UNICEF (1999) defines anaemic children based on the following cut off points for haemoglobin: children aged 6-60 months are considered anaemic when they have Hb level below 11g/dl (59).
CHAPTER 3: RATIONALE OF THE STUDY

Information about individual and/or household level factors impacting on the nutritional status of members in the household is broadly established and helpful in policy formulation. For instance, there is well established knowledge about the influence of socio-demographic, economic factors on dietary intakes and the nutritional status of the individuals (1;9). Nonetheless, it is still very important to continue identifying factors that influence the nutritional status of children because of variations in different environmental settings and rapid demographic transition. Interventions based on appropriate current information can be both effective and successful. Such information will in addition be a yardstick for evaluating interventions. While this is the case, little is known about the existing association between community level factors and the nutritional status of children under five years old. A study conducted in Brazil among children under five (47) pointed to infrastructure, health and educational services as important community factors determining the nutritional status of children. Unlike many communities, Lungwena shares common socio-cultural values evidenced by the large majority of the population speaking Yao and belonging to the Islamic faith. Cultural factors including language and religion have an influence on the type of habits that people exhibit, including food habits. Thus, community factors have an impact including individual and household factors. Therefore, data analysed at the three levels would identify factors which influence the nutritional status at different levels. The current sub study is planned to assess factors at these three levels which may be impacting on the nutritional status of the children under five. We have also compared the anthropometric status of these children across the six villages. This study did not look into the dietary intakes, except for exclusive breast feeding, because the existing data is too little to allow for statistical analysis. Instead, only anthropometric data was analyzed. Despite the interaction that exists between anthropometric status and infections, analysing such data offers still a better understanding of the health and nutritional status of the population.
3.1 RESEARCH QUESTION
What are the factors at individual, household and community level associated with undernutrition among children less than five years of age in Lungwena, rural Mangochi-Malawi?

3.2 OBJECTIVES OF THE STUDY
Broadly, this study is set to answer the following objectives:

1. The main objective is to describe health services, socio-economic, infrastructure, educational services and the agricultural factors at individual, household and community level and assess their association with the nutritional status of the under five in different villages of Lungwena community.

The specific objectives include the following:

a. To describe the prevalence and severity of undernutrition among children under 5 years old in Lungwena, Mangochi.

b. Describe the prevalence of anaemia in under five year old children in Lungwena Mangochi.

c. To analyse the associations of socio-demographic factors such as vaccination status, availability of clean water, latrine availability, education of caretakers, credit facility, assets, marital status and child feeding practices on the indicators of nutritional status.

d. Identify community level factors which could have a bearing on nutritional status of the under five in the various sub communities in Lungwena.

e. Assess differences in these factors between the different sub-communities (TAs and/or villages) in Lungwena.

f. Compare intervention and control villages regarding household characteristics and nutritional status

g. Relate these community level factors to other socio-demographic factors at individual/household level and to nutritional status of the under five children.
CHAPTER 4: District profile: Mangochi

Mangochi district with a population close to 600,000 is located along Lake Malawi and bordered by districts namely: Machinga, Balaka, Ntcheu and Dedza. With the infant mortality rate of 169 per 1000 compared to 134 per 1,000 at national level, the place has one health delivery hospital and 29 primary health care facilities. The fertility rate is higher than the national level one; 7.6 and 6.8 respectively(12)

Mangochi district is divided into rural and urban areas. The urban area covers Mangochi Township in which the district administrative offices are located. This central area is full of all kinds of businesses and people migrate from the rural to the area for business. Compared to many districts in Malawi, the district offers a very good base for both small scale and large scale business. Compared to the rural areas the central area has a better infrastructure including district administrative offices, post office, banks, rest houses and also restaurants. Tarmac roads from the district do not extend deep into the rural area but diminishes on the way. The district hospital is located right in the township. Lungwena community, like many rural areas, does not have most of the infrastructures enjoyed in the township. While people in the township earn their living in their businesses and formal and informal jobs, their rural counterparts depend on small scale farming and fishing, as main economic activities.

4.1 Study setting profile: Lungwena area

The study was conducted in catchment area of Lungwena Health centre located in Mangochi district about 40km north east of Lake Malawi. There are 26 villages in two Traditional authorities (TAs) namely Makanjira and Chowe. Lungwena, just like any native in Mangochi, speak Yao as their mother tongue. Other languages exist but in small pockets. The health centre is bordered on the west by Lake Malawi and a chain of hills on the east. The TA Makanjira has a population of 14022 (60.7%) while TA Chowe has a population of 9078 (38.3%). A natural increase of 4710 was observed from 2003 to 2004 as reported in the census January 2003-January 2004 report (60). Furthermore, the community has a sex ratio (male to female) of 93, similar to 92.5 for Mangochi district but lower compared to 99 at national level.
A year prior to census survey, about 634 deaths occurred and most of the deaths occurred among the under fives. *Below is the map of Malawi showing map of Lungwena in Mangochi district:*

![Map of Malawi showing Lungwena in Mangochi district](image)

**Figure 4.1:** Map of Malawi showing Lungwena in Mangochi district
**Health centre:** The health centre is located in Ng’ombe village under Traditional Authority, CTowe, which is however not among the 6 villages where the NUFU project collected the baseline data. The health centre is located along the secondary road going to Makanjira from Mangochi district. The centre provides almost all basic health services for minor ailments and refers complicated cases to the district hospital at Mangochi. In addition, it provides both the preventive and curative services such as family planning, antenatal and delivery services, growth monitoring, vaccinations and treatment of common illnesses. However, the centre has no doctor but three nurses. Patient-nurse ratio is about 72. The centre experiences many deliveries that outnumber beds present. For instance, as for 2003-2004, there were 8 beds accommodating about 14 deliveries in a month and other cases presenting at the clinic. For the period stated, home deliveries outnumbered deliveries at the hospital. Home deliveries are largely conducted by traditional birth attendants. Beds for the waiting patients are always not available. As a result, waiting patients are oftentimes put on the floor. The centre does not separate the labour ward from the antenatal clinic in its operations. Information regarding still births is not kept but is often times live births are documented.
CHAPTER 5: METHODS AND MATERIALS
This chapter outlines the methods and materials that were used in the NUFU baseline survey of 2004 and the present community sub study conducted in October 2006. Both the first and the latter studies were conducted in the same villages.

5.1 SECONDARY DATA: NUFU

5.1.1 Study area and Subjects
The NUFU collaborative survey was carried out in Lungwena in Mangochi district, southern Malawi. Malawi has a population of 11 million. About 85% of the population is rural mainly occupied with smallholder farming and 55% have cultivable land less than one hectare (5). Thus, most of them are subsistence farmers and that food production is suboptimal for household consumption. Lungwena is an agricultural setting in Mangochi district in which maize; the main staple food, and cassava subsistence farming are the primary pursuits of the Chiyao speaking individuals. However, Chichewa as a national language is also widely spoken. Illiteracy is common. Of those aged five years and above, only 15.5% were reported to be able to read and write (60) The country experiences a sub-tropical climate with two main defined climatic seasons namely: the rainy season between November and May and dry season between June and October. The study area is a catchment area for Lungwena Health centre.

This area was identified as a potential site for implementing a joint study under the University of Malawi. Only six villages participated in the baseline data. Children under five years of age, women of child bearing age and men and the adolescents were eligible to participate. This report however has only focused on anthropometric data of under five children, and demographic and socio-economic information at household and community level.

5.1.2 General design
The study is cross sectional in design and used data collected within the framework of the Lungwena NUFU project. There was ample baseline data collected by the Lungwena collaborative Demographic and Health Survey, and environment and agriculture survey between the University of Malawi and Universities in Norway. Data were collected in 2004 supervised by experts from these collaborating
institutions. My study therefore analysed nutritional data relating to children under five years old and linking the data to individual, household and community level factors aforementioned, implicated to have potential influence on nutritional status.

5.1.3 Sample size and sampling
The study population was drawn from a random sample of households selected from the six villages earmarked for agriculture, health and nutritional interventions. As part of the multidisciplinary research project, collaborators from the university of Malawi (Bunda College of Agriculture and the Polytechnic) and Norwegian University of Life Sciences randomly sampled 6 villages, 4 villages along the lake and 2 villages in the upland, along the Makanjira mountainous area. The number of villages selected along the lake and close to the mountain chains followed a probability proportion to size sampling method. The villages were further divided into intervention and control groups. From the six villages, a sample of 424 households was drawn to undergo a baseline survey on agriculture, health and nutrition. For the demographic and health survey, 300 households were included. Subjects included were men, women, adolescent males and females residing in the selected households. The census survey which was conducted in the area a few months before the baseline survey provided a sampling framework.

5.2 PRIMARY DATA: Sub study
The study was conducted in the same six villages as the NUFU study. The study was conducted almost two years after the NUFU baseline study. Chiefs and other key people (chief advisors) were targeted for this primary data. The chief and one key person provided information for each village. Some information was collected from the Lungwena Health Centre regarding the quality of health care delivery. The questionnaire (Appendix 3.0) used was semi-structured and a single questionnaire was used in each village.

5.3 DATA COLLECTION

5.3.1 Individual/ household level and community data: Secondary data
A questionnaire was developed and pre-tested prior to the actual survey. Mothers or caretakers of the children were interviewed to collect demographic information,
breast-feeding, health, agriculture, water and sanitation practices, socioeconomic variables and also information on production patterns and socioeconomic characteristics. The anthropometric measurements were taken to provide the anthropometric data of infants while blood drawn from these under five year old children determined the hemoglobin levels. At community level, facilities available were mapped and distances from the sampled households to these facilities were measured. Measurements that were taken included weight, height and mid upper arm circumference (MUAC) for which appropriate standard procedures and calibrated equipment were used (61). Appropriate indicators were employed to assess nutritional status of these under five children. These included weight for age, height for age and weight for height for children. Iron nutritional status was determined by measuring blood haemoglobin concentration with a Hemo-Cue® instrument from a finger prick blood sample.

5.3.2 Community sub study: Primary data
Presently, village specific data were collected from the six villages, which also participated in the NUFU baseline surveys. An interview was conducted and responses were recorded by the researcher himself. A minimum of two people participated in the interview, where at least a village head was included. Essentially, this data were collected to validate the quantitative secondary data collected in 2004 by the existing NUFU Project. Yet, it was a valuable resource which helped in explaining the observed patterns in the quantitative analysis. The participants consented to take part in the study in which a written consent form (Appendix 1.0) was translated into a national local language (Appendix 2.0), and read before the participants.

5.4 Field work and constraints
Much data planned to be collected were already covered by the NUFU project. This was initially not known because the GIS data which covered most community level data was not included in the original protocol for the NUFU, which acted as a reference point in proposal development. The challenge therefore was to start cutting
out what was already covered and remained with very few questions for which I collected new data.
5.5 Conceptual framework for determining undernutrition
The population determinants of undernutrition were analyzed within the framework adapted from the United Nations Children’s Fund (UNICEF)(22). The prevalence of undernutrition is determined by immediate, underlying and basic causes (Fig 5.1). As shown below, causes above each level are a result of the inadequacy and poor organization of the resources below it.

Source= UNICEF world summit 1990

Figure 5.1: Conceptual framework for determining the prevalence of undernutrition in a population in Lungwena
5.6 Variables and definitions used in the study

This section outlines variables as they are understood in the analysis and mainly they are dependent and independent variables. The independent variables are regarded as potential risk factors for determining undernutrition. We also have variables as community social services which were only used in descriptive analysis.

5.6.1 Dependent variable
Indicators of nutritional status namely: height for age, weight for age and weight for height are the only dependent variables the study utilized when making associations. These indicators were categorized as malnourished and normal using a standard reference recommended by NCHS/WHO (62) which defined malnutrition as a median z-score (standard deviation, SD) below minus 2, applied to any of the three indicators of nutrition. Normal children are those for which the median z-score (SD) is equal or more than minus 2.

5.6.2 Independent variables
Based on previous studies, demographic, socio-economic, environmental and agricultural factors were considered as independent variables. These factors have a previous history to be potential factors impacting on stunting, underweight and wasting. Below is an outline of independent variables included in the analysis:
Demographic data and socio-economic factors included such variables as age, marital status, gender, education status, economic activity of the household head; gender and age of the child; plot size and the number of assets in the household.
Environmental factors included types of sources for drinking water, distance to the water source, type of pit latrines available and whether the household has a pit latrine or not.
5.3.3 Operational definitions for the variables

**Dependent variables**

**Nutritional status**

- **Over-nourished children**: > +2 Z score\(^1\) for height for age; or weight for age; and weight for height
- **Normal children**: +2 to -2 z scores for height for age; or weight for age; and weight for height
- **Moderately undernourished**: <-2 to -3 z score for either height for age; or weight for age; and weight for height
- **Severely undernourished**: <-3 Z score for either height for age; or weight for age; and weight for height

Undernutrition is assessed by three well known indicators of malnutrition including stunting, underweight and wasting (19;62), and these indicators are based on the relationship between height, weight and age. The status of the child with regard to stunting, underweight and wasting is determined by how many standard deviations the child is measured below the mean of the NCHS reference population (62). If the child is between two and three SD below the mean, the child is considered moderately malnourished (stunted, underweight and wasted); if the child is three or more SD below the mean, the child is considered severely malnourished

**Some of the independent variables**

**Values given to assets:**

Each household had many assets and these were categorized into scores of 3, 2 and 1 according to the degree of economic value, representing high, medium and low economic status respectively. Thereafter, a sum of the scores was obtained for each household and then ranked again into three categories as the latter but cut off points were as follows; < 5, 6-8 and > 10 as low, medium and high. A car was removed from the item that received a score because it was a very rare asset.

