The role of health extension workers to control diarrheal disease among under-five children in Ethiopia: - A literature review

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A thesis submitted in partial fulfillment of the requirement for the degree of
Master of Public Health
by
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Declaration:
Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.

The thesis (**The role of health extension workers to control diarrheal disease among under-five children in Ethiopia**) is my own work.

Signature: 

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Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
AOR	Adjusted Odds Ratio
CHERG	Child Health Epidemiology Reference Group
CHWs	Community Health Workers
CI	Confidence Interval
CSA	Central Statistical Agency
EDHS	Ethiopian Demographic and Health Survey
EMDHS	Ethiopian Mini Demographic and Health Survey
FMoH	Federal Ministry of Health
GDP	Gross Domestic Product
GLAAS	Global Analysis and Assessment of Sanitation and Drinking Water
HEP	Health Extension Program
HEWs	Health Extension Workers
HIV	Human Immunodeficiency Virus
HSDP	Health Sector Development Program
HSTP	Health Sector Transformation Plan
iCCM	Integrated Community Case Management
IMCI	Integrated Management of Childhood Illness
JMP	Joint Monitoring Program
LMICs	Low and Middle Income Countries
MDG	Millennium Development Goal
MoE	Ministry of Education
ORS	Oral Rehydration Solution
RR	Relative Risk
SNNPR	South Nations, Nationalities and People's Region
STIs	Sexual Transmitted Infections
TB	Tuberculosis
UN	United Nations
UNICEF	United Nations Children's Fund
UN-IGME	United Nations Inter-agency Group for child Mortality Estimate
USAID	United States Agency for International Development
VU	Vrije Universiteit
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

Glossary

The glossary terms are adapted from the World Health Organization and national hygiene and environmental health strategy definition of terms (1) (2).

Community: "A group of people living in a defined geographical area that shared a common culture, values and norms, and are arranged in a social structure according to relationships which the community has developed over a period of time" (1).
Diarrheal disease control: the measures designed to prevent or reduce the incidence, prevalence and consequences of diarrheal diseases such as preventive and curative care.
Household water treatment and safe storage: "water safety practice of treating water at point of use and safe guarding clean water from contamination during storage and withdrawing from storage" (2).
Hygiene: conditions and practices that help to maintain health and prevent the spread of diseases.
Improved latrine: "A hygienic sanitation option for securing sustainable access to safe, hygienic, sealed and convenient service for excreta disposal providing adequate and secured privacy, protected from rain, built either on site or connected to a sewer or septic tank while at the same time ensuring a clean and healthful living environment" (2).

Model family: a family which has fulfilled all the packages of the HEP.

Public Health sector: The sector consisting of organized public health services, the policies and activities of ministries and health departments.

Under-five mortality: the probability of dying between birth and the fifth birthday.

Unimproved latrine: "sometimes known as traditional latrines are the lowest-cost option considered at the bottom of the sanitation ladder which is mostly open, un-cleanable, with poor superstructure, unsafe, and accessible to flies, domestic foul, and other animals" (2).

Abstract

Background: Although preventive and curative interventions were provided through Health Extension Workers (HEWs) at grass roots level, diarrheal diseases remains among the leading causes of death among under-five children in Ethiopia. Moreover, there is a lack of organized evidence on the role of HEWs in controlling diarrheal diseases among under-five children.

Objective: To identify and analyze the role of HEWs to control diarrheal diseases among under-five children in Ethiopia to improve control programs.

Methodology: The study was done by literature review. The adapted lancet diarrhea and pneumonia intervention study group's conceptual framework is used.

Findings: HEWs contribute to the reduction of diarrheal disease among under-five children by providing promotive, preventive and curative interventions at household, community and health post levels. However, the coverage and utilization of interventions to control diarrheal disease are still minimal especially among the poor, low educated and rural populations. Households who have the highest wealth quintile, live in urban areas and have more than a secondary education are more likely to access the interventions. HEWs spent less time on providing health education and spent more time on waiting for clients at health posts and travel between work activities. Despite their roles HEWs face challenges related to lack of proper supervision, training, referral and performance review meetings.

Conclusion and recommendation: The HEWs have a major role to control diarrheal disease among under-five children by implementing preventive and curative health interventions. For their role to be improved, HEWs need to be supported by the community and health sector.

Key words: Ethiopia, health extension workers, intervention, diarrheal disease, under-five children

Word count: 12, 967

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Introduction

Ethiopia is one of the least developed countries located in the Sub-Saharan region of African. According to a report released in 2016 under-five mortality rate was about 67/1000 live births during five years preceding the survey that was in 2012 (3). Diarrheal diseases are the second largest causes of death in under-five children after passing their neonatal period. To prevent diarrheal diseases designing, implementing and scaling up a community based disease prevention strategy through Health Extension Workers (HEWs) has become one of the priority intervention areas.

I graduated in 2010 from Jimma University, Ethiopia, with a Bachelor of Science degree in Health Education and Promotion. Since 2011 I have been working in the Federal Ministry of Health (FMoH) of Ethiopia in different positions: from June 2011 to July 15, 2013, I worked as a health promotion and disease prevention officer, and as of July 15, 2013 I have been working as a hygiene and environmental health program expert. While working in the Ministry I have supervised and supported the health extension program (HEP) which is considered a flagship program in the country. During this period, I have observed how easily preventable diseases such as diarrheal diseases affect the community due to a lack of health information, poor access to health care and poor implementation of effective interventions. People from the low socioeconomic groups, rural areas and pastoral communities are the most affected.

After being assigned as a hygiene and environmental health expert, I was involved in various hygiene and environmental health related tasks which helped me to recognize and understand the hygiene and sanitation associated problems in the country. Of the hygiene and sanitation problems, diarrheal diseases rank in the top for under-five children. To improve the health status of the population with special focus on mother and child health, the Ethiopian government introduced HEP implemented by HEWs since 2003. During this period, we have seen many health improvements because of the work done by HEWs. However, diarrheal diseases remain the second causes of death in under-five children. This health problem motivated me to conduct a study on the role of HEWs to control diarrheal diseases among under-five children in Ethiopia.

The paper is structured into five chapters, starting with chapter one describing the background information of Ethiopia. Chapter two is about problem statement, justification, objectives and methodology. Findings from literature review are presented in chapter three. Chapter four presents the discussion, and chapter five presents' conclusions and recommendations.

Chapter one

1. Back ground information of Ethiopia

This chapter has background information about Ethiopia including geography and climate, demography, government and administration, socio-economic situation, education, health status , health system, and HEP.