---

\(^1\) A Z-score is a statistical measure which tells us how a single data point compares to normal data. It tells us whether a data point is above or below average but also how unusual the measurement is. Mathematically, it is obtained by subtracting mean value from a data point and then divided by the standard deviation in the data.
An appendix 5.0 shows all the assets included in creating the scores.

**Plot size**

The average hectare was calculated because there were situations in which two household members could be living in the same household but each one of them owns a separate piece of land. Finally, data were categorized into land <=2 hectares =1; and > 2 hectares =2.

**Vaccination status**

Categorization of this data was based on the number of immunizations a child received. Those who had < 8 vaccinations were considered to have incomplete vaccination; those with 8 or more had complete vaccination status. A child is considered fully vaccinated if he or she has received one dose of BCG, three doses each of DPT and polio vaccine and one dose of measles vaccine (4).

**Others variables**

Demographic, some socio-economic and environmental factors have been categorized as presented in the tables, graphs and specifically in Table 6.11a and 6.11b.

**Additional variables**

**Haemoglobin:**

Blood from a thumb prick was taken and analyzed to determine the extent of anaemia among children under five years old. The WHO and UNICEF defines anaemic children based on the following cut off points for haemoglobin: children aged 6-60 months are considered anaemic when they have Hb level below 11g/dl (59).

**Community social services:**

At community level, we considered the availability and accessibility of social services grouped as follows: Natural resources including boreholes, woodlot, river, dambo1, and lake and forest reserve. Social factors

---

1 A piece of wetland used during the dry season for growing different crops and is water logged during the rainy season
including mosque, fish dock, grocery, secondary road, primary school, health centre and traditional healers. Presently, community data was also collected to supplement the secondary data. This data principally covered health, production and transport patterns existing in the area.

**Dummy variables**

Dependent variables including HAZ and WAZ have been dichotomized into 0=malnourished child (<-2 Z score) and 1=Normal child (≥-2 Z score). Independent predictors were all dichotomized.

### 5.7 Database handling

Cross sectional data on anthropometric and iron status, demographic, agricultural and environmental data were obtained purposively from the NUFU project electronic data base. The NUFU project was initiated in 2004 with a view to inform planned interventions and also help to evaluate such interventions by monitoring trends. Six villages were included in the baseline survey and in which many members from each household participated. However, the present analysis focused on the nutritional status of children less than five years and related these indices to several variables at household and community level. Thus, data used in this report were at three levels namely: individual, household and community. These data were secondary, collected under the auspices of the NUFU project. The secondary data were either continuous and/ or categorical. All data were initially entered into Microsoft access software but for the purposes of our analysis data were exported into SPSS, Epi Info and Excel analytical packages. Errors in the electronic data sets were checked against the filled questionnaires to correct for typing errors. Corrections were also made for missing data. All continuous data, such as number of years the household head spent in school, age of the house head, plot sizes and indicators of nutritional status were categorized to produce frequencies, tables and graphs. Also, the categorical data were used in the binary logistic regression to assess predictors of stunting and underweight among the
under five children. Dependent variables were the indicators of nutritional status and the rest were independent variables. NUFU community based data (GIS data) included the availability of facilities in the villages and distance taken to access these facilities. Data were entered into SPSS and Excel for analysis.

At present, village level data were also collected. Village level data included health, production and transportation aspects. Health aspects included availability of services and how they were accessed both at the health centre and villages in the peripheral. Production pattern covered some common practices such as fishing, handicraft, beer brewing and farming. Finally, the nature of roads and means of transportation were also considered.

5.8 Data analysis
The EPI Info software was used to analyze anthropometric data using median z scores as standard reference recommended by NCHS/WHO (62). The Statistical Package for the Social Sciences (SPSS) produced descriptive statistics in form of frequencies expressed as percentages, and means and graphs but also provided the machinery to associate indicators of nutritional status with potential factors at individual, household and community level. Some graphs are produced by Microsoft Office Excel 2003. In SPSS, 2 by 2 cross tabulations produced odds ratio for categorical variables and chi-square was used to test the hypothesis that nutritional status was not associated with area of residence and other grouped categories. Binary logistic regression was employed to assess the effects of stunting and underweight. The forward stepwise logistic regression method was used in identifying predictors that influence poor nutritional status. Variables to be included in the model were selected after the exploratory bivariate analysis. In this method, confounding factors are automatically controlled for. All continuous data followed a normal distribution in the data except for Hb data. The statistical significance of the observed differences and associations was assessed at 5% level of significance.
Presently, community data were also collected to provide us with background characteristics for the villages under study. This additional community data were analyzed in SPSS, in which percentages for different aspects were provided.
5.9 Presentation, dissemination and use of results

The results will be distributed and discussed with the local community and the representatives of the District health office and College of Medicine. The main findings will be published in internationally peer reviewed journals. The results will provide useful baseline information regarding the nutritional status and outline possible risk factors of malnutrition for the planning and development of an intervention study. It will also act as a monitoring tool.

5.10 Ethical considerations

The study underwent approvals from two ethical committees. In the first instance, the University of Oslo, Department of General Practice and Community medicine approved the study. Since the protocol for the Lungwena DHS already underwent a local ethical review by the College of Medicine in the University of Malawi, further approval from the Malawi ethics committee was deemed not necessary because the present study was considered a sub study within the main ongoing project. The NUFU project did not go through the Ethics committee in Norway because there were no health professionals from Norway involved in data collection and processing. The agriculture and environment component did not need that kind of clearance. Largely, data analysis was based on the NUFU project secondary data. In addition, the data collected was little and not life threatening to warrant a new approval.

5.11 Informed consent

Mothers and caretakers of children consented to participate in the baseline study. Declaration of participation was obtained by signing or using a thumb print. For the additional community data collected, the village headmen and key people gave verbal consenting where the participant information sheet was read before them. Clarifications were sought by participants wherever the information read seemed not to be clear.
5.12 Sampling flow chart for the secondary data of the NUFU project

Figure 5.2: Flow chart describing the sampling process

5.12.1 Describing the flow chart
Figure 5.2 illustrates the type of studies, their relationships and the sample sizes included for which the analyses of this report was based. In total, the community has about 23,102 people from 5,174 households as provided from the census report documented by the University of Malawi (60). Lungwena Health, Nutritional and
Agricultural multidisciplinary project will pilot the six villages for an intervention in the areas of health, nutrition and agriculture. The intervention will stretch to cover the whole community if proven successful. As observed, about 8% (424/5174) of the households in these six villages was selected for the baseline line study for which we present the results. At a later stage, Lungwena Demographic Health Survey (LDHS) was also conducted for a similar purpose. Sampling for DHS was based on the agriculture and environment sampling framework, but they included relatively a smaller sample of households (300). These smaller samples are not necessarily the same as those included in the baseline study, but with some overlapping.

The merged file with some overlapping households comprises of 78 cases based on the number of the matched cases from anthropometric data and baseline data. In fact, the initial number of cases for anthropometric data was 186. Thus, 108 children could not be included.

As shown in section 5.6 there are different sample sizes for different variables included in the analysis. Village’s characteristics have been compared using both community based primary and secondary data.
CHAPTER 6: RESULTS SECTION

6.1. VILLAGE CHARACTERISTICS: Community primary data
This section will cover information on six villages which were also included in the baseline survey conducted as part of the Lungwena Health, Nutrition and Agricultural Multidisciplinary Project: Towards Poverty Reduction. Three villages were categorized as intervention villages and the other three were categorized as control villages. The three intervention1 villages were Chapola, Chilonga and Mdala-Makumba while the three control villages were Milombwa, Ntumbula and Kwilasya. The villages were categorised into intervention and control groups to allow the project to introduce specific interventions in the three villages and to assess the impact of such interventions by comparing the two groups of villages. The presentation of the paper further groups the villages into lake and mountain side villages. Kwilasya and Mdala Makumba are situated very far from the lake, a distance greater than 6 kilometers. Below is the map showing villages involved in the NUFU project:

---

1 Farmers are given farm inputs and some food processing equipments from an agricultural college, Bunda college of Agriculture. They are also trained on how to follow land husbandry practices, animal husbandry and also food preparation on specific foods such as soy meat. Sanitary practices are also instructed.
Map of Lungwena and the villages: Legend see next page
Figure 6.1: Map of Lungwena: The study area showing villages involved in the NUFU Project surveys

LAKE SIDE VILLAGES

Chilonga

The village is not immune to hunger in times of erratic rains. Worse still, irrigation farming is non-existent in the village. Bunda College of Agriculture with support from the NUFU project has given goats, poultry and mango juice preparation equipment to the village.
**Production pattern**

While the majority of the people in the village practices subsistence farming, commercial farming is practiced by less than one quarter of the people. Like in all six villages, rainfall pattern is considered unreliable, according to chiefs and councillors. The rainy season lasts for 4 months in a year. While fishing, handicraft and beer brewing are not widely practiced, irrigation is not practiced at all. Fishing is the most common practice. There is no market place found in the area.

**Health pattern**

The health services available in the village include outreach clinics, traditional healers and Traditional Birth Attendants (TBAs). People found it easy to obtain medicine in the area and they expressed not to have experienced shortage of medicine. They also visit Lungwena Health Centre (LHC) when traditional health services seem not to be working for them.

**Transport system**

The village has muddy roads but also have access to the tarmac road. Muddy roads are mostly feeder roads and foot paths. The tarmac road is the secondary road that connects the whole community to Mangochi district. The transport system is divided between the lake and road. People mostly use bikes for transport. During acute sicknesses, they use what is known as *Chikuku* (a modified bike).

**Chapola**

The village gets some services from visiting organisations but they could not mention which these organisations were. Some of the services rendered by the organisations include water and sanitation and crop and animal husbandry. Involved in this is also the Ministry of Health (MoH) and Ministry of Agriculture (MoA) in collaboration with non governmental organisations (NGOs). The work performed by these organisations was considered very satisfactory. People in the villages were taught how to rear poultry and administer insecticides. The *mvu*, a wild animal, causes massive and persistent destruction of crops such as maize.
Production pattern
Many (50-75%) practices subsistence farming and a quarter of the households practices commercial farming. Rainfall is unreliable with an average period of 4 months. People do not practice irrigation farming even though they found it useful. Fishing is practiced by the majority of people while handicraft and beer brewing are rare practices. Sales from rice and cassava form an economic base for the people. A permanent market is available in the area.

Health pattern
The health services available in the village included outreach clinics, traditional healers and TBAs. However, it is not always easy to access medicine in times of abrupt sickness. Instead, have to travel to other places to access medication. Delays in procurement and delivery of essential medicines to treat for instance, malaria and diarrhoea, contributed to drug shortages.

Transport system
Access to the tarmac road is easy from the village. The tarmac road connects the community to Mangochi district. Most feeder and foot paths were muddy in nature. Road transport was the most common. Bicycles were the most used mode of transport, but also other means like private cars were common. Like in Chilonga, Chikuku was used in times of an abrupt sickness.

Ntumbula
The village head indicated no knowledge of the existence of organisations providing services to people in the village. Just like Chapola, government services prevail. Also, technical support given was sufficient.

Production pattern
More than three quarters of the people in the area practiced subsistence farming. Commercial farming was on the other hand practiced by few households. Rainfall was unreliable with an average of 4 months annually. Irrigation farming was not even practiced. The village had a lot mango trees providing sufficient fruit for household consumption when in season.
Fishing, beer brewing is practiced by less than one quarter of the people in the village. Maize sales and handicraft however are the main economic services taking place in the area. There is no market place in the area.

**Health pattern**

An outreach clinic, traditional healers and TBAs operated in the area for the health related programs. Medication is accessed easily by the people in the village.

**Transport system**

Road accessibility is difficult in the area. But they are also able to access the tarmac road close by. Road transport was common and bicycles are mostly used. During emergencies, sick people are taken to Lungwena Health Centre by the modified bike known as *Chikuku*.

**Milombwa**

The village is very underprivileged when it comes to services available. However, the village has groceries, wells and boreholes near it. It had some dambo land close by as well. Organisations found in the area include Ministry of Health (MoH) and Ministry of Agriculture (MoA) but no NGOs are present. They were somewhat satisfied with the way assistance was given.

**Production Pattern**

While commercial farming is practiced by less than 25% of the people, 75% it practices subsistence farming. Rainfall is unreliable and the period of annual average rainfall is about 3.5 months. Although irrigation was practiced, they did not find it satisfactory. Beer brewing, fishing and handcraft was practiced in less than 25% of the population. They sell fish to earn a living but on a very small scale. There is no permanent market available in the area.

**Health pattern**

There are no western types of health facility, save the availability of the outreach clinic activities. Traditional healers and Traditional Birth Attendants are otherwise the most available health services in the village. They do not find difficulties in accessing these traditional medicines.
Transport system
Muddy feeder roads are plenty and access to the tarmac road is not a problem in the area. Road transport is mostly used with the help of bicycles and cars. As in other villages, Chikuku is used to take the sick to Lungwena HC.

MOUNTAIN SIDE VILLAGES
Mdala Makumba
The village is very close to the foot of the mountain compared to the other villages. In terms of health services near to it, the community is catered to by traditional services; otherwise people have to visit the LHC, the like other communities. Groceries are the only nearest market service where they can access household necessities like salt and soap. The village is close to the forest reserve as well. Dambo wells and boreholes are also close by.

Apart from Lungwena primary school, this is the only village with a primary school within, and it also has a mosque. MoA and MoH also operate in the area. Services given were considered satisfactory.

Production pattern
While people in the area generally practice subsistence farming, commercial farming is practiced by very few households. Rainfall is unreliable occurring on an average of 3 months annually. Irrigation farming is practiced but people have not started reaping the benefits expected. Fishing, beer brewing and handicraft is practiced by less than 25% of the people in the village. Maize sales are the main economic activity taking place in the area. They do not have a market place in the area.

Health services
Traditional healers, TBAs and an outreach clinic operate in the area for health related programs. The village people interviewed do not know whether it is easy to access medication or not.