1.1. Geography and climate

Ethiopia is located in Sub-Saharan Africa lying on a geographic area of approximately 1.1 million square kilometers. It shares its borders with Djibouti, Eritrea, Kenya, Somalia, South Sudan and Sudan (4).

Ethiopia has three broad climatic zones: “Kolla” also called hot lowlands, “Weyna Dega” and “Dega” also named as cool temperature highlands. The “Kolla” climatic zones encompasses topography below 1500 meters, “Weyna Dega” ranges from 1500- 2400 meters and “Dega” contains topography above 2400 meters (5). Climate change has an effect on the occurrence of diarrheal diseases as temperature, precipitation and humidity all determine diarrheal disease occurrence (6).

1.2. Demographic profile

Ethiopia is the second most populous country in Africa with an estimated total population of 94.4 million based on the 2007 population and housing census. About 80% live in rural areas in 2017 (4) (7). Forty five percent of Ethiopia’s population is under the age of 15 years and 14% are under the age of five years. The national average household size was 4.8. The urban populations have lower average household size 3.6 people than the rural population, 5.1 (8). Life expectancy at birth is 65 for both sexes with 66 years for women and 63 years for men (9).

1.3. Government and administration

Ethiopia has a federal democratic republic government. According to the 1995 introduced constitution the country is divided into nine regional states and two city administrations (10). The regional states and city administrations are divided into Zones, Woredas (districts), and Woredas are sub-divided into Kebeles (sub-districts). Kebeles are the smallest administrative unit structure in the country. Recently there are 956 Woredas and approximately 100,000 people live in each Woreda. There are 16,541 Kebeles, which represent average of 5000 people each (11).

1.4. Socio-economic situation

Ethiopia’s economy is largely dependent on agriculture which accounted for 40% of the Gross Domestic Product (GDP) in 2014. The country had registered an average of 9% economic development per annum in between 2000-2014. However, nationally the proportion of people living under the absolute poverty line was 23.4% in 2014. In urban areas the unemployment rate was 17.4% and unemployment among youths (aged 15-29 years) was 22.8% (12). In urban areas 84 % of the population are in the highest wealth quintile where as 10 % of the populations are in the highest wealth quintile found in the rural areas (8).

1.5. Educational status

According to the 2014 Ethiopian Mini Demographic and Health Survey (EMDHS) 49 % of females and 37 % of males have never attended school (8). Recently, the net enrolment of male and female in primary education (grade 1 to 8) was 98 % and 91 % respectively with a 100 % Gross Enrolment Rate (13). In addition in urban and rural areas for both sexes the net enrolment in primary education was 84.8 % and 59.2 % respectively (12).

1.6. Health

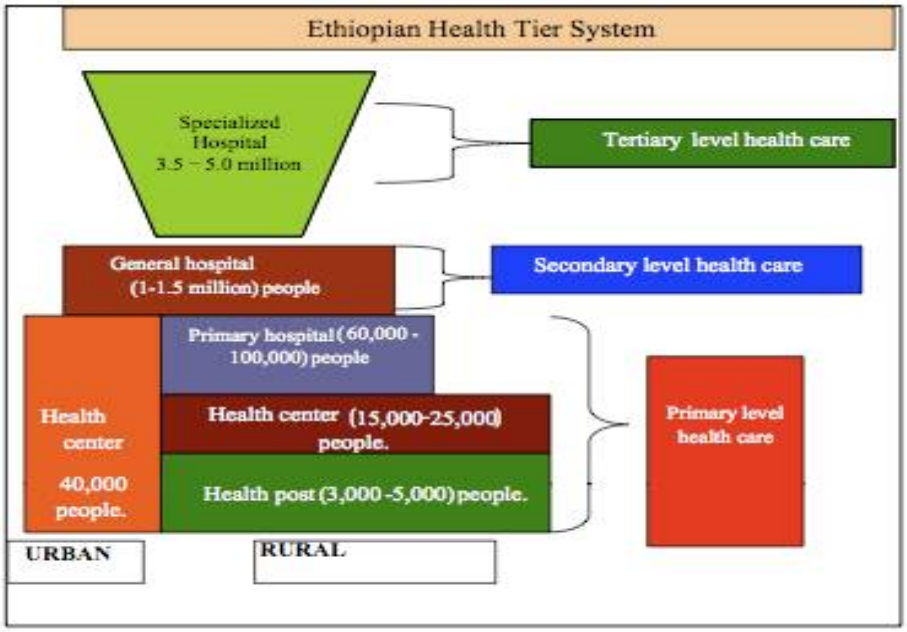
1.6.1. Health status

In the last two decades Ethiopia has made major progress in improving the health status of the population (4). The country has a 20 years life expectancy increment at birth for both sexes over the period of 1990-2013 to reach 65 years. Under-five mortality rate was reduced from 205/1000 to 64/1000 live births in 1990 and 2013 respectively (9). Preventable communicable diseases such as diarrheal diseases and nutritional problems are the major health problems in the country (14). To improve the child health FMoH has developed a number of strategies. Among these in 2005 child survival strategy was developed and targeted to reduce under-five mortality from 200/1000 live births in 1990 to 67/1000 live births by the end of 2015. To achieve this target HEP was the main pillar of the strategy to scale up essential health services to reduce under-five mortality (5). According to the 2014 Millennium Development Goals (MDG) report under-five mortality was 60/1000 live births (12). However, child deaths are still a major health problem in the country and more than 90 % of child deaths are due to neonatal problems and childhood illness such as pneumonia, diarrheal and malnutrition. To address these problems currently the FMoH of Ethiopia developed a national newborn and child survival strategy; this is being implemented from 2015/16-2019/20.The strategy targets to reduce under-five mortality from the 2013 level of 64/1,000 to 29/1,000 by 2019/20 and it has a long term vision to end all preventable child deaths by 2035 (11).

1.6.2. Health System

The Ethiopian health policy was formulated in 1993 which introduces democratization and decentralization of health system focusing on special attention for children and women (15). To achieve the goal of health policy a 20 year Health Sector Development Program (HSDP) was formulated and implemented in a consecutive of 5 years starting from 1997 to 2015 (14). Recently, FMoH has launched a 5 year strategic plan called Health Sector Transformation Plan (HSTP) (2015-2020) focusing on quality and equity health care services. The health care delivery system in the country is organized into three health tier system as shown in figure 1. The primary level of health care delivery system includes health post, health center and primary hospital. In urban setting the health center is the first point of contact into the health system. The secondary level health care level includes general hospitals, and the tertiary level health care is provided at tertiary hospitals (4).

Figure 1: Ethiopian Health Tier System (4)



Source: Health Sector Transformation Plan, Ethiopia, 2015.

According to HSDP IV annual performance report in 2014/15 there are 20,183 functional public health facilities (189 hospitals, 3547 health centers and 16,447 health posts) in the country providing health care services for the population (16). Nationally the health facility distributions to population ratio is one per 476, 593, one per 25, 395 and one per 5, 477 for hospitals, health centers and health posts respectively (17).

1.6.3. Health Extension Program (HEP)

HEP is a community based approach and an essential package of promotive, preventive and selective curative health care services provided focusing on households and communities. The Ethiopian government launched this program in 2003 in Amhara, Oromia, Southern, Nations, Nationalities and People's Region (SNNPR) and Tigray; in 2006 in Afar, Gambella, Somali and Benishanbule Gumuz regional states and in 2009 in urban areas to improve the health status of the population in an accessible and equitable manner. The goal of HEP is to make the society healthy and reduce the morbidity and mortality of mother and children through household and community full participation and by using their knowledge, skill and local technology (18). To encourage the household to be responsible for producing and maintaining their own health by transferring the right knowledge and skill is the philosophy of HEP. HEP is also meant to be a platform to strengthen community ownership on their own health, to control infectious diseases such as diarrhea, connect the community each other and links the community to the health sector through HEWs (18) (19).

Chapter Two

2. Problem statement, Justification, Objectives and Methodology

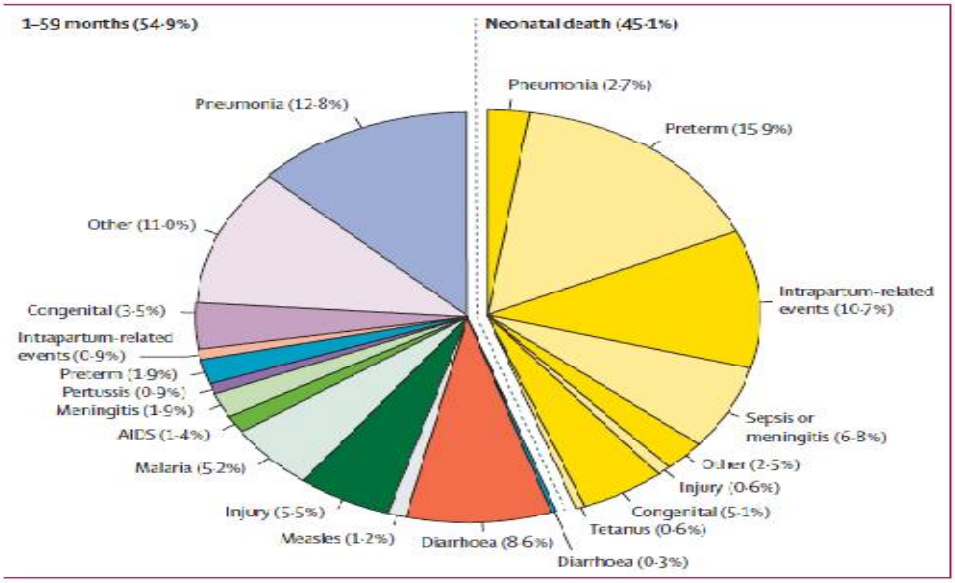
In this chapter the identified problems, justification, objectives, methodology and a conceptual framework used for the study findings are presented.

2.1. Problem statement

According to World Health Organization (WHO) diarrheal disease is defined as "the passage of unusually loose or watery stools, usually for at least three or more times in a 24 hour period" (20). Diarrheal disease is caused by virus, bacteria or other parasitic organisms. In low income countries most cases of diarrheal diseases occur due to rotavirus and Escherichia coli bacteria, which are transmitted via contaminated water and food, and mostly prevalent in areas where there is lack of access to Water, Sanitation and Hygiene (WASH) facilities (21). About 90% of deaths among under-five children occurred due to diarrhea results from inadequate WASH in the world (22). In Low and Middle Income Countries (LMICs) inadequate WASH accounts 58% of total diarrheal deaths, 1.5% total diseases burden and 5.6% total deaths among under-five children in 2012 (23).

Globally, diarrheal disease is the second cause of death in children under-five years old after neonatal period as shown in figure 2. As the report released by United Nations Children's Fund (UNICEF) in 2015 the greatest proportions of diarrhea deaths in under-five children were concentrated in South Asia and Sub-Saharan Africa. Around 88% of all diarrhea deaths existed in these two regions (21). In 2011, 50 % of childhood deaths occurred in Sub-Saharan Africa (24). Although diarrheal deaths are reduced from 1.2 million in 2000 to 526,000 in 2015, more than 1,400 under-five children killed by diarrhea illness in every day globally. Approximately 70% of deaths occur in the first two years of life were associated with diarrheal diseases (21).

Figure 2: Causes of under-five children globally, 2015 (25).



Source: Global, regional and national causes of under-five mortality in 2000-2015 updated systematic analysis.

In Ethiopia, according to the 2014 World Health Organization/ Child Health Epidemiology Reference Group (WHO/CHERG) estimated report Pneumonia, diarrhea and neonatal death (preterm birth, birth complications and neonatal infection) were the major causes of under-five mortality (26).

Diarrhea is the leading causes of death in under-five children who passed their neonatal period, which is the first 28 days of life. It is the second causes of morbidity and mortality in under-five children (11)(17). Diarrhea is mostly common in children aged 6-23 months. About 23-25 % of diarrheal diseases are prevalent in these age groups (27). As the 2015 United Nation Inter-agency Group for child Mortality Estimated (UN-IGME) reports in Ethiopia the mortality rates of under-five, infant and neonatal were 59, 41 and 28 per 1000 live births respectively. The same report showed that the under-five child mortality were not proportionate across different childhood age groups, socio-economic status and geographic regions in the country (28).

The Ethiopian Demographic and Health Survey (EDHS) 2011 report indicated that the under-five child mortality was 53/1000 live birth in Addis Ababa, 69/1000 and 127/1000 live births in Benishangul Gumuz and Afar regions respectively (27).