Transport system
Road accessibility is difficult in the area. There are muddy roads and access to the tarmac road is easy. Road transport is common and bicycles and cars are mostly used. During emergencies, sick people were taken to Lungwena Health Centre (LHC) by Chikuku.
**Kwilasya**

Like Mdala Makumba, the village is also rich in natural resources. It has a dambo, close to a forest reserve and a woodlot. It has a river, well, and boreholes close to it as well. Like many villages, schools attended are far away. MoH and MoA operate in the area but no NGOs. They are satisfied with the way assistance is given.

**Production pattern**

Like most but not all, subsistence farming is more common than commercial farming. Rainfall is unreliable with an average period of 2 months annually. Irrigation farming is practiced and people find the practice to work satisfactorily. Fishing and beer brewing are practiced in less than one quarter of the people, but handcraft is practised by more than 75% of the people. Sales of firewood, making *malichero* and *sungwi* are the main economic services found in the area. They do not have a market place in the area.

**Health pattern**

Regarding health services, traditional healers, TBAs and an outreach clinic operated in the area for health related programs. The village people do not regularly visit Lungwena Health centre and they find the process to get western medicines cumbersome.

**Transport system**

Road accessibility is difficult in the area. There are muddy roads and access to the tarmac road is difficult. Road transport is common and bicycles are mostly used. During emergencies, sick people are taken to Lungwena Health Centre (LHC) by *chikuku*.

---

1. *Weaving baskets made from reed like grass grown along water masses*
2. *Reed like grass grown along water masses for making various item collection baskets*
6.2. COMPARISONS BETWEEN VILLAGES

Figures 6.2 and 6.3 compare 6 villages in Lungwena community regarding access to water and other natural resources, and also some social services by indicating distances to facilities. We have presented services that are found in the villages or within reach in the village but also those that are accessed but are far from the village. The distances are estimated from each of the sampled households and thereafter the average distance for the village calculated. Some facilities or services could be found in one village but not in the other. It is also evident that some and not all are common in all the six villages. Figure 6.2 shows that Kwilasya had more services compared to other villages. On the other hand Milombwa was the most deprived.

![Graph showing mean distance in metres to natural resources by village.](image)

1=A piece of wetland used during the dry season for growing different crops and is water logged during the rainy season.

Facility non-existent

Figure 6.2: The availability and mean distance to access the natural resources in metres according to the village where they exist.
**Natural resources:** Woodlots are very important because they provide firewood for households in a sustainable way. In its absence, restricted places like forest reserves are penetrated to get firewood. Figure 6.2 tells us that woodlots are found in Kwilasya and Chilonga only. For many villages, the forest reserve was farther away. Distance to travel to get to the forest reserve in all villages is far beyond 500 metres. Boreholes\(^1\) are found in all villages and the distance falls within less than 500 metres.

**Social services:** Fig 6.3 shows that while Milombwa is the most deprived village, Chapola has plenty of social services within close reach than any other village. As observed from map for the villages, Fig. 6.1, Milombwa only has water sources and no forest reserves available.

---

\(^1\) Source of drinking water recommended by WHO in the rural and poor settings

---

**Figure 6.3:** The availability and distance to access the social services in metres according to the village where they exist.
Figure 6.3 not only indicates traditional healers to be common within all villages, but they also appear to be more close to the households than the government health centres. The distance from respective villages, except for Chapola, to LHC is substantially longer. For instance, the minimum distance is about 2 kilometers and maximum is about 13 kilometers.

As shown in the maps (Figure 6.1), there are no nursery and secondary schools in any of the villages. However, where Madras\(^1\) schools exist they are situated within the villages. Figure 6.3 shows that primary schools are accessed in many but not all villages. Apart from Mdala Makumba, all other villages access schools only outside their own village, and these are either at Lungwena or Mtengeza primary school.

Groceries (shops) are available in almost all villages and at close distance. As shown in the village maps (Figure 6.1), seasonal markets are non existent in all villages and a permanent market is only found in Lungwena trading centre in Chowe village, a village outside the six villages.

**Comparing mountain and Lake:** Figure 6.4 shows the availability and mean distances to access the available resources in the groups of lake and mountain villages. There are in general as many services along the lake as in the mountain, except for the fish dock which is found only on the lake side. Despite the universal existence, facilities in the mountain are considerably further away compared to the lake. Traditional healers are easily accessed in all villages and in less than 500 metres compared to the health centre from which basic western health services are provided.

\(^1\) It is a school where Moslems learn their Islamic values and principles
Comparing intervention and control villages: Figure 6.5 shows the availability and mean distances to access the available resources in the intervention and control villages. There are in general as many services within the intervention villages as in the control, except for the fish dock which is found only within intervention villages. Despite the universal existence, facilities such as the primary school and the health centre in the control are considerably further away compared to the intervention group. Traditional healers are easily accessed in both groups and in less than 500 metres compared to the health centre from which formal health services are provided.

Figure 6.4: Mean distance and availability of facilities according to lake and mountain areas
Figure 6.5: mean distance and availability of facilities according to intervention and control villages

= Facility not available
6.3 COMPARISON OF SAMPLES

Describing different samples

Table 6.1 below compares some household characteristics of the total sample in the baseline survey against a total sample in a merged file, which is between baseline sample and the Lungwena Demographic and Health Survey (anthropometry). Not all anthropometric data were collected from the households which participated in the baseline study. This made it impossible to have complete matching cases for all children with anthropometric measures. The mean age of the household heads dropped from 42.8 percent to 34.4 percent. The percent of female headed household also dropped from 34 percent to 24 percent. However, the mean socio-economic status remained the same while mean number of years spent on schooling differed slightly between the two groups. The sustained mean value for SES and number of years spent schooling gives hope for some comparisons. The association between nutritional status and various variables were based on the 78 households. In ten households, two children from the same households have been included in the analysis. When the older children in these ten households were excluded from the merged file, none of the variables was found significant at p=0.05, but when included some were found significant at the same significance level. The absence of an overlap between the households included in the anthropometric survey (LDHS) and the baseline household survey was due to method of sampling. This entailed including a certain percentage of households of children under five by a random method and not going back to the households identified in the household survey.

Table 6.1: Comparison between a baseline sample and the merged file from baseline and LDHS surveys

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Baseline (n=424)</th>
<th>Merged file (n=78)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age HHD</td>
<td>42.8</td>
<td>34.4</td>
</tr>
<tr>
<td>SES mean</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Education(mean years)</td>
<td>1.6</td>
<td>2.2</td>
</tr>
<tr>
<td>% FHHD¹</td>
<td>33.5</td>
<td>24.4</td>
</tr>
</tbody>
</table>

¹=Female headed households
6.4 RESULTS FROM HOUSEHOLD SURVEY

6.4.1 Demographic information

The mean household size in the study area was 5 persons. The minimum number of years of schooling of household head was zero and the maximum was 14 while mean was 1.6. The mean age of children assessed in the survey was 30.4 (±16.2) months. The minimum age of children was 5 months and maximum was 60 months.

Table 6.2 shows the distribution of some socio-demographic factors within the lake and mountain villages in the Lungwena community.

Table 6.2: Distribution of household characteristics

<table>
<thead>
<tr>
<th></th>
<th>Lake³ (n=258)</th>
<th>Mountain³ (n=166)</th>
<th>Milombwa Chilonga (n=36)</th>
<th>Chapola (n=123)</th>
<th>Chilonga (n=28)</th>
<th>Ntumbula (n=71)</th>
<th>Mdala (n=62)</th>
<th>Makumba (n=104)</th>
<th>Kwilasya (n=104)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender of hhd¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>69.0</td>
<td>62.7</td>
<td>58.3</td>
<td>66.7</td>
<td>75.0</td>
<td>76.1</td>
<td>62.9</td>
<td>62.5</td>
<td></td>
<td>66.5</td>
</tr>
<tr>
<td>Female</td>
<td>31.0</td>
<td>37.3</td>
<td>41.7</td>
<td>33.3</td>
<td>25.0</td>
<td>23.9</td>
<td>37.1</td>
<td>37.5</td>
<td></td>
<td>33.5</td>
</tr>
<tr>
<td>Marital status of h.hd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>29.8</td>
<td>25.3</td>
<td>36.1</td>
<td>31.7</td>
<td>25.0</td>
<td>25.4</td>
<td>21.0</td>
<td>27.9</td>
<td></td>
<td>28.1</td>
</tr>
<tr>
<td>Married</td>
<td>70.2</td>
<td>74.7</td>
<td>63.9</td>
<td>68.3</td>
<td>75.0</td>
<td>74.6</td>
<td>79.0</td>
<td>72.1</td>
<td></td>
<td>71.9</td>
</tr>
<tr>
<td>Age of f². members</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 15 years</td>
<td>n=1139</td>
<td>n=748</td>
<td>n=495</td>
<td>n=139</td>
<td>n=341</td>
<td>n=280</td>
<td>n=468</td>
<td>n=1987</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50.2</td>
<td>52.7</td>
<td>51.2</td>
<td>48.1</td>
<td>51.8</td>
<td>52.2</td>
<td>50.7</td>
<td>53.8</td>
<td></td>
<td>51.2</td>
</tr>
<tr>
<td>15-49 years</td>
<td>39.6</td>
<td>38.9</td>
<td>39.6</td>
<td>40.0</td>
<td>39.6</td>
<td>39.0</td>
<td>41.8</td>
<td>37.2</td>
<td></td>
<td>39.3</td>
</tr>
<tr>
<td>≥50 years</td>
<td>10.2</td>
<td>8.4</td>
<td>9.1</td>
<td>11.9</td>
<td>8.6</td>
<td>8.8</td>
<td>7.5</td>
<td>9.0</td>
<td></td>
<td>9.5</td>
</tr>
</tbody>
</table>

¹ Means head of the household  ² Family

The term ‘lake and mountain’ refer to a general grouping of villages in the subsequent columns as follows: 3 includes Milombwa, Chapola, Chilonga and Ntumbula; 4 includes Mdala Makumba and Kwilasya

Gender of the household head: According to Table 6.2, there were a higher percentage of male headed households in the lake than in the mountain and only about one third of the household heads are female. In general villages in the mountainous area had more female headed households than villages in the lake shore area.

Marital status of the household head: In total the community had a higher percentage of married household heads than singles. The mountain villages had more married household heads however.
**Age of household members:** About half of the household members in both the lake and mountain in Lungwena were less than fifteen years old. Forty percent of the family members in the area were in a productive age bracket (15-49).

### 6.4.2 Socio-economic situation of the households

Table 6.3 shows the distribution of socio-economic factors within the lake and mountain villages in Lungwena community.

<table>
<thead>
<tr>
<th>Economic activity of household head</th>
<th>Lake (n=258)</th>
<th>Mountain (n=166)</th>
<th>Milombwa (n=36)</th>
<th>Chapola (n=123)</th>
<th>Chilonga (n=28)</th>
<th>Ntumbula (n=71)</th>
<th>Mdala Makumba (n=62)</th>
<th>Kwilasya (n=104)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer</td>
<td>67.8</td>
<td>84.3</td>
<td>61.8</td>
<td>71.4</td>
<td>69</td>
<td>77.4</td>
<td>88.5</td>
<td></td>
</tr>
<tr>
<td>Fisherman</td>
<td>19.4</td>
<td>2.4</td>
<td>13.9</td>
<td>23.6</td>
<td>25.0</td>
<td>12.7</td>
<td>1.6</td>
<td>2.9</td>
</tr>
<tr>
<td>Skilled job</td>
<td>5.8</td>
<td>7.8</td>
<td>0</td>
<td>8.9</td>
<td>0</td>
<td>5.6</td>
<td>16.1</td>
<td>2.9</td>
</tr>
<tr>
<td>Unskilled work</td>
<td>3.5</td>
<td>3.0</td>
<td>2.8</td>
<td>4.1</td>
<td>0</td>
<td>4.2</td>
<td>1.6</td>
<td>3.8</td>
</tr>
<tr>
<td>Under age</td>
<td>1.2</td>
<td>0</td>
<td>1.6</td>
<td>0</td>
<td>1.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Business</td>
<td>1.6</td>
<td>2.4</td>
<td>0</td>
<td>0</td>
<td>3.6</td>
<td>4.2</td>
<td>3.2</td>
<td>1.9</td>
</tr>
<tr>
<td>Not applicable</td>
<td>0.8</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.8</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education of hhd</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>67.1</td>
<td>66.9</td>
<td>63.9</td>
<td>65.9</td>
<td>71.4</td>
<td>69</td>
<td>58.1</td>
</tr>
<tr>
<td>School</td>
<td>32.9</td>
<td>33.1</td>
<td>36.1</td>
<td>34.1</td>
<td>28.6</td>
<td>31</td>
<td>41.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SES (mean=1.7)</th>
<th>n=246</th>
<th>n=163</th>
<th>n=32</th>
<th>n=118</th>
<th>n=27</th>
<th>n=69</th>
<th>n=60</th>
<th>n=103</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>43.5</td>
<td>43.6</td>
<td>40.6</td>
<td>42.4</td>
<td>44.4</td>
<td>46.4</td>
<td>33.3</td>
<td>49.5</td>
</tr>
<tr>
<td>Medium</td>
<td>38.2</td>
<td>34.4</td>
<td>31.3</td>
<td>42.4</td>
<td>40.7</td>
<td>33.3</td>
<td>33.3</td>
<td>35</td>
</tr>
<tr>
<td>High</td>
<td>18.3</td>
<td>22.1</td>
<td>28.1</td>
<td>15.3</td>
<td>14.8</td>
<td>20.3</td>
<td>33.3</td>
<td>15.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plot size(mean=2.2)</th>
<th>n=260</th>
<th>n=163</th>
<th>n=40</th>
<th>n=120</th>
<th>n=29</th>
<th>n=71</th>
<th>n=61</th>
<th>n=102</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤1 ha²</td>
<td>21.9</td>
<td>18.4</td>
<td>30</td>
<td>22.5</td>
<td>13.8</td>
<td>19.7</td>
<td>9.8</td>
<td>23.5</td>
</tr>
<tr>
<td>&gt;1 ha²-&lt;2 ha</td>
<td>21.9</td>
<td>27.6</td>
<td>20</td>
<td>16.7</td>
<td>20.7</td>
<td>32.4</td>
<td>26.2</td>
<td>28.4</td>
</tr>
<tr>
<td>2 ha -2.5 ha</td>
<td>30.4</td>
<td>31.3</td>
<td>32.5</td>
<td>31.7</td>
<td>27.6</td>
<td>28.2</td>
<td>31.1</td>
<td>31.4</td>
</tr>
<tr>
<td>&gt; 2.5 ha</td>
<td>25.8</td>
<td>22.7</td>
<td>17.5</td>
<td>29.2</td>
<td>37.9</td>
<td>19.7</td>
<td>32.8</td>
<td>16.7</td>
</tr>
</tbody>
</table>

1=Socioeconomic status; 2=hectare (unit of measurement for plot sizes)

**Economic activity:** Farming is the most practiced economic activity in both the lake and the mountain villages, represented by 67.8% and 84.3% respectively. We noted however that there is a marked difference in fishing practice between the lake and the mountain where 19.4% and 2.4% are observed to practice this activity respectively. The highest proportion of household heads (88.5%) was found in Kwilasya and these
were farmers. Very few people did business in the lake and mountain village groups. The lowest proportion is found in the mountain villages where the practice ranged from 1.6 percent to 2.9 percent for Mdala and Kwilasya respectively. Milombwa and Ntumbula had a lower proportion of households in fishing compared to the other two villages along the lake.