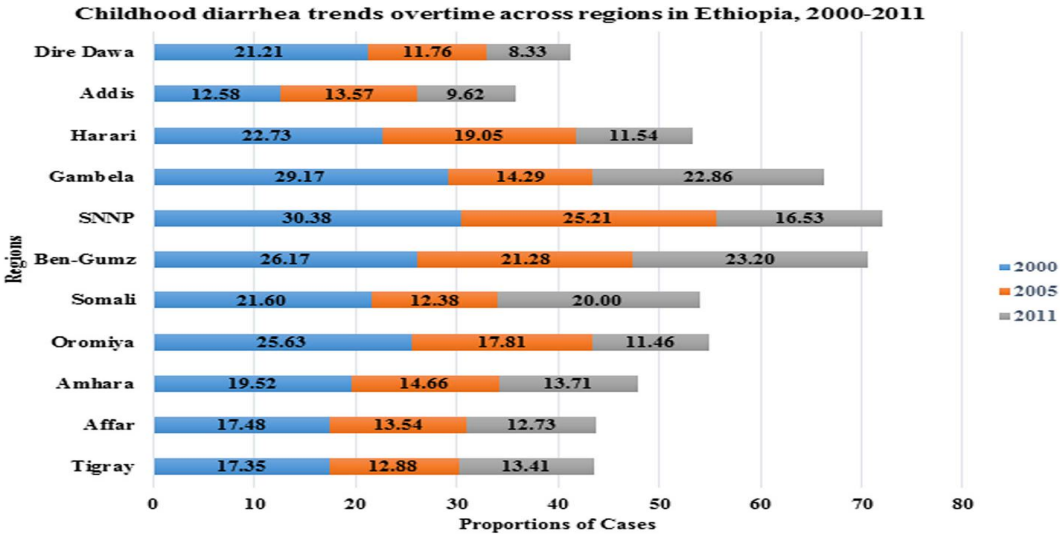
Among the poorest 20% of the population (137/1000) the under five mortality is 1.6 times that of the wealthiest 20% of the population (86/1000). The under-five mortality in mothers with more than a secondary education was 24/ 1000 live births, with below secondary education 46/1000 live births and with no education 121/1000 live births. Similarly the under-five mortality rates for children who live in urban areas were 83/ 1000 live births and 114/1000 live births in rural areas. The prevalence of diarrhea is highest among children living in households that used unprotected water source for drinking (18%), living in rural areas (14 %) and 23% living in pastoral areas (Benishangul Gumuz and Gambela regions) (27).

Ending preventable child deaths from diarrhea by 2025 is the global action plan for diarrheal diseases. To achieve this target WHO pointed out that community based primary health care through Community Health Workers (CHWs) is one of the strategy to strengthen diarrhea prevention and treatment (29). Similarly, Ethiopia is targeted to end all preventable child deaths by 2035 as indicated in the national strategy for newborn and child survival. To achieve this target one of the intervention mentioned in the strategy is community based health intervention that is scaling up of community based newborn and child survival interventions through HEWs (11).

HEWs are female, members of the community where they work and selected by a committee comprised from local community, district health and education office and district capacity building office. HEWs are government employee, had salary via government payroll and trained for one year (30). There are 38,000 HEWs trained and deployed in more than 16,447 health posts in urban, rural and pastoral areas. HEWs provide promotive, preventive and selective curative health care services to reach all segments of the population in an accessible and equitable way focusing on maternal and child health. The health services are provided with free of service charge at the health post, community and household levels (31). HEWs provide health care services on management of communicable diseases such as diarrhea through integrated Community Case Management (iCCM) of childhood illness program. In addition to promotive and preventive health services, the iCCM program improves the health status of children by providing curative health care services for those children who are sick and lack of access to health centers (32).

The Ethiopian government formulated a 20 year strategic program called HSDP in 1997 which was implemented in 5 series phases. During the first phase of program implementation achieving or reaching basic health care services was a challenge especially for poor and rural populations. As a result accelerated primary health care services were initiated and HEP implemented by HEWs, was launched in the second phase of HSDP (2002/3-2004/5) (30). Since 2003 HEWS provide promotive, preventive and selective curative health care services in the household, community and health posts focusing on maternal and child health. As a result Ethiopia has a major progress in reduction of under-five mortality. Between 1990 and 2013 the under-five mortality reduced from 204/1000 live births to 67/1000 live births and the country achieved MDG in 2013 and further reduced to 59/1000 live births in 2015. Although the child health has improved since the introduction of HEP, respiratory infection, diarrheal diseases and neonatal death are still continuing for the cause of death among under-five children in Ethiopia (26). Nationally diarrheal diseases in childhood showed a slight decreasing pattern since 2000. However, the pattern is not consistent across regions in the country as illustrated in figure 3 (33). In high diarrheal disease burden Sub-Saharan African countries so many children who have diarrheal diseases were not receiving adequate care at health facility and community level (34). In Ethiopia even though there is high burden of diarrheal diseases, the proportions of children with diarrheal disease getting advice or treatment from health care provider were 32% in 2011 (27). In addition, the occurrence and burden of diarrheal diseases still continue in childhood in the country (26).

Figure 3: Trends of childhood diarrhea across regions in 2000, 2005 and 2011, Ethiopia (33).



The figure shows trends of childhood diarrhea in 2000, 2005 and 2011 across different regions in Ethiopia. The bar and numbers on each bar shows the magnitude and prevalence of childhood diarrhea respectively.
Source: Bogale et al. 2017

2.2. Justification

Ethiopia is one of the five countries that shares the 50% of world's diarrheal deaths occurring among children and adolescents in 2013 (35). Diarrheal diseases are a public health concern because of high under-five morbidity and mortality due to the disease and the presence of effective preventive and treatment interventions to control the disease, and to prevent this morbidity and mortality (27). The FMoH of Ethiopia developed a 5 year strategy on national newborn and child survival implemented from 2015/16-2019/20. In the strategy diarrheal diseases are mentioned as the second causes of under-five morbidity and mortality after passing their neonatal period. Moreover, the strategy indicated that community based health intervention both prevention and curative services implemented through HEWs are the main approaches to control diarrheal diseases and other preventable diseases.

However, there is a lack of study conducted on the role of HEWs to control diarrheal diseases among under-five children in Ethiopia. Conducting a study on the role of HEWs to control diarrheal disease among under-five children is crucial to improve the control programs for diarrheal diseases and contribute the end of all preventable child death by 2035 in the country and ending preventable child death from diarrhea by 2025 globally.

The findings of this study will contribute to the under-five children health care planning and implementation strategies, and hopefully will improve the under-five children survival in Ethiopia.

2.3. General objective

To identify and analyze the role of HEWs in implementing health service packages from HEP to control diarrheal diseases among under-five children in Ethiopia to make recommendations for policy makers and program managers to improve control programs.