*Education:* The level of education is generally very low in the Lungwena. In both the lake and mountain groups, about 67% of the household heads had not been to school. With the presence of a primary school in Mdala Makumba, it is not surprising that there was a higher proportion of people who have been to school in the village.

*Socio-economic status (SES):* As observed in many variables of interest, Table 6.3 shows small differences between the Lake and the Mountain regarding economic status based on selected assets owned. In both, about 43% of the population had a low SES while 18% and 22% of the population for the lake and mountain respectively had a high SES. On average, a close-to-medium SES score of 1.7 was observed. The proportion of high SES is relatively larger in Milombwa and Mdala Makumba. Notwithstanding, equal proportions of wealth across the three SES groups is observed in Mdala Makumba village.

**Plot size**

Land holding size for each household member was assessed, but only the distribution of the mean household size within four categories is reported here. Table 6.3 shows a small difference in the distribution of land holding size between the lake and the mountain, in which about 22% and 18% of the households respectively own land less than or equal to one hectare. Apparently, Mdala Makumba and Chilonga had the lowest proportions of households owning land equal or less than one hectare (9.8% and 13% respectively). These villages had also the most uneven distribution of land and about one third owned more than 2.5 hectare of land. Generally, household land ownership is relatively large. For instance, about half of the households owned more than two hectares. The mean plot size in the area was 2.2 hectares.
Source of credit

Figure 6.6 indicates that most households (88.8%) did not have access to credit. The source for the fortunate few was in majority from relatives or friends, 6.4% and 4.3% respectively. Very few households had access to NGOs credit facility.

![Source of credit chart]

Figure 6.6: Percent (%) of households by source of credit

6.4.3 Socio-economic difference between the intervention and the control

Table 6.4 below describes the distribution of socio-demographic and socio-economic factors between the control and the intervention villages. There are marked differences between the two groups. The proportions of the gender of the household head do not change between the two groups; about 66% for the males and 33% for females. A higher percentage of heads of the house heads were farmers for both the intervention (68%) and the control (81%). There are proportionally more fishermen in the intervention (17%) than in the control (8%). The control group has a higher proportion of single headed households (72%) compared to 28% for the intervention.
group. The percentage distribution of household heads without education, with low SES and with a plot size of one hectare or less is relatively higher in the control group than in the intervention group.

Table 6.4: Distribution Socio-demographic and socio-economic characteristics between the control and intervention villages

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Intervention (n=213) %</th>
<th>Control (n=211) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer</td>
<td>67.6</td>
<td>81.0</td>
</tr>
<tr>
<td>fisherman</td>
<td>17.4</td>
<td>8.1</td>
</tr>
<tr>
<td>Skilled worker</td>
<td>9.9</td>
<td>3.3</td>
</tr>
<tr>
<td>Unskilled worker</td>
<td>2.8</td>
<td>3.8</td>
</tr>
<tr>
<td>Under age</td>
<td>0.9</td>
<td>0.5</td>
</tr>
<tr>
<td>Business</td>
<td>1.4</td>
<td>2.4</td>
</tr>
<tr>
<td>NA</td>
<td>0</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Gender of hhd

<table>
<thead>
<tr>
<th>Gender</th>
<th>Intervention (n=213)</th>
<th>Control (n=211)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>66.7</td>
<td>66.4</td>
</tr>
<tr>
<td>Female</td>
<td>33.3</td>
<td>33.6</td>
</tr>
</tbody>
</table>

Marital status

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Intervention (n=213)</th>
<th>Control (n=211)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>73.3</td>
<td>28.4</td>
</tr>
<tr>
<td>Single</td>
<td>27.7</td>
<td>71.6</td>
</tr>
</tbody>
</table>

Education

<table>
<thead>
<tr>
<th>Education</th>
<th>Intervention (n=213)</th>
<th>Control (n=211)</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>35.7</td>
<td>30.3</td>
</tr>
<tr>
<td>None</td>
<td>64.3</td>
<td>69.7</td>
</tr>
</tbody>
</table>

SES

<table>
<thead>
<tr>
<th>SES</th>
<th>Intervention (n=213)</th>
<th>Control (n=211)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>40.0</td>
<td>47.1</td>
</tr>
<tr>
<td>Medium</td>
<td>39.5</td>
<td>33.8</td>
</tr>
<tr>
<td>High</td>
<td>20.5</td>
<td>19.1</td>
</tr>
</tbody>
</table>

Plot size

<table>
<thead>
<tr>
<th>Plot size</th>
<th>Intervention (n=213)</th>
<th>Control (n=211)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 1 ha</td>
<td>17.6</td>
<td>23.5</td>
</tr>
<tr>
<td>&gt; 1 ha-&lt; 2ha</td>
<td>20.0</td>
<td>28.2</td>
</tr>
<tr>
<td>2 ha-2.5 ha</td>
<td>31.0</td>
<td>30.5</td>
</tr>
<tr>
<td>&gt; 2.5 ha</td>
<td>31.4</td>
<td>17.8</td>
</tr>
</tbody>
</table>

6.4.4. Water and sanitation

Pit latrine Availability

According to Table 6.5, there is a slight difference between the mountain and lake in the proportion of households having no pit latrines. Milombwa registers a highest percentage of households without pit latrines while Chapola registers the lowest.

---

8 hhd=household head
Traditional pit latrines were the most common type of pit latrines in the villages. The lake and mountain villages show about the same proportion of traditional pit latrines. Except for Milombwa, all other villages showed some pockets of Improved pit latrine with sanplat\(^9\). Generally, all villages except for Chapola lacked ventilated improved pit latrines.

Table 6.5: Proportion (%) of households by type of pit latrine

<table>
<thead>
<tr>
<th>Type of pit latrine</th>
<th>Lake (n=253)</th>
<th>Mountain (n=167)</th>
<th>Milombwa (n=36)</th>
<th>Chapola (n=118)</th>
<th>Chilongwa (n=29)</th>
<th>Ntumbula (n=70)</th>
<th>Mdala Makumb a (n=63)</th>
<th>Kwilasya (n=104)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No pit latrine</td>
<td>12.6%</td>
<td>13.8%</td>
<td>30.6%</td>
<td>5.1%</td>
<td>27.6%</td>
<td>10.0%</td>
<td>17.5%</td>
<td>11.5%</td>
</tr>
<tr>
<td>TP(^1)</td>
<td>85.4%</td>
<td>83.8%</td>
<td>69.4%</td>
<td>92.4%</td>
<td>69.0%</td>
<td>88.6%</td>
<td>79.4%</td>
<td>86.5%</td>
</tr>
<tr>
<td>IPS(^2)</td>
<td>1.2%</td>
<td>2.4%</td>
<td>0.8%</td>
<td>3.4%</td>
<td>1.4%</td>
<td>0.0%</td>
<td>3.2%</td>
<td>1.9%</td>
</tr>
<tr>
<td>VIP(^3)</td>
<td>0.8%</td>
<td>0.0%</td>
<td>1.7%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

1=Traditional pit latrine, 2=Improved pit latrine with san plat, 3=Venerated Improved pit latrine

**Water sources**

The information regarding the proportion of households using particular sources of drinking water is presented in Figure 6.7. The use of boreholes was common among all villages and in almost similar proportions with no differences among the lake and the mountainous villages. Uniquely, a relatively good proportion of households in Kwilasya, a mountainous village, drank water from the river.

\(^9\) A concrete latrine slab that can be integrated into any existing traditional latrine system
Figure 6.7: Source for drinking water by village

Distance to drinking water source

This part describes Table 6.6 and 6.7. About forty one percent of the households along the lake have less than 50 metres to collect water while below half (19.8%) of the households have similar distances in the mountains. A higher percentage of households (35.7%) in the intervention category travel less than 50 metres compared to 26.2% for the control category. The control villages have a higher percentage of households traveling more than 50 metres to a drinking water source. Chapola had the largest proportion of households with water source close by. It is also noted that in all villages 50-200 metres is the most prevalent distance to drinking water. Fewer households across the villages travel a distance of over 500 metres.

Table 6.6: Proportion (%) of households according to distances to the water source

<table>
<thead>
<tr>
<th>Metres</th>
<th>Lake (n=218)</th>
<th>Mountain (n=202)</th>
<th>Milombwa (n=36)</th>
<th>Chapola (n=119)</th>
<th>Chilonga (n=29)</th>
<th>Ntumbula (n=70)</th>
<th>Mdala Makumba (n=62)</th>
<th>Kwilasya (n=104)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>&lt;50</td>
<td>41.3</td>
<td>19.8</td>
<td>30.6</td>
<td>48.7</td>
<td>24.1</td>
<td>35.7</td>
<td>16.1</td>
<td>18.3</td>
</tr>
<tr>
<td>50-200</td>
<td>39.4</td>
<td>51.0</td>
<td>52.8</td>
<td>34.5</td>
<td>44.8</td>
<td>45.7</td>
<td>62.9</td>
<td>43.3</td>
</tr>
<tr>
<td>200-500</td>
<td>15.1</td>
<td>23.3</td>
<td>16.7</td>
<td>12.6</td>
<td>24.1</td>
<td>15.7</td>
<td>16.1</td>
<td>29.8</td>
</tr>
<tr>
<td>500-1000</td>
<td>3.7</td>
<td>5.0</td>
<td>0</td>
<td>4.2</td>
<td>3.4</td>
<td>2.9</td>
<td>4.8</td>
<td>6.7</td>
</tr>
<tr>
<td>&gt;1000</td>
<td>0.5</td>
<td>1.0</td>
<td>0</td>
<td>0</td>
<td>3.4</td>
<td>0</td>
<td>0</td>
<td>1.9</td>
</tr>
</tbody>
</table>
Table 6.7: Proportion (%) of households according to distances to the water source

<table>
<thead>
<tr>
<th>Metres</th>
<th>Intervention(n=210)</th>
<th>Control(n=210)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50</td>
<td>35.7</td>
<td>26.2</td>
</tr>
<tr>
<td>50-200</td>
<td>44.3</td>
<td>45.7</td>
</tr>
<tr>
<td>200-500</td>
<td>15.2</td>
<td>22.9</td>
</tr>
<tr>
<td>500-1000</td>
<td>4.3</td>
<td>4.3</td>
</tr>
<tr>
<td>&gt;1000</td>
<td>0.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>

6.5 CHILD CHARACTERISTICS: THE UNDER FIVE

Nutritional status according to biological characteristics

Table 6.8 shows that there are more boys in youngest age category than females. But there are more girls in the oldest children (42.2 %) compared to boys (32.1%). In both the lake and mountain groups, the proportion of children increases with an increase in age. Notably, there were more children above 2 years in the mountain than in the lake villages.

Table 6.8: Distribution of children in age groups according to gender and location

<table>
<thead>
<tr>
<th>Age group in months</th>
<th>Male (n=84)</th>
<th>Female (n=102)</th>
<th>Lake (n=124)</th>
<th>Mountain (n=62)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>≤ 12</td>
<td>20.2</td>
<td>14.7</td>
<td>21.0</td>
<td>9.7</td>
</tr>
<tr>
<td>&gt; 12-≤24</td>
<td>26.2</td>
<td>23.5</td>
<td>25.0</td>
<td>24.2</td>
</tr>
<tr>
<td>&gt; 24-≤36</td>
<td>21.4</td>
<td>19.6</td>
<td>16.9</td>
<td>27.4</td>
</tr>
<tr>
<td>&gt;36</td>
<td>32.1</td>
<td>42.2</td>
<td>37.1</td>
<td>38.7</td>
</tr>
</tbody>
</table>

The proportion of undernutrition in males and females assessed by <2 -z-scores for height for age, weight for age and weight for height is summarized in figure 6.8. The results from this figure indicate that a higher percent of female children have low weight for height and low weight for age respectively. The difference between the boys and girls is not significant (95% CI). The proportion of stunted children is the same between male and female children.
Figures 6.8, 6.9, 6.10 and 6.11 show the proportion of children with moderate (<-2 Z-score) and severe (<-3 Z-score) stunting for (height for age) and underweight (weight for age) according to the villages as well as lake and mountain in which these children belong. Note that Chilonga village was not included when analyzing anthropometric data because it had very few cases for comparison. Thus, only five villages have been considered where nutritional status is compared across villages.
Figure 6.9: Height for age

*Stunting:* In Figure 6.9, the proportion of children with stunting was higher in the mountain than in the lake with about 38 percent in the mountain and 29 percent in the lake, but not significantly different ($p=0.12$). Actually, it seems from the figure that the lake had almost double (12%) the proportion of severe stunting compared to 6% for the mountain. Notably, Milombwa had the highest percentage of infants with severe stunting. Except for Milombwa, severe stunting remained constant across villages.
Underweight: Figure 6.10 shows the relative proportions of moderate and severe underweight of the lake and mountain, but also among villages.