2.3.1. Specific objective

To analyze the HEWs health service package implementation modality for controlling of diarrheal disease in under-five children

To analyze the available health interventions provided by HEWs for controlling diarrheal disease

To identify evidences of factors that shapes the effectiveness of similar CHWs for controlling diarrheal disease from other countries

To provide recommendations based on study findings to policy makers and program managers

2.4. Methodology: Literature review

2.4.1. Search strategy

A literature review was used as a methodology for this study. Peer reviewed articles, reports and documents are used to identify and analyze the role of HEWs to control diarrheal diseases among under-five children and beyond. Both published and unpublished (such as FMoH performance reports) review literatures were used. Gray literatures were used from websites of Ethiopian FMoH, Central Statistical Agency (CSA) and Ministry of Education (MoE), and websites of United Nation (UN) agencies such as WHO, UNICEF and CHERG to access guideline, manual, policy documents, articles, reports and facts.

Google scholar, VU University e-Library and Pub Med were used as a search engines to access published articles, peer reviews and reports by using search words in separate and in combination. To access evidences of factors that are shaping the effectiveness of CHWs for controlling diarrhea from other countries, peer reviewed literatures from low and middle income countries, on similar CHWs cadres are used. Search terms that are used for general background and each objective as shown in table 1. Screening of literatures are done by using inclusion and exclusion criteria.

Inclusion and exclusion criteria: Given the large number of keywords, to narrow the search peer reviewed and gray literatures in English language and published since 2003 year (except policy documents which are published before 2003) are used as a limiting criteria. This is because HEP started since 2003. Articles which did not meet the criteria were excluded.

2.4.2. Limitation of search

Published and unpublished articles which are in English language are used for this study. Other language articles are not used. For this study except gray literature, published article after the year 2003 are used. As a result relevant articles might have been missed.

Table 1: search table

Chapter	Search strategy	sources
Background information and problem statement	"Diarrhea in Sub-Saharan Africa", "Diarrhea AND under-five children", "Diarrheal disease trends AND Ethiopia", "Water, sanitation and hygiene AND prevention of diarrheal diseases", "Ambient temperatures AND diarrhea in Ethiopia", "conceptual framework for diarrhea prevention AND community health workers", "Health extension workers in Ethiopia"	Google, Pub Med, Google scholar
	Health sector transformation plan, Health sector development plan IV, Ethiopia demographic and health survey, Health and health related indicator, Health policy, Integrated community case management (iCCM), Ethiopian constitution, Web sites of ministry of health, education, UNICEF, WHO	Gray literature Web sites Ministry of health, education, UNICEF, WHO
Health extension workers health service packages implementation modality to control diarrheal diseases	"Implementation modality AND health extension workers", "iCCM AND Ethiopia", "Health extension workers AND time allocation", "Challenges of health extension program", "Health extension program in pastoralist areas"	Google scholar, Pub Med
Analyze available intervention program for controlling diarrheal diseases	"Role of community health workers AND Ethiopia", "Intervention AND diarrh* AND Ethiopia", Prevent* interventions AND diarrh*, "Health center AND health extension workers", "Health extension workers AND community satisfaction in Ethiopia", "Health extension workers AND satisfaction in Ethiopia"	Pub Med Google scholar
Evidences on effectiveness of HEWs to control diarrheal disease from other countries	Community health worker AND Diarrhea OR Framework", "Water, sanitation and hygiene AND diarrhea", "Breastfeeding AND its effect", "Prevent* AND treatment AND diarrh*", "Complementary feeding AND diarrh*", "Access of household water treatment AND Ethiopia", "Community health worker AND prevent* AND diarrh*", "Community health workers AND community AND developing country"	Pub Med, Google Scholar
	Child Health Epidemiology Reference Group (CHERG) websites	

2.4.3. Conceptual framework

2.4.3.1. Conceptual framework of the effect of interventions for diarrhea and pneumonia

The lancet diarrhea and pneumonia intervention study group's conceptual framework (as shown in the Annex I) is used to guide the literature review. It identifies the preventive and curative interventions for diarrheal disease control and indicates how the different interventions influence the control of diarrheal diseases (36).

According to the conceptual framework, interventions for both diarrhea and pneumonia (strategies to promote breastfeeding, improved water provision, use, sanitation and hygiene promotion, and preventive zinc supplementations), diarrhea specific interventions both preventive (rotavirus and cholera vaccine) and therapeutic (ORS, zinc and feeding strategies and improved dietary management of diarrhea) interventions, pneumonia specific interventions both preventive and therapeutic interventions, and delivery platforms (community-based promotion and case management, and reduction of financial barriers) were identified and described (36).

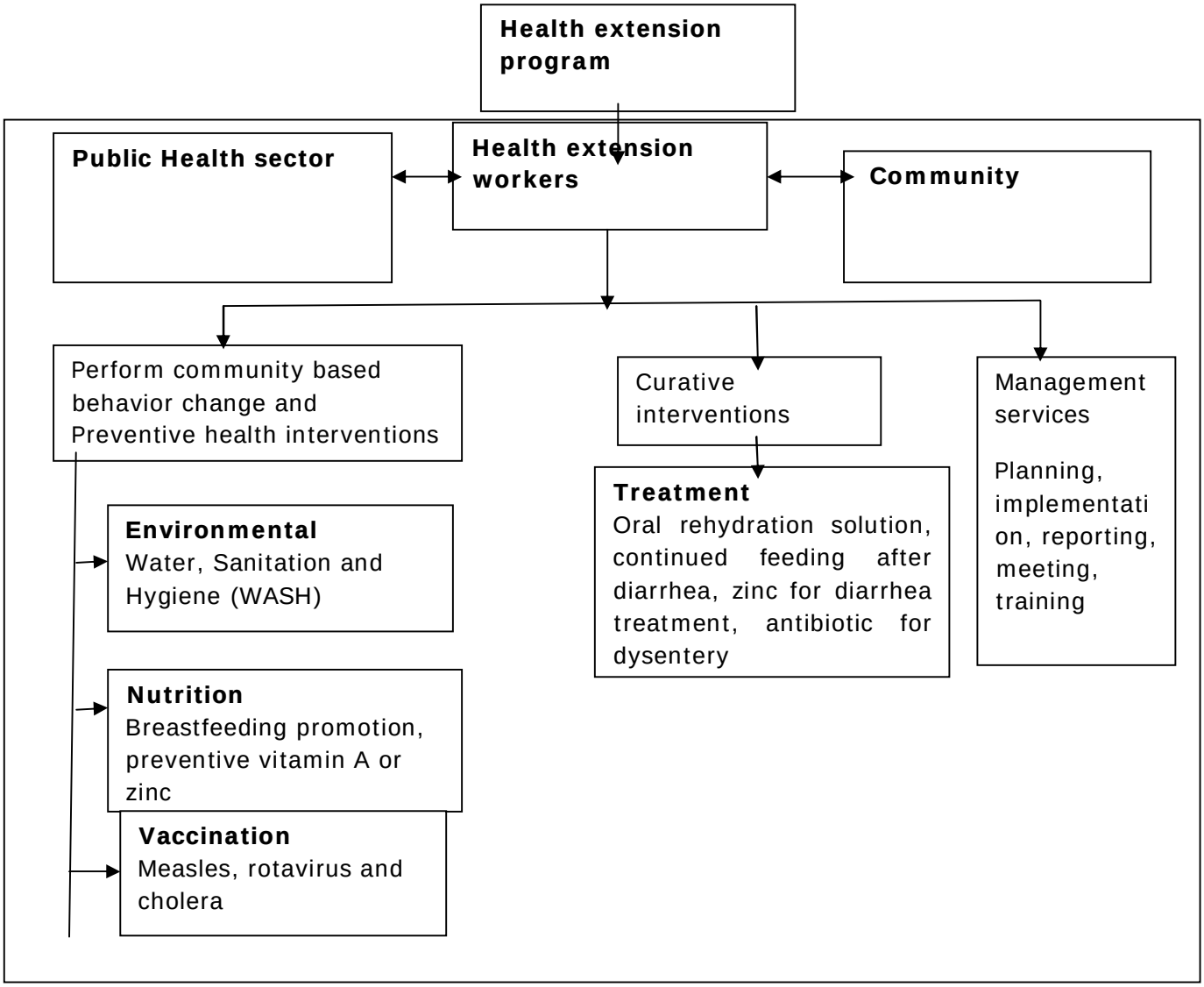
2.4.3.2. Adapted version of the conceptual framework

Based on the topic and objectives the conceptual framework of effect of interventions for diarrhea and pneumonia is modified and focusing on diarrheal disease control among under-five children as illustrated in figure 4. This framework helps to identify and analyze the roles of HEWs to control diarrheal diseases in line with the available interventions. The framework also used to analyze the preventive and curative interventions used for prevention and management of diarrheal diseases. On the delivery platform promotion of community-based health and behavioral change through HEWs are discussed. Financial incentives to promote care seeking are not discussed because in Ethiopia the health care services at health post are free of charge. Integrated community case management is analyzed because it is parts the HEWs work. The environment (WASH), nutrition, vaccine and treatment interventions were analyzed. In addition, HEWs are parts of health delivery system and they are working together with health sector and community. HEWs are bridges that link the community to the health sector. So their relationships with health sector and community are also described.
In this framework health sector and community include elements that increase the performance HEWs to improve child health by controlling diarrheal diseases. Supporting and solving the problems of HEWs are important to ensure the sustainability and performing the interventions for controlling diarrheal disease among under-five children.

Preventive interventions include environmental, nutrition and vaccines. Curative intervention contains Oral Rehydration Solution (ORS), continued feeding after diarrhea, zinc for diarrhea treatment and antibiotic for dysentery. WASH under the environment; breastfeeding promotion, preventive vitamin A or zinc under nutrition; and measles, rotavirus and cholera under the vaccine are analyzed. In addition to the health service delivery their managerial roles is discussed. This study assumed that effective implementation of available intervention and evidences of factors that are shaping the effectiveness of CHWs from low and middle income countries will lead to the reduction of diarrheal diseases.

Therefore, the roles of HEWs to control diarrheal diseases among under-five children are identified and analyzed, and effect of interventions on diarrheal control will be described by using this conceptual framework. I selected this conceptual framework because it enables to identify and analyze the roles of HEWs in relation to the preventive and curative health care services for controlling diarrheal diseases among under-five children.

Figure 4: Adapted conceptual framework of health extension workers role for diarrheal disease control



Chapter Three

3. Study findings

This chapter presents the literature search findings in four sub headings based on the objectives and conceptual framework: - (1) analysis of HEWs health service packages implementation modality, (2) analysis of available interventions provided by HEWs to control diarrheal diseases, (3) HEWs relationship with public health sector and community, (4) evidences of factors that are shaping the effectiveness of CHWs in controlling diarrheal diseases.

3.1. Analysis of HEWs health service packages implementation modality

In this section the health service packages, implementation modality and existing challenges are described.

HEWs health service packages

Creating a healthy society and reducing maternal and child mortality is the general goal of the HEP (37). To achieve this goal, HEP has four major health program components and in which 16 health service packages are included as shown in the table 2. The HEP program components are family health, disease prevention and control, hygiene and environmental sanitation, and health education and communication (38) .

Family health includes health service packages of maternal and child health, family planning, immunization, nutrition and adolescent reproductive health. Disease prevention and control component comprises health service packages of Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) and other Sexual Transmitted Infections (STIs), Tuberculosis (TB), malaria prevention and control, and first aid. Personal hygiene, proper and safe excreta disposal system, proper and safe solid and liquid waste management, water supply and safety measures, food hygiene and safety measures, healthy home environment and control of arthropods and rodents are health service packages under the hygiene and environmental sanitation component. Health education and communication component is cross cutting for HEP used to increase the awareness and knowledge of household and community by providing continues health education through community participation in order to bring positive change in knowledge, attitude and behavior (18) (37).

Table 2 : Major HEP components and health service packages (38).

Major program components and health service packages
Family health services
Maternal and child health
Family planning
Immunization
Nutrition
Adolescent reproductive health
Disease prevention and control
HIV and AIDS and other STIs
TB
Malaria
First aid
Hygiene and environmental sanitation
Excreta disposal system
Solid and liquid waste management
Water supply and safety measures
Food hygiene and safety measures
Healthy home environment
Arthropods and rodent control
Personal hygiene
Health education and communication (cross cutting)

Implementation modality

The health service packages are implemented in the households, the community, youth centers, schools and health posts by HEWs (38). Two female HEWs are deployed in each health post, at Kebele level both in urban and rural areas. HEWs are recruited from the community they belong and originally come from as they are supposed to work and continuing to live in that community. The HEWs in rural areas are grade 10^{th} completed and trained for one year both theoretical and practical on HEP module whereas urban HEWs are diploma nurses and trained for 3-4 months on HEP. HEWs provide promotive, preventive and curative health care services to serve 3000-5000 catchment populations (600-1000 households) at the health post and community and household levels. Urban HEWs expected to work mostly on household and community levels. Health posts are a central institution for the HEP that links the community to health sector to access health services for everyone with free of charge. HEWs are expected to spend 50 % of their time at the health post and the other 50% at household and community levels, and the health post is open throughout the day. Thus, one HEWs provide health services at health post and the other is conduct outreach at community and households such as household visits, organize community meeting and educating families to adopt healthy life style and preventions of communicable diseases such as diarrhea, pneumonia and malaria (37) (38) (39) (40).