![Weight for age](image)

**Figure 6.10: Weight for age**

Figure 6.10 shows that both the proportions of moderate and severe underweight were similar in the lake and the mountain. Milombwa was by far the worst in both moderate (21%) and severe (19%) underweight children. For the other villages, the distribution of underweight levels was proportionally similar.
Wasting: Figure 6.11 shows the relative proportions of moderately and severely wasted children in the lake and mountain but also among villages.

![Figure 6.11: Weight for height](image)

**Figure 6.11: Weight for height**
A similar proportion of severely (3%) wasted children was observed between the lake and the mountain but the total percentage of wasted children were higher in the lake villages due to a higher percentage of children moderately wasted. Among the villages, Chapola had the highest proportion of wasted children, most of them being moderately wasted. All the children in Milombwa and most children in Mdala Makumba were severely wasted.

**Intervention and control villages:** Table 6.8 below describes the proportions of undernutrition between the control and the intervention group. The results show some differences between the two groups. However, the differences were not significantly different at p>0.05, except for wasting, as shown in Table 6.8. Yet, the percentage of wasted children in the intervention villages were more than double that of control villages and difference was significant at p=0.04.

<table>
<thead>
<tr>
<th>Category</th>
<th>Stunting</th>
<th>Underweight</th>
<th>Wasting</th>
<th>Total N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>33.7</td>
<td>19.1</td>
<td>5.9</td>
<td>89</td>
</tr>
<tr>
<td>Control</td>
<td>29.9</td>
<td>23.7</td>
<td>2.2</td>
<td>97</td>
</tr>
</tbody>
</table>

Table 6.8: Nutritional status according to intervention and control villages groups

---

n=183
Anaemia prevalence

Low levels of haemoglobin are classified into mild (10.0-10.9g/dl), moderate (7.0-9.9g/dl) and severe (<7.0g/dl) anaemia. Figure 6.12 below describes the distribution between the categories of anemia.

![Figure 6.12: Severity of hemoglobin prevalence](image)

Table 6.12 shows that the proportions within the different levels of anaemia in children did not vary widely between the lake and the mountain. There were small variations across villages regarding the proportion of children with mild anaemia. However, differences in severe forms of anaemia were relatively pronounced. Proportionally, more children were moderately anaemic, but Milombwa and Kwilasya differed much in percentages with other villages. Milombwa had the highest proportion of children with severe anaemia. Mdala Makumba had the highest total proportion of children with anaemia compared to any of the villages; in which about ninety percent were found to be anemic. The prevalence of anaemia among the under five children in Lungwena is about 79 percent (*Table not shown*).

**Exclusive breast feeding:** As seen in Figure 6.13 below, the majority of women in Lungwena reported that they breast feed their babies exclusively for 6 months. Close to half of the women reported to have significantly breast fed exclusively their babies, with 95% CI, for 6 months and 15% for period between 4-5 months.
According to Table 6.9, slightly above half and about 40% of mothers along the lake and in the mountain, respectively, reported to have exclusively breast feed their babies for 6 months. At the other extreme, exclusive breast feeding for less than 4 months was similar between the lake and the mountain. Milombwa had a disproportionately higher proportion of babies exclusively breast fed for 6 months or more (75%) than other villages. Half of the mothers in Chilonga reported exclusive breast feeding for 6 months. Significantly, about 47% mothers in the total sample reported breast feeding their babies exclusively for six months compared to those breast feeding less or more than 6 months.
Table 6.9: Percent of exclusive breast feeding period in months by villages

<table>
<thead>
<tr>
<th>Months</th>
<th>Lake %</th>
<th>Mountain %</th>
<th>Milombwa %</th>
<th>Chilonga %</th>
<th>Ntumbula %</th>
<th>Mdala %</th>
<th>Kwilasya %</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4</td>
<td>21.0</td>
<td>22.4</td>
<td>12.5</td>
<td>50.0</td>
<td>21.4</td>
<td>18.8</td>
<td>26.9</td>
<td>21.7</td>
</tr>
<tr>
<td>4-5</td>
<td>24.2</td>
<td>37.9</td>
<td>12.5</td>
<td>0.0</td>
<td>31.0</td>
<td>40.6</td>
<td>34.6</td>
<td>30.8</td>
</tr>
<tr>
<td>6-7</td>
<td>54.8</td>
<td>39.7</td>
<td>75.0</td>
<td>50.0</td>
<td>47.6</td>
<td>40.6</td>
<td>38.5</td>
<td>47.5</td>
</tr>
</tbody>
</table>

Vaccination status

Close to 61% of children at the lake side had incomplete immunization (Table 6.10). Milombwa had the worst immunization status among the infants along the lake while Ntumbula registers better status among children. Villages close to the mountains have a higher level of incomplete immunizations (85.9% of the 64 children). For instance, about 88% of children in Mdala Makumba had poor immunization status compared to 83% of the children in Kwilasya.

Table 6.10: Percent (%) of households by vaccination status

<table>
<thead>
<tr>
<th>Immunization</th>
<th>Lake: n=124</th>
<th>Mountain: n=64</th>
<th>Milombwa: n=18</th>
<th>Chapola: n=55</th>
<th>Chilonga: n=5</th>
<th>Ntumbula: n=46</th>
<th>Mdala Makumba: n=34</th>
<th>Kwilasya: n=102</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete</td>
<td>61.3%</td>
<td>85.9%</td>
<td>77.8%</td>
<td>69.1%</td>
<td>60.0%</td>
<td>45.7%</td>
<td>88.2%</td>
<td>83.3%</td>
<td>69.7%</td>
</tr>
<tr>
<td>Complete</td>
<td>38.7%</td>
<td>14.1%</td>
<td>22.2%</td>
<td>30.9%</td>
<td>40.0%</td>
<td>54.3%</td>
<td>11.8%</td>
<td>16.7%</td>
<td>30.3%</td>
</tr>
</tbody>
</table>

6.6: FACTORS RELATED TO NUTRITIONAL STATUS

In Lungwena, about thirty one and twenty three percent of the under five children were stunted and underweight. Substantially, there are marked differences in nutritional status between male children and female children have a higher proportion of underweight (Table 6.11). Furthermore, stunting and underweight vary substantially across subgroups of children. Living in the mountain, female headed households, households with married couples, household head age more than or equal 30 years old, households with low socioeconomic status, household heads who had not been to school, immunizations less than eight, without pit latrines, older and
female children and longer periods of exclusive breast feeding were more likely to have stunted and underweight children. Children from households where head of the household is a farmer were more likely to be stunted than those from households with different occupation.

The effect sizes of different variables on height for age and weight for age have also been presented in Table 6.11a and 6.11b and described in this section. The odds ratio are generally small for many variables but have been presented. Children from households with a low SES were 2.5 times likely to be underweight. Household heads not having attended any school, age of the child, exclusively breast feeding for more than 6 months, household without pit latrines however showed a higher likelihood for the child to be both stunted and underweight. Children older than two years had a significant likelihood of being stunted. It is also somewhat likely for a child to be stunted if it is male. In addition, household heads older or equal to 30 years, being a farmer, children with incomplete immunization were more likely to be stunted.
Table 6.11a: Factors associated with height for age (stunting) and weight for age (Underweight) in the bivariate analysis

<table>
<thead>
<tr>
<th>Background factors</th>
<th>N</th>
<th>%</th>
<th>OR</th>
<th>95% CI</th>
<th>%</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land profile</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mountain</td>
<td>62</td>
<td>37.1</td>
<td>1.4</td>
<td>0.8-2.7</td>
<td>21.0</td>
<td>1.0</td>
<td>0.5-2.0</td>
</tr>
<tr>
<td>Lake</td>
<td>124</td>
<td>29.0</td>
<td>1.0</td>
<td>0.5-2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Village group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention</td>
<td>89</td>
<td>33.7</td>
<td>1.2</td>
<td>0.6-2.2</td>
<td>19.1</td>
<td>0.8</td>
<td>0.4-1.5</td>
</tr>
<tr>
<td>Control</td>
<td>97</td>
<td>29.9</td>
<td>1.0</td>
<td>1.0</td>
<td>23.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gender of hhd</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>19</td>
<td>47.4</td>
<td>2.2</td>
<td>0.8-6.4</td>
<td>31.6</td>
<td>1.4</td>
<td>0.4-4.1</td>
</tr>
<tr>
<td>Male</td>
<td>59</td>
<td>28.8</td>
<td>1.0</td>
<td>1.0</td>
<td>25.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>62</td>
<td>35.5</td>
<td>1.7</td>
<td>0.5-5.7</td>
<td>27.4</td>
<td>1.1</td>
<td>0.3-4.1</td>
</tr>
<tr>
<td>Single</td>
<td>16</td>
<td>25.0</td>
<td>1.0</td>
<td>1.0</td>
<td>25.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Parental age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥30 years</td>
<td>25</td>
<td>44.0</td>
<td>1.7</td>
<td>0.2-1.6</td>
<td>24.0</td>
<td>0.8</td>
<td>0.2-2.4</td>
</tr>
<tr>
<td>≤29 years</td>
<td>53</td>
<td>32.1</td>
<td>1.0</td>
<td>1.0</td>
<td>28.3</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Education status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No school</td>
<td>47</td>
<td>36.2</td>
<td>1.4</td>
<td>0.5-3.7</td>
<td>34.0</td>
<td>2.6</td>
<td>0.8-8.3</td>
</tr>
<tr>
<td>School</td>
<td>31</td>
<td>29.0</td>
<td>1.0</td>
<td>1.0</td>
<td>16.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmer</td>
<td>47</td>
<td>38.3</td>
<td>1.8</td>
<td>0.7-4.7</td>
<td>25.5</td>
<td>0.8</td>
<td>0.3-2.3</td>
</tr>
<tr>
<td>Otherwise</td>
<td>31</td>
<td>25.8</td>
<td>1.0</td>
<td>1.0</td>
<td>29.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Plot size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥2 hectare</td>
<td>38</td>
<td>35.9</td>
<td>1.2</td>
<td>0.4-3.1</td>
<td>28.2</td>
<td>1.1</td>
<td>0.4-3.0</td>
</tr>
<tr>
<td>&lt;2 hectare</td>
<td>39</td>
<td>31.6</td>
<td>1.0</td>
<td>1.0</td>
<td>26.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Socioeconomic status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>26</td>
<td>38.5</td>
<td>1.5</td>
<td>0.5-3.9</td>
<td>38.5</td>
<td>2.5</td>
<td>0.9-7.1</td>
</tr>
<tr>
<td>High</td>
<td>50</td>
<td>30.0</td>
<td>1.0</td>
<td>1.0</td>
<td>20.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pit latrines in use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not in use</td>
<td>8</td>
<td>50.0</td>
<td>2.2</td>
<td>0.5-9.5</td>
<td>50.0</td>
<td>3.1</td>
<td>0.7-13.8</td>
</tr>
<tr>
<td>In use</td>
<td>70</td>
<td>31.4</td>
<td>1.0</td>
<td>1.0</td>
<td>24.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6.11b: Factors associated with height for age (stunting) and weight for age (underweight) in the bivariate analysis (Continued from Table 6.11a)

<table>
<thead>
<tr>
<th>Background factors</th>
<th>N</th>
<th>%</th>
<th>OR</th>
<th>95% CI</th>
<th>%</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water source</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borehole</td>
<td>75</td>
<td>50.0</td>
<td>2.0</td>
<td>0.3-15.0</td>
<td>25.0</td>
<td>0.9</td>
<td>0.1-8.7</td>
</tr>
<tr>
<td>River</td>
<td>4</td>
<td>33.3</td>
<td>1</td>
<td>28.0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Immunization status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incomplete</td>
<td>94</td>
<td>36.7</td>
<td>1.3</td>
<td>0.6-2.6</td>
<td>20.2</td>
<td>1.1</td>
<td>0.5-2.6</td>
</tr>
<tr>
<td>Complete</td>
<td>60</td>
<td>26.7</td>
<td>1</td>
<td>18.3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Exclusive breast feeding</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 6 months</td>
<td>49</td>
<td>36.7</td>
<td>1.8</td>
<td>0.8-4.5</td>
<td>22.4</td>
<td>1.6</td>
<td>0.6-4.6</td>
</tr>
<tr>
<td>&lt; 6 months</td>
<td>46</td>
<td>23.9</td>
<td>1</td>
<td>15.2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sex of the child</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>84</td>
<td>34.5</td>
<td>1.3</td>
<td>0.7-2.4</td>
<td>16.7</td>
<td>0.6</td>
<td>0.3-1.6</td>
</tr>
<tr>
<td>Female</td>
<td>102</td>
<td>29.4</td>
<td>1</td>
<td>25.5</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age of the child</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;2 years</td>
<td>108</td>
<td>40.7</td>
<td>2.8</td>
<td>1.4-5.7</td>
<td>23.1</td>
<td>1.3</td>
<td>0.6-2.6</td>
</tr>
<tr>
<td>≤2 years</td>
<td>78</td>
<td>19.2</td>
<td>1</td>
<td>19.2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Independent predictors of stunting and underweight in multivariate analysis**

Several dichotomized household level independent predictors were entered into a binary logistic regression model. The dependent variables were low height for age and low weight for age. Household heads who practice farming only predicted stunting while being female (child) and breast feeding for 6 months and beyond predicted underweight. These results were significantly different at p=0.05. The chance for the child to be stunted when the child is from a household head practicing farming is two times more likely than when they do other businesses. In addition, variables excluded from the model have also been listed in Appendix 6.0.
Table 6.12: Independent predictors of low height for age (stunting) and low weight for age (underweight) in multivariable modeling

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>S.E</th>
<th>Wald</th>
<th>df</th>
<th>Sig</th>
<th>Exp(B)</th>
<th>95% C.I. for EXP (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stunting (Low HAZ):Dependent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupation:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmer versus other businesses</td>
<td>-1.32</td>
<td>0.67</td>
<td>3.96</td>
<td>1</td>
<td>0.047*</td>
<td>0.27</td>
<td>0.072 0.98</td>
</tr>
<tr>
<td>Constant</td>
<td>1.32</td>
<td>0.56</td>
<td>5.52</td>
<td>1</td>
<td>0.019</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td><strong>Underweight (Low WAZ):Dependent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex of the child: Female Versus Male</td>
<td>-2.93</td>
<td>1.14</td>
<td>6.62</td>
<td>1</td>
<td>0.010*</td>
<td>0.05</td>
<td>0.01 0.50</td>
</tr>
</tbody>
</table>
| Exclusive breast feeding:  
  ≥ 6 months versus < 6 months | -1.50 | 0.77  | 3.98 | 1   | 0.046*| 0.22   | 0.05 0.98          |
| Constant             | 1.91  | 0.58  | 11.03| 1   | 0.001 | 6.77   |                     |

*Results significant at p=0.05

The dependent variables (HAZ and WAZ) were categorized as 0=malnourished child, 1=Normal child, while all other independent predictors were also dichotomized.

v1= Sex of the child  
v2= exclusive breast feeding  
v3= lake vs. mountain  
v4= Intervention vs. control  
v5= Education  
v6= use pit latrines  
v7= age of household head  
v8= age of the child  
v9= occupation  
v10= vaccination status  
v11= socio-economic status  
v12= marital status of household head  
v13= sex of household head  
v14= plot size
CHAPTER 7: DISCUSSION

Undernutrition among children under five years was found to be 31.7%, 21% and 8.1% for low height for age (stunting), low weight for age (underweight) and low weight for height (wasting). A higher percentage of stunted children was observed in the mountains while similar proportions were observed in the lake and the mountain for underweight children. The differences were however not significantly different. A higher percentage of stunted children were observed in the intervention villages while higher proportions of underweight children were observed in the control villages. The differences were not significant.

The lake villages had relatively better socio-economic characteristics than the mountain side villages. Also, intervention villages had better socio-economic characteristics than the control villages.

The services and facilities available and accessed in the community were very inadequate. Many people in the area did not have easy access to schools, hospitals, permanent markets and woodlots for firewood. For instance, Milombwa village was the most deprived village among the six villages. Mdala Makumba village had fairly more facilities and services in the study area.

Farming, as an economic activity predicted stunting while both female child and breast feeding exclusively for more than or equal to 6 months predicted underweight among children under five years in Lungwena. However, the predictions were borderline, except for a female child.

7.1 Methodological discussion

7.1.1 Strength and limitation of present village study

The study was aimed at gathering information which could characterize specific villages by identifying common and unique features. The information gathered also validated the results from the secondary data of the NUFU baseline survey. The aspects of internal validity were taken care of because the researcher himself collected this data. Before the researcher could record data on the questionnaire, efforts were made to ensure that the questions were clear and understood by the respondents. The use of village heads and the advisers together as key informants in gathering such information was an added strength to the study. It is a general belief that village heads are the store of information at village level and so, using them to provide us with what
characterizes such villages enriches the information gathered. In this way, the researcher formed a good base on the physical constructs of particular villages and how they were functioning.

7.1.2. Strengths of the NUFU study
The cross sectional nature of the study enabled us to calculate prevalence of undernutrition. The prevalence of undernutrition is of a particular value in planning nutritional programmes since it indicates the amount of illness requiring care.

**Multidisciplinary approach**
The study design and procedures in data collection were incepted by people with a professional diversity. This enabled the study to take into account all relevant issues which could influence the occurrence of malnutrition in the area. Areas covered in the baseline included health, nutrition, agriculture and environment.

**Variables covered in the NUFU data**
The baseline in the NUFU data covered several demographic, socio-economic, agricultural and environmental factors. This holistic approach enabled the study to expose factors purported to have a bearing on the nutritional status of children. Thus, in a given analytical model, systematic variation is maximized while unsystematic variation is minimized (63).

**Wide coverage of villages**
The coverage of the baseline study was large enough to allow for comparisons among villages. Therefore, interventions would be implemented based on the characteristic differences observed in these villages.

**Random selection**
Households as well as individuals in the study were recruited randomly. This provided equal opportunities to participate in the study. Thus, representativeness of the findings was probable assuming, of course, that the sample sizes were large enough to extrapolate the results.

7.1.3 Limitations of the NUFU baseline study

**Sample sizes**
The nutritional data had a very small sample size compared to planned sample sizes for the study. For instance, very few data were collected in addition to anthropometric data. This had a very negative effect on the statistical power of the study. Since we
had to merge these data with data from the household file and only 78 households could be identified to be identical in the two studies. Thus, the study would not be able to detect an effect which genuinely existed (63)

**Unsystematic recording of participant identification in electronic data**

Since the study involved many sub surveys and different institutions, systematic recording of data in the electronic database was lacking. For instance, participants identification could be represented by a unique identifier (recommended) in one file while on the other file a household number could be used. It was hardly possible to make a good matching in a merged file. Since data was analyzed at individual, household, and community levels, the problem was resolved by using a household number as a key variable when merging data. This however created problems when merging anthropometric data files because some households comprised two under five children. Thus, the number of the under five children dropped even further because under such conditions only the youngest child was included in the analysis.

**Sampling methods**

Given the circumstance that the planned sample sizes were not met, random allocation might have been violated. Under such a circumstance, anthropometric data could have been collected from households with similar characteristics, and more likely from households with poor living standard. For example, people in the whole district are very mobile, and especially people from well off households. Considering the fact that the survey was conducted during summer (October-December 2004), well off families might have moved to other places for other business ventures. The lower mean age (34.4 years) of the household head in the merged file compared to 42.8 years in the baseline file indicate that families visited during the DHS (anthropometry) study were young. In Lungwena, some husbands migrate to South Africa for better paid jobs and job conditions and leave their wives alone; but this is usually the case in families who are older in their life course. These families are less likely to have children less than five years. This is also demonstrated by the higher percentage of female headed households in the baseline study than in the merged file. Thus percentage of female headed households is likely to be lower in young families, since the husband is usually present.

However the most likely explanation is the small sample (n=78) in the merged file. Previous studies have shown significant associations between nutritional status and
the socio-economic and demographic variables in binary logistic model (32). The prevalence of undernutrition is likely to be underestimated because of the wide differences observed between the baseline sample size (n=424) and DHS-anthropometry (n=186). However, even if the sample is biased the associations would not be affected to the same degree since variations in demographic and socio-economic characteristics were observed between the sampled households. Therefore, the results have been discussed under the assumption that the associations between the socio-demographic independent variables and nutritional status in the merged file are representative of sample for the baseline study, although prevalences may not show the true values.

**Cross sectional studies**

The prevalence studies measure the etiology of disease that does not only depend on initiation but also duration of disease. Thus, the risk factors may change during the risk interval and so these risk factors may assume different values at different times (64). Furthermore, where causality is of primary concern, it is almost always necessary to use incidence, rather than prevalence as a measure of disease occurrence. It is also found to be difficult to identify the cause and effect of the relationship because information is collected at the same time. On the other hand, cross sectional studies are associated with selection bias in which both the prevalence of the condition as well as its association with other factors may be affected. Randomized sampling helps to minimize the problem of selection bias (65). The response rate in the baseline study was about 71%, indicating that the results could be fairly representative of the population in Lungwena community.
7.1.4 Confounders

Lake versus Mountain

The definitions of lake and mountain was based on how near villages were either to the lake or chains of hills to the east of Lake Malawi. All villages however had almost similar beliefs, attitudes and living conditions. Therefore, the differences observed could be confounded by other factors.

Availability of and access to services

Since villages are very close to each other, it is possible that services available in one village can be accessed more by a neighbouring village than the one harbouring it depending on the financial standing of that particular village. This would therefore give a meaningless conclusion regarding the association between the availability of and accessibility to services in the area. However, access to water sources does not necessarily depend on economic status of villages.

7.2 Discussion of the study findings

7.2.1 Comparison of villages: Natural resources and social resources

Like in many rural areas, physical availability of and access to services such as clean water and health services are believed to determine the health status of children in Lungwena. The community study showed that place of residence is an important factor in determining access to both natural and social economic services. By implication, households which are far from such services are likely to have poor health status. Kwilasya and Mdala Makumba were found to be further away from the lake. However, it is also clear that other sources of water for irrigation and domestic use such as dambo, rivers and boreholes are available. These sources, if put into productive use, would secure households from food shortages. Given the fact that rains are erratic in the area, households would still manage agricultural activities in light of irrigation farming.

The results also indicate that boreholes are located in a walking distance to the households under study. The distance is within what UNICEF recommends to be a comfortable walking distance to fetch water in rural areas. This gives the community hope when it comes to access to clean drinking water. Thus, the community is able to prevent some of the common diseases such as diarrhea, of which the medium of
infection is unclean water for drinking. Diarrhoea is implicated for contributing to undernutrition among infants (66).

It is also observed that only Kwilasya and Chilonga villages have woodlots within. Woodlots provide firewood in the home for cooking and other household chores. For other villages, they have to encroach into the nearby forest. This, in a broader sense, has a lot to do with biodiversity of the environment. However, we restrict our discussion to the direct effects that households can face. Women will have to walk long distances looking for firewood, deviating attention from household activities such as child rearing and other household related activities. Since most household activities are done by women in homes, walking long distances looking for firewood just strains them even more.

In all villages, traditional healers are very close to the sampled households. It is a fact that human beings are likely to utilize services and/or facilities which are very close before exploiting those which are farther away. It is possible therefore that they start consulting traditional healers before they attempt to visit the formal health facilities when sick. Both distance and lack of transportation may prevent visits to health facilities if far away. It is only when such a treatment fails that they force themselves to consult the health clinics or facilities. In most cases traditional medicine is not even hygienic, exposing a person, even child to several diseases such as diarrhea because containers used for taking medicine are mostly unclean. Children are therefore likely to be malnourished once their immunity is compromised.

The absence of nursery and primary schools is indicative of lower education levels in the community. In addition, previous studies have emphasized the link between education status and nutritional status (9). In general, Lungwena has demonstrated a poor nutritional status of children in the community. Mdala Makumba, being the only village with a primary school within, has also indicated a higher proportion of household heads in the village which had been to school.

Even though permanent markets were not available in the villages, except for Chapola, people were able to access basic necessities from the available groceries found in all villages. For instance, access to shops provides easy access to iodized salts, which is very important for the motor development of growing infants. To have a shop near home is not only important for easy access but also it is economically viable in that money and time spent hunting for a shop is saved. Generally, the lake
villages have more facilities and more within reach by the sampled households compared to the mountain. In both village groups, the health facility is far away from the households and this necessitated people to visit traditional healers instead of the western health facility in Lungwena. In the control group, while the primary school and the health centre is far away, a fish dock is lacking. However, this disadvantage over the intervention group does not feature many nutritional problems comparatively. Vaccine coverage would, to some degree, be a problem. However, if they can not easily access the formal health services if sick they are likely to lose weight. Probably, this explains why there were high percentages of underweight children in the control than in the intervention group. The inverse law of health services states that the farther away people are to the services in a given community the less they are accessed and therefore such people have poor health(67). It is not surprising therefore to note that Milombwa has the highest proportion of stunted and underweight children among all the six villages.

7.2.2 Household demographic differences
Like in many other places in Malawi, decision making is primarily in the hands of the household head. In Lungwena, where most of the people are Moslems decision making is vested in husbands. In addition, husbands are bread winners and many households are headed by men. Thus, it is not surprising to note that households headed by men have a smaller percentage of children stunted and underweight. Mostly, family members are in the productive age group, rendering the households to be economically stable. However, people in the area are very poor. One reason may be migration. Older men in Lungwena, potentially able to participate in agricultural activities such as tilling for crop production and also animal rearing migrate to South Africa in search for better living conditions. Possibly, most men in female headed households have emigrated. The money they get from abroad is usually meant for other concerns other than household food consumption. Most men opt to have more wives, which they consider a symbol of status. It is not surprising that stunting is high in female headed households. The responsibility of providing for the family culturally meant to be for the man in Lungwena is forced on the woman who might not have been prepared to face the challenges of food insecurity.
7.2.3 Socio economic status at household level
Results showed that most of the family members in the productive age bracket are farmers (the types of crops grown are mostly cereals). This indirectly suggests that most households could be food secure given the availability of farm inputs and an enabling climate. Contrary to this norm, the lower nutritional status suggests the opposite. But other business could imply higher income: so that farmers in general are fairly poor. Furthermore, culture and low education levels widely known to define food preferences could be responsible for the poor nutritional status in the area. Even though we have not explored how much culture defines food preferences in the area, it is pretty well known that Moslems are very restrictive when it comes to food choices. Parental education is also associated with better nutritional status for preschool children (9;30;68). The mean number of years spent in school in Lungwena is 1.6. Low education on the other hand is the result of lack of schools, only Mdala Makumba has a primary school within the village. Also, despite being close to the lake, people might not be able to afford fish for household consumption because most of them are living in abject poverty.