To control diarrheal diseases HEWs provide health service packages at the health post, community and household level. They have a role to assess, classify, treat, counsel and follow up children with diarrhea. At the health post level they provide routine immunization (including measles and rotavirus), limited curative services for management of acute diarrheal disease, and referral services for seriously sick children with diarrhea, nutritional advice and growth monitoring. At the community and household level HEWs provide preventive interventions and behavior change communications to increase the awareness and knowledge of community and household about transmission, symptom and treatment of diarrheal diseases, and to produce healthy life style and proper health seeking behavior. Micronutrient supplementation, child nutrition advice (counseling on exclusive breastfeeding, complementary feeding,

cooking nutritious meals, vitamin A supplementation); sanitation and hygiene (environmental and personal hygiene promotion and education, establish and demonstrate community appropriate hygiene and sanitation technologies), household water treatment and safe storage and conduct training on HEP to create model families are some of health service activities provided at household and community level (37) (38).

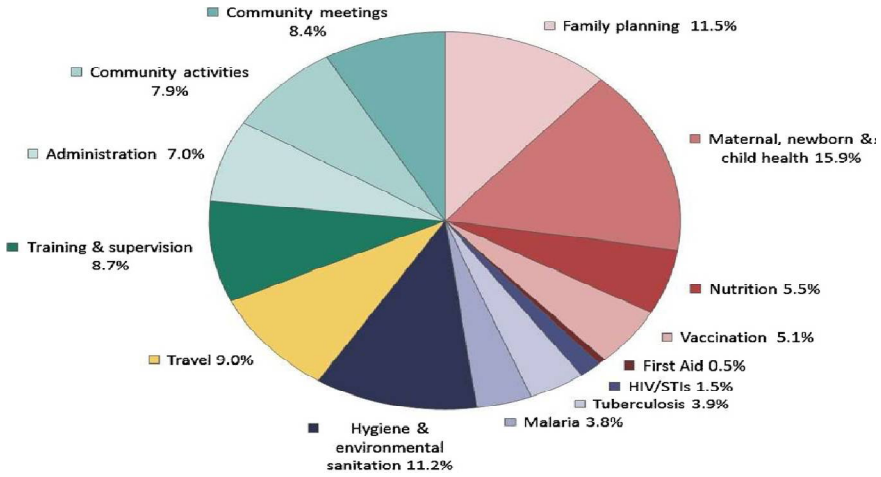
In addition to providing health care services, HEWs have managerial roles including organizing health related events, participate in meetings, conduct training, record keeping, reporting, managing family folders, managing commodities and supplies, receive training and supervision, travel in work places, and mobilize the community to generate resources to support poor families and disables (41) (42).

Challenges

The first challenge is the HEP implementation guideline and other documents lack how HEWs allocate their time for each health service packages in the HEP, and lack of transportation. As a result the time allocation of HEWs for the health service packages and managerial activity are not balanced and mainly focus on certain health service packages and managerial activity. According to the 2014 how do HEWs in Ethiopia allocated their time study on 131 rural HEWs indicated that HEWs spent 51% their time at health post and 37% of their working time at community and household level (15%, 13% and 9% community outreach, visiting households and work related travel respectively) and 11% other activity. Excluding lunch/ break times, HEW spent around 64% (5 hours) of their time on work.

Each week HEWs spent 16% their time on curative health care services, 43% on health promotion and prevention, and 41 % spent on work related travel, training and supervision, administration and community meetings. HEWs on average take 50 minutes to travel to work. They spent 7.2 and 7.3 % of their time on children whose aged 1-5 years and 1-12 months old respectively (43). Detail weekly time spent on health service packages shown in figure 5.

Figure 5: Average weekly time allocation for HEWs (43).



Source: Mangham-Jefferies et al. Human Resources for Health, 2014

In addition, a 2014 study conducted in Oromia region of Ethiopia focused on self reported time allocation of 201 HEWs by comparing HEWs trained on integrated Community Case Management (iCCM) and HEWs who had not trained on iCCM. HEWs who trained on iCCM spent 6.1 hours an average per day at work. They spent 4 hours at health post, 1 and half hour providing service and conducting awareness activity at the community level. This indicated that they spent more time at the health post (44).

Moreover, a 2015 time motion study showed that HEWs spent on work minimum 4.5 and maximum 6.5 hours per day (break and lunch time not included). Rural HEWs spent more time at work than urban HEWs (16.2 days/21 days and 13.8days/21 days respectively). Regarding to the HEP components HEWs spent 30.3% their time on hygiene and environmental sanitation and 44.7% on family health (41).

HEWs also did managerial activity as illustrated in table 3. The same study indicated that in the implementation of HEP urban HEWs focus more on hygiene and environmental sanitation component where as rural HEWs focuses on family health and disease prevention and control component (41).

Table 3: HEWs work activities and spending time (41).

Activities	**Spent time (%)**
Providing health education	12.8
Meeting participation and conduct training	9.3
Community mobilization	0.8
Record keeping, reporting and managing family folder	13.3
Managing commodities and supplies	1.3
Receiving supervision	3.2
Receiving training	1.6
Travel between work activities/on travel	15.5
Waiting for clients at health facility	24.9
Building relationship in the community	13.3
Other activities not categorized meaningfully	4

Source: HEWs time motion study, Ethiopia, 2015.

This table indicated that HEWs spent less time on providing health education and spent more time on waiting for clients at health post and travel between work activities.

The second challenge is the implementation of HEP in the urban areas and pastoral communities have a low progress. These affect the control of diarrheal disease. The project evaluation in 2012 by United States of Agency for International Development (USAID) /Ethiopia revealed the HEP in urban areas were not adequately designed in line with the context and health needs of the urban community rather directly adapted from rural HEP. There was a wide gap of knowledge, attitude and behavior among urban populations (40). In addition, study on the Ethiopian HEP and variation in health system performance in 5 regions indicated those urban communities who have high wealth quintile prefer to access physicians in health facilities and had low respect to urban HEWs. Urban communities spent much of time outside their home for work so it was difficult for urban HEWs to provide interventional activities house to house in control of diarrheal diseases (45).