Previous studies have found malnutrition rate to be higher among households with low socioeconomic status (33). Similarly, the results of our present study showed that malnutrition is high among household with low SES. Figure 6.12 shows that household heads with low SES have higher percentage of stunted and underweight children. But the differences between SES groups were not as large as expected and also not significant possibly because all are poor.

Agricultural productivity among smallholders is limited by agricultural land shortage. With an increasing population growth, land holding size will continue to be a problem on a smallholder. In Lungwena, where the majority of households own more than one hectare, land is generally not a big problem. But since population growth is observed (2003-2004 census), this becomes a potential threat on household plot size in future. Possibly, land in Lungwena is not put to agricultural use because, surprisingly, results indicate that people with more land turn to have children with poor nutritional status. Partly, one could argue that more land does not, in itself, demonstrate high agricultural productivity but this depends on how efficiently it is utilized. In addition,
those with bigger land holdings are selling off produce. Growing crops mainly for sale is linked to poor nutritional status (69)

Low adoption of agricultural technologies is said to be a major problem in Malawi (70). Lack of capital to finance these technologies is therefore among the many reasons for this low adoption. More than three quarters of the households do not have access to credit. Informal sources such as relatives and friends have provided these credits. Financing smallholder farmers would significantly improve their agricultural productivity. Poor health and malnutrition are among the negative effects of low access to credit (70). Fear of loan recovery and debt partly explain why there is low access to loan.

7.2.4 Control and intervention villages

The intervention and control villages showed marked differences regarding their nutritional status even though the differences were not significant, except for low weight for height. The low weight for height and height for age z-scores showed that a higher proportion of children in the intervention villages are poorly nourished than in the control villages. Low weight for height indicated that children in intervention villages were thinner. This perhaps indicates some higher degree of acute malnutrition at the time of the nutrition survey. Differences in the nutritional status of the groups suggest the differences in dietary intakes and infection between the groups. Socio-economic and socio-demographic characteristics also influence the nutritional status of people, including children. For example, the proportions of socio-economic characteristics revealed that households in the control villages were less privileged than the intervention villages. In addition, fishing and skilled work is proportionally much less in the control than in the intervention. The control villages also had a higher percentage of household heads as farmers. Farming predicted stunting among the under five year old children. Low weight for age, unlike low height for age and weight for height, is consistent with the percentage distribution of socio-economic characteristics in the intervention and control groups. Even so, the differences in percentage distribution of these socio-economic characteristics between the control and intervention groups are seen to be insignificant. Place of residence apparently explain better why there is high undernutrition.
7.2.5. Water and sanitation

Pit latrines

In Malawi, about 16 percent of the households have no pit latrines. About 13 percent of the households in Lungwena do not have pit latrines. Faecal contamination leads to many diseases which would generally result when pit latrine use is lacking. In our present study, slight differences were observed between households without pit latrines in both the lake and the mountain side villages. The proportions of households with traditional pit latrines were relatively the similar between the lake and the mountain villages as well. Traditional pit latrines are most common type of pit latrine facilities found in Lungwena. Nevertheless, Milombwa and Chilonga have the lowest percentage of households with traditional pit latrines. This explains partly why there is poor nutritional status in Milombwa village.

Water source

Potentially, water borne diseases such as bilharzia are prevalent in areas with unprotected water sources. The present study showed that most households in Lungwena drink water from the boreholes, being more along the lake than the mountain. Water from boreholes is considered safe for drinking, especially in rural areas (WHO). This is hygienically encouraging because boreholes, compared to other clean sources of drinking water, are a low cost technology for domestic water supply especially in resource poor settings. In rural Malawi, the use of boreholes has however not been sustainable. Water from protected wells has been the only hope in many places. People in Ntumbula and Chilonga might possibly end up drinking unsafe water in case of technical failure with a borehole because the only dependable source of safe source of drinking water is a borehole. Households in Ntumbula, for instance, are close to both the river and lake and this closeness would facilitate drinking unclean water from these sources, which are potential cites for infections. Infected children are more likely to be undernourished (19). Apparently, Ntumbula has a better off nutritional status compared to other villages.
The majority of the people travel less than 0.5km to reach a borehole, which is considered a comfortable walking distance to fetch water at household level in rural areas according to UNICEF. Women would thus have time devoted to child feeding, rearing, general cooking and other related activities. Increasing the time the mother spends with her children improves their social interaction.

7.2.6. Exclusive breast feeding

In Malawi, breast feeding is practiced by almost all mothers (95 %), though exclusive breast feeding for the first 6 months is not optimally practiced. The MDHS 2000 and 2004 showed that 45 percent and 53 percent of babies respectively were exclusively breast fed for 6 months of life. This study, not being different enough, showed that about 47 percent of the mothers reported having breast fed their babies for 6 months of life. Partly, public campaigns of exclusive breast feeding might explain the stable and increasing trend. Despite the increase in the practice, the nutritional status of the under five has continued to worsen. In this study, mothers who exclusively breast fed their children the longest (6 months or more) are more malnourished.

7.2.7 Vaccination status of children

Malawi’s Expanded Programme on immunization (EPI) follows guidelines for vaccinating children set by the World Health Organization (WHO). A child is considered fully vaccinated if he or she has received one dose of BCG, three doses of DPT and a polio vaccine and one dose of measles vaccine. Since 1992, the trend of vaccination rate has been declining in Malawi. In addition, about four percent of the people had not received any vaccination (4). In our study, the prevalence of incomplete vaccination was 69.7 percent. In this study, the proportion of children vaccinated varied substantially between the lake and the mountain, as well as across villages. While the lake had a relatively better vaccination status, the mountain had the worst. Such differences existed among villages also. The increased availability of and access to health facilities and services would help increase the proportion of children vaccinated. For instance, Milombwa with both a poor vaccination and nutritional status among all the villages has been observed to be the most deprived village. It is noted that Ntumbula has in general many services available and accessible than other villages but the services in question can not plausibly explain the
differences in vaccination status. Health services were a possible explanation for the differences but we do not have substantial differences attracting our attention. Similarly, differences in nutritional status existing between the lake and the mountain remain difficult to explain.

7.2.8 Anaemic situation among the under five
Anaemia is a serious concern for young children because it can result in impaired behaviour and motor development, coordination, language development, scholastic development as well as increased morbidity from infectious diseases. In the present study, the prevalence of anaemia was about 78.7 percent, and there was no difference between the prevalence in the lake and the mountain villages, being 79 percent and 76 percent respectively. This difference varied slightly across villages. Anaemic situation across villages is generally high with moderate anaemia being higher. For instance Mdala Makumba has the highest number of infants with anaemic children. Given such a high proportion of infants with anaemia, influencing factors are likely to be multicausal. Because the findings in this report are based on cross sectional data, our findings are discussed based on what is known about anaemia. Given the poor educational status of mothers in Lungwena, mothers are also very likely to have low Hb because evidence exists that women with lower education status often have low Hb (71). Furthermore, children born from anemic mothers have a lower Hb (72). A study done in Indonesia among 3-5 age group identified season, infection and sex of the child as factors enhancing low Hb (73). Low Hb has been found to be prevalent where there is poor quality of complementary feeding practices for which foods eaten are of low iron status (73). In this study, exclusive breast feeding was found to be high. If over reporting was not an issue in our data, then we can assume that such a practice would continue even after 6 months, which would in turn bring about low Hb among children because at this stage breast milk contain less iron(19). The observed differences in the prevalence of low Hb could, in part, be due to differences observed in the services available and accessed in the community. Though not assessed in our present study we can assume that iron pills were not taken to most expectant mothers because traditional birth attendants are just very common. These TBAs might not understand the importance of iron pills which mothers are supposed to get during pregnancy.
7.2.9 Nutritional status according to biological characteristics
In the present study, the proportion of boys was higher in the age group 0≤3 years than in older groups compared to girls. The lake had more children aged 2 or less years than the mountain, which had more children aged 2 or more years. One half of both boys and girls were stunted. There were more wasted and underweight girls than boys in the area. These findings are inconsistent with recent MDHS which indicated small differences in the nutritional status between boys and girls(4). Such findings suggest inequalities in child rearing practices, access to services available, occupation status, education of household heads and many others in or found in the Malawi.

7.2.10 Nutritional status according to area of residence
The poor community and household characteristics embedded in the community may largely explain the poor nutritional status of children in Lungwena. Evidence exists that demonstrate the association between household characteristics and low nutritional status (3). Difficulty encountered in accessing health services is a maker of poor health (48). Except for wasting, the prevalence of undernutrition among the under five children in Lungwena was lower than the three national demographic surveys so far conducted since 1992 (4). It is also lower than a study previously done in the area (1). Stunting, underweight and wasting were 31.7 percent, 21.5 percent and 8.1 percent in the present study compared to 49 percent, 25 percent and 6 percent for the MDHS 1992 respectively.

Like in many studies, higher percentages of children are stunted, followed by those underweight but fewer wasted children (1;4). Milombwa has the highest proportion of children with poor nutrition status compared to other villages. Mdala Makumba, however, had a relatively higher percentage of children with a better nutritional status. Variations in the services available and accessed in the respective villages may explain the observed differences in the nutritional status among the villages. In fact, Milombwa demonstrated a higher deprived state in the services available and accessed by its people. Since many of demographic and socio-economic factors could not have effects the nutritional indicators, it is suggestive that place of residence might explain better stunting and underweight. Thus, either infections or feeding practices could have better explanation for the poor nutritional status in Lungwena.
The prevalence of moderate to severe forms of malnutrition which ranged from as low as 4 percent to 63 percent across villages has been presented. Milombwa has a comparatively higher proportion of both moderately and severely stunted and underweight children. Levels of wasting are generally low, implying that the chronic form of malnutrition is the most common. The results suggest that at the time the study was carried out, the area was not exposed to factors such as inadequate dietary intake and infections, which make children susceptible to wasting.

7.2.11. Factors related to nutritional status

In many previous studies height for age and weight for age z-scores were found to be associated with socio-economic and socio-demographic factors. Like in many rural communities, the influence of these factors in Lungwena can not be underestimated.

Socio-economic characteristics

Education and socio-economic status of the household heads, farming as an economic activity were associated with a higher risk of low height for age (stunting) and low weight for age (underweight). However, farming alone showed some borderline significance in predicting both stunting and underweight. Children from households whose household head had never been to school were three times more likely to be underweight than those who have been to school. One similar study in the catchment area of a rural hospital in Zambia found maternal education to be related to nutritional status (35). Households with low socio-economic status were three times likely to be underweight. Similarly, a study done in Uganda found that households with lower SES are more likely to be undernourished than those with higher SES (68). In Lungwena, households with lower SES had either only an axe or a hoe and less other items. Household heads which have not been to school find difficulties to understand a recommended composition of a balanced diet. They are concerned with bulky foods more than foods which provide adequate nutrients for the body. Farming as an economic activity may provide diversified food stuffs and this could avoid monotonous diets. Yet, farming is locally managed unlike other business ventures which require a big capital. However, the results in this study indicated that children from households depending on farming are more likely to be stunted. Possibly, farmers do not produce enough and varied food for home consumption. In addition, farmers have no access to credit in the area. Thus, they do not have alternatives to farming even when rains have been so insufficient for crops to grow. Another
problem is the tendency to call every villager a farmer. This distorts the true proportion of the farmers in rural areas, which would then bring about wrong conclusion.

**Socio-demographic characteristics**
Marital status, household headship and whether the child lived in the mountain or lake were associated with stunting. Children from female headed households were three times more likely to be stunted compared to those from mountain side villages and those who were married. Most women in Lungwena are in poverty and therefore find it difficult to provide food and other basic needs for the home. In fact, most of these women are house wives but also occupied with activities with less economic value such as selling of firewood.

**Health related characteristics**
Immunization status and period of exclusive breast feeding were related to low HAZ. Children who received less than 8 immunization doses and those who were exclusively breast fed for more than 6 months were likely to be stunted and underweight than children on other sub-groups. Breast feeding exclusively for six months or more predicted underweight among under five children. Households with incomplete immunization alone are twice as likely to have stunted children. Children with incomplete immunization are prone to more infections which reduce the immune system. Children with lower immune system are likely to be undernourished. Children exclusively breast fed for more than 6 months are likely to be more undernourished because at this point breast milk does not contain sufficient nutrients to sustain the growing child (19). It is also possible that people are likely to breast feed beyond what is recommended because most households are food insecure, so the only ready food for the child is the breast milk. Households without pit latrines showed a higher chance for children to be stunted and underweight. Many diseases are likely to occur when people use the bush instead of pit latrines. Pit latrines help to minimize contamination in rivers, from which some households collect drinking water. For instance, households in Mdala Makumba drink water from rivers, in addition to the available boreholes.

**Bio-social characteristics**
Age of the household heads, age and sex of the child were related to stunting and underweight. Children from older household heads were likely to be undernourished.
A higher percentage of female children were likely to be underweight. Culturally, such a pattern was expected because males are given more food. Also, being a Moslem community one would expect males to be more preferred to females. Older household heads pay less attention to child caring practices because, suggestively, at this age most people shift their attention from providing food for the home to investment. Significantly, with a 95% C.I. stunting was also associated with children greater than 2 years. In Lungwena, just like most rural communities, children after this age do not eat enough to meet the requirement on the dietary intakes because most households do not have enough food.

CHAPTER 8: CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion
Access to social services in Lungwena is low. Services such as health clinic, schools and protected wells are placed farther away from the sampled households and, yet these services are believed to be linked to nutritional status. Notwithstanding the problems mentioned, access to boreholes was easy. Illiteracy levels in the community were very high. Since education is key to many socio-economic services; the low level may explain the prevailing poor socio-economic standing in the area.