In pastoral communities the evidence showed that health care services had low performance. The HEP was not fully addressed the health needs of the community due to their lifestyle conditions such as dispersed settlement pattern, seasonal mobility, traditional practices, low utilization of health care services, lack of available and poor organized health facilities, and lack of human resources. In addition, HEWs recruitment, training and retaining was difficult because of lack of female 10^{th} grade completed in some communities. In some places HEWs recruitment was not done by their performance and merit but “just to benefit the clan members and family. As a result it is difficult for district health office and health centers to take disciplinary measures for those HEWs underperform due to fear of conflict” (46) (47).

The third implementation challenge is in addition to health related and administrative activities one of HEW is the member of the Cabine in the kebele administrator. To be a member is important for HEWs to get support from kebele administrator. However, sometimes HEWs are requested to work on other sectors activity such as environmental protection (terracing), different campaigns and tax collection in the community (41). This may affect their regular work and overload HEWs with more duties and responsibilities which negatively affect their performance for the implementation the available interventions (48).

3.2. Analysis of the interventions provided by HEWs to control diarrheal diseases

In this section the available interventions currently implemented in Ethiopia, coverage and utilization status, roles of HEWs and challenges are presented.

According to the Ethiopian FMoH national implementation plan for community case management of common childhood illness the available interventions for controlling diarrheal diseases are grouped into preventive and curative intervention as shown in table 4. HEWs are expected to implement these interventions in the community and household, and health post levels. HEWs are trained in six days on community case management of common childhood illness focusing on providing essential and postnatal care for mothers and newborn, caretaker counseling, treating pneumonia, diarrhea, malaria and uncomplicated severe acute malnutrition, and referring severe illness and sick newborns to health facility (49).

Table 4: Interventions for diarrheal disease prevention (49)

Preventive interventions	**Curative interventions**
Hand washing	ORS
Sanitation	Zinc treatment
Safe water	
Household water treatment and safe storage	
Exclusive breastfeeding	
Adequate complementary feeding	
Vitamin A supplementation	
Measles vaccine	
Rotavirus vaccine	

Source: National implementation plan for community case management of common childhood illness, FMOH, 2010.

HEWs expected provide promotive, preventive and curative interventions for the control of diarrheal diseases among under-five children. They provide promotional activities to increase the knowledge and skills of the community and household to prevent diarrheal diseases and be able to access available health services at health facility.

Preventive interventions decrease the susceptibility and vulnerability of children to diarrheal diseases. They provide curative interventions in order to treat and manage sick children with diarrheal disease and giving referral services for seriously sick children (49).

Preventive interventions

Preventive interventions promoted and provided by the HEWs include WASH (hand washing, improved sanitation and water, and household water treatment and safe storage), nutrition (exclusive breastfeeding, adequate complementary feeding and vitamin A supplementation) and vaccines (measles and rotavirus).

HEWs promote and provide preventive interventions, which are listed below, mostly at household/ individual and community, and health post level to prevent diarrheal disease among under-five children. A study conducted in the Northwest Ethiopia indicated that 35% of diarrheal diseases occur because of individual and community factors. Age of children (6-35 months), starting complementary feeding below 6 month, poor hand washing practice with soap, low knowledge of mothers on diarrhea, lowest wealth quintile and no regular visit to households by HEWs are mentioned as the individual factors; and lack of improved water and sanitation, and unvaccinated children with measles and rotavirus vaccine are factors at community level that increase diarrheal disease among childhood (50).

Hand washing

Hand washing is a hygienic practice with soap/substitute performed at all critical times to promote self and family health that reduces the incidence of diarrheal diseases. Critical times include hand washing before eating and cooking, after using the toilet, after cleaning a baby or an adult bottom, before and after taking care of a sick person, and after performing and cleaning job. The recent developed five year hygiene and environmental health strategy indicated the proportion of households practicing hand washing with soap or substitute at all critical times in Ethiopia was 1 % as base line target in 2016 (2). In addition, according to the WHO 2014 preventing diarrhea through better WASH: exposures and impacts in LMICs indicated that in Ethiopia the practice of hand washing after using toilet or latrine was 22%. However," the data was used based on limited country survey data" (23).

Sanitation

Sanitation refers to" the principles and practices relating to the proper collection, removal or disposal of human excreta, household waste water and refuse to prevent adverse effect upon people and their environment"(2). According to 2016 EDHS key indicators report indicated that the household improved latrine utilization (not shared) was 6 % (16 % urban Vs 4% rural), shared facility 9% (35% urban and 2% rural) and unimproved toilet facility was 50 % and 94 % in urban and rural households respectively. In addition, 32 % of households in the country have no any type of toilet facility (3).

The 2011 EDHS showed that more than 15 million households out of 17.4 million total households have an access of latrine with coverage of 86 %. However, the coverage of households with improved latrine was 8.3 % (14.1 % for urban and 6.6 % for rural). About 14% under-five children's stools living with their mothers was thrown in the garbage, 36 % child's stool dispose safely and others left open (27).

The WHO/UNICEF Joint Monitoring Program (JMP) 2015 progress report on sanitation and drinking water showed that in the last two and half decades Ethiopia reduced the population of practicing open defecation from 44.3 million/48 million (92%) in 1990 to 28.3 million/98.9 million (29%) in 2015. The same report indicated that the access of population using improved and unimproved sanitation was 28% and 72 % respectively (51).

Improved water supply

Ethiopia has a major progress for accessing improved water for the population. About 57% the population had access to improved water according to the WHO/UNICEF JMP 2015 progress report on sanitation and drinking water (51). Similarly, 65% (97 % urban and 57 % rural) of Ethiopian household's have access to drinking water from improved source according to 2016 EDHS key indicators report. Improved source of water include piped into premise (14%), piped to neighbor (3%), public tap/standpipe (18%), borehole (11%), protected dug well (6%), protected spring (12%), rain water (0.5%) and bottled water from improved source (0.2%) (3).

Household water treatment and safe storage

"Drinking water, even from an improved source, is not necessarily free of faecal pathogens and safe for health". So, people are recommended to use different household water treatment and safe storage methods to make the water safe for drinking at household level. Although the data was used from limited country survey information, the proportion of population filtered or boiled their drinking water at household level in Ethiopia was 2% as indicated by the WHO 2014 report on LMICs (23).

In 2016 EDHS key indicators report over all 91% of households do not treat their drinking water (92 % in rural and 88 % in urban areas) and 7 % use appropriate treatment methods and bleaching is the common treatment method as illustrated in the table 5 (3). The