Generally, the nutritional status of children under five years was low in the area. Prevalence of stunting was by far the highest among the three nutritional indicators. When variables were regressed on stunting and underweight, farming and exclusive breast feeding for 6 months or more had borderline significance predictions, except for female sex of the child, which predicted underweight significantly. Small sample sizes and lack of diversity could partly explain why we have many non significant results.

Socio-economic status and education indicated some likelihood of underweight and stunting among the under five. Children from households with low SES and from household heads who have never been to school were more likely to be undernourished.
Villages belonging to the mountain and intervention groups have more nutritional problems in Lungwena community. The mean nutrition z-scores are the lowest for the two groups.

8.2 Recommendations
There is need to collect sufficient information on dietary intakes among the under five. As observed, few factors were found to be significant predictor of stunting and underweight. Although this can be explained by a small sample size, we assume that the dietary intake may explain the nutritional status of children. In fact, information collected on the dietary intakes was very little from the sampled households.

Both questionnaires and electronic data sets had a lot of missing data, which at times were difficult to resolve because some missing data such as age would require a new data collection. This suggests that enumerators were not addressing some questions. This, from my experience, is because some enumerators do not have the feel of the significant role they play in the entire study and how any mistake committed limits the extrapolation of the results of the study. I suggest a serious consideration of checking electronic databases against physical questionnaires

Considering high illiteracy levels and unavailable schools for basic education, government official and political decision makers must be notified of the implications of the prevailing poor education levels detailed hinged, of course, on nutritional problems. Thus, efforts for nutritional improvement might not amount to anything if education levels remain so low. In addition, access to health services is poor in many villages because of long distance connecting Lungwena Health Centre and certain villages. Many villages were on average far from the health centre. Important messages on vaccination, breast feeding and antenatal care are not accessed by many. For instance, Baby friendly Hospital Initiative (BFHI), important as it is, is not accessible by many.

TBAs were very close to many households in all villages and coverage of complete vaccination in these villages was low. Messages about the importance of completed vaccination doses would be informed to women through TBAs. Thus, all TBAs must
be trained on many other health related issues including the importance of completing all vaccination doses.

The Ministry of Health and NGOs, in their concerted efforts to improve sanitary practices, should encourage and monitor on a regular basis, through structures at community level, the availability of and access to pit latrines locally erected. Most households in Lungwena do not have pit latrines suggesting that people use the bush. Such practices facilitate disease transmission from one individual or area to another.
9.0 Reference list

Reference List


   Ref Type: Internet Communication


(46) Fotso JC, Kuate-Defo B. Socioeconomic inequalities in early childhood malnutrition and morbidity: modification of the household-level effects by the community SES. Health Place 2005 Sep;11(3):205-25.


APPENDIX 1.0

Participant Information Sheet

I am Andrews Gunda, a student from the University of Oslo in Norway studying International Community Health. I am interested in issues that may help improve the nutritional status of the under five in Malawi. The aim of this study is to gain knowledge about the general nutritional status and the factors affecting the nutritional status of the under five. I am here to collect additional community data that could identify possible community factors impacting on the nutritional status of the under five. This data will be combined with the existing data of the NUFU-Lungwena project, already collected in 2003-2004. So, I will conduct an interview with you about the situation in this community that you think is important to explain why there is malnutrition among the under fives. I may also ask for the possible source documents from which I can pick additional information.

The information you provide will be treated confidentially and shall not be used for any other purpose other than the production of the scientific reports. Your name will not be linked to any information in the written papers.

If you do not wish to participate in the study, this will not affect your opportunity to access the usual services you currently receive or expect to get from your community or health providers now and in future.

The interview is expected to take about 30 minutes. Any questions you have about this study can be directed to me, Gerd Holmboe-Ottesen, University of Oslo, Norway and Kenneth Maleta, University of Malawi, Malawi. A summary of preliminary results can be provided at your request. The final results of the study will be shared with the Ministry of health, Non Governmental Organizations and Community Based Organizations represented in the study. The results may also be used in further studies or as a contribution to the body of knowledge on factors associated with undernutrition in Malawi.

Thank you for considering participating in this study.
APPENDIX 2.0

Participant Information Sheet in local language

Ndine Andrews Gunda, ndimaphunzira maphunziro a ukachenjede(Master) a International Community Health ku Oslo university ku Norway.

Ndine wokhudzika ndi nkhani zo pititsa patsogolo moyo wathanzi wa ana wochepera zaka zisanu ku Malawi.

Cholinga cha kafukufukuyu ndi ku dziwa za thanzi ndi zomwe zimakhudza thanzi la ana ochepera zaka zisanu.

Kafukufukuyu ndi kufuna kutolera mfundo zothandiza kudziwa zinthu zomwe zimakhudza thanzi la ana osachepera zisanu mdera lino.


Ndikhoza kufunsanso za komwe ndi ngapeze zoonjezera pankaniyi.


Zotsatirazi zikhoza kugwirisidwa ntchito pa maphunziro apamwamba kapena ngati mfundo zoonjezera pazomwe zimaphunzira kunyentchera kwa ana osachepera zaka zisanu Malawi.

Zikomo potengapo gawo mu kafukufukuyu.
APPENDIX 3.0
Community level study questionnaire

Traditional authority (TA) __________________________
Village _______________Number of households________

Support organisations (Informant: (Any key person in the village)

1. Any agricultural, environmental, nutritional, health related organisation in the village
   1. Yes
   2. No
   3. Don’t know

2. If yes, indicate name, type and activities of the organisation and state if it is a Private, NGO or a government (on type, indicate whether it deals with agriculture, nutrition, business etc...)

Definition of quality:

1. Not satisfactory
2. Somewhat satisfactory
3. Satisfactory
4. Very satisfactory
5. Not applicable

Table 1: Organizations providing service to the community

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Activity</th>
<th>Private</th>
<th>NGO</th>
<th>Govt</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Production pattern

3. Subsistence farming practice among inhabitants is:
   1. < 25%
   2. 25-<50%
   3. 50-<75%
   4. >75%

4. Commercial farming among inhabitants is:
   1. < 25%
   2. 25-<50%
   3. 50-<75%
   4. >75%
5. How would you describe the rainfall pattern in this area?:
   1. Reliable
   2. Unreliable

6. For how many months do you have the rains in a year?
   _______________

7. Do people in this village practice irrigation farming?
   1. Yes
   2. No

8. If yes, do people find it good and helpful?
   1. Yes
   2. No
   3. Don’t know

9. Fishing practice among inhabitants is:
   1. < 25%
   2. 25-<50%
   3. 50-<75%
   4. >75%

10. Handcraft practice among the inhabitants is:
    1. < 25%
    2. 25-<50%
    3. 50-<75%
    4. >75%

11. Beer brewing practice for sale by women is:
    1. < 25%
    2. 25-<50%
    3. 50-<75%
    4. >75%

**Health pattern (Informant: any key person)**

12. Where is the nearest health facility situated?
    1. Within the village
    2. Outside the village

13. If the health centre is outside own village, what is the approximate distance to the facility?
14. Assessing the quality of health services (Informant: Medical officers)

Table 3: Quality of health services at Lungwena HC

<table>
<thead>
<tr>
<th>Data element/variable</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of nurses</td>
<td></td>
</tr>
<tr>
<td>Number of doctors</td>
<td></td>
</tr>
<tr>
<td>Number of beds in Lungwena health centre</td>
<td></td>
</tr>
<tr>
<td>Distance to Lungwena HC</td>
<td></td>
</tr>
<tr>
<td>Patient daily attendance</td>
<td></td>
</tr>
<tr>
<td>Number of home deliveries in the village</td>
<td></td>
</tr>
<tr>
<td>Number of deliveries at the LH centre</td>
<td></td>
</tr>
<tr>
<td>Number of live births in the village</td>
<td></td>
</tr>
</tbody>
</table>

15. When people are ill, is it easy to get medicine at the healthy facility?
   1. Yes=1
   2. No=2

16. If No, how else do you solve the situation
   1. Buy from the shop
   2. Consult neighbors
   3. Visit traditional healers
   4. Nothing is done

17. What do you think leads to lack of medicine in the health facility

_____________________________________________________________________

Transport

18. Are there road networks from the homes to the nearest town?
   1. No
   2. Yes

19. How far is it to the nearest town?

_____________________________________________________________________

20. Are the roads accessible during the rainy season?
   1. Yes
2. No

21. In what condition are the roads?
   1. muddy
   2. no clear paths
   3. tarmac with pot holes
   4. tarmac

22. On the average, how far is it to the nearest town?

23. What means of transport do people use to and from the town?
   1. water transport
   2. road transport

24. In the case of road transport, which mode of transport do people use?
   1. Bus
   2. Bicycles
   3. Ox carts
   4. others (specify)

25. What type of transport do people use in case of emergencies?
   1. Ambulance
   2. Bus
   3. Ox-carts
   4. Other (Specify)

26. How long is the village to:
   1. The nearest river
   2. The lake
   3. The nearest town
APPENDIX 4.0
LIST OF VARIABLES INCLUDED IN DATA ANALYSIS

Age
Age of the child and household head in months and years, respectively

Gender
Either the child or household head was male or female

Marital status
Married, never married, single, widowed, separated and divorced.

Nutritional status
Height and weight in relation to age compared to the standard growth curve

Haemoglobin level
Haemoglobin concentration in capillary blood in grams per dl

Education
Number of years of education

Immunisation coverage
Percentage of children immunized (less than five years)

Exclusive breast feeding
Number of months mothers exclusively breast fed their babies

Occupation
The occupation for which the household head was trained or the actual work they do at home to earn their living.

Assets owned
Number of items owned by the household

Plot size
Size of cultivable land occupied by the household members measured in hectare.

Pit latrines
Type of pit latrines at household level and assessed whether they use pit latrines or not

Water source
Type of source for drinking water and distance, measured in metres, covered to access the source

Community services
Availability and mean distance to access both social services and natural resources in the area

Lake versus mountain
Geographical distribution of household close to the lake and those close to a chain of mountains

Control versus intervention
Villages were grouped into control and intervention groups

Villages
Two villages close to the mountains and 4 villages along the lake were included in the analysis.
### APPENDIX 5.0

#### Table 16: Assets owned by household members in Lungwena

<table>
<thead>
<tr>
<th>Car</th>
<th>Dug out canoe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bike</td>
<td>Motor cycle</td>
</tr>
<tr>
<td>TV</td>
<td>Sprayer</td>
</tr>
<tr>
<td>Radio</td>
<td>Cell phone</td>
</tr>
<tr>
<td>Blanket</td>
<td>Beach signet (Khoka lapansi-chalira)</td>
</tr>
<tr>
<td>Mattress</td>
<td>Open Water Signet-Chilimira</td>
</tr>
<tr>
<td>Bed</td>
<td>Gillnet-matchera</td>
</tr>
<tr>
<td>Mosquito net</td>
<td>Sofa set</td>
</tr>
<tr>
<td>Tilley lamp</td>
<td>Dining set</td>
</tr>
<tr>
<td>Ox-cart</td>
<td>Simple chair</td>
</tr>
<tr>
<td>Work oxen</td>
<td>Table</td>
</tr>
<tr>
<td>Ox-drawn plough</td>
<td>Iron roofed house</td>
</tr>
<tr>
<td>Ox drawn ridger</td>
<td>Sawing machine</td>
</tr>
<tr>
<td>Treadle pump</td>
<td>Solar panel</td>
</tr>
<tr>
<td>Boats</td>
<td>Other</td>
</tr>
</tbody>
</table>
APPENDIX 6.0

TABLE 17: Independent predictors of stunting and underweight from multivariable modeling

<table>
<thead>
<tr>
<th>Variables</th>
<th>Low height for age</th>
<th>Low weight for height</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variables included</strong></td>
<td>p-value</td>
<td>P-value</td>
</tr>
<tr>
<td>Occupation (farmer vs. otherwise)</td>
<td>0.047*</td>
<td>0.993</td>
</tr>
<tr>
<td>Exclusive breast feeding (≥6 months vs. &lt; 6 months)</td>
<td>0.205</td>
<td>0.046*</td>
</tr>
<tr>
<td>Sex of the child (female vs. male)</td>
<td>0.674</td>
<td>0.010*</td>
</tr>
<tr>
<td><strong>Variables excluded</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age of the child (&gt; 2 years vs. &lt; 2 years)</td>
<td>0.275</td>
<td>0.659</td>
</tr>
<tr>
<td>Lake versus Mountain</td>
<td>0.463</td>
<td>0.824</td>
</tr>
<tr>
<td>SES (low vs. high)</td>
<td>0.834</td>
<td>0.089</td>
</tr>
<tr>
<td>Education (no school vs. school)</td>
<td>0.955</td>
<td>0.453</td>
</tr>
<tr>
<td>Age of household head (≥30 years vs. ≤29 years)</td>
<td>0.672</td>
<td>0.756</td>
</tr>
<tr>
<td>Marital status (married vs. divorced)</td>
<td>0.955</td>
<td>0.820</td>
</tr>
<tr>
<td>Intervention versus control</td>
<td>0.296</td>
<td>0.254</td>
</tr>
<tr>
<td>Sex of household head (female vs. male)</td>
<td>0.280</td>
<td>0.368</td>
</tr>
<tr>
<td>Use of toilet (not in use vs. in use)</td>
<td>0.242</td>
<td>0.256</td>
</tr>
<tr>
<td>Plot size (≥ 2 hectare vs. &lt; 2 hectare)</td>
<td>0.813</td>
<td>0.839</td>
</tr>
<tr>
<td>Vaccination status (incomplete vs. complete)</td>
<td>0.909</td>
<td>0.935</td>
</tr>
</tbody>
</table>

* Significant at p<0.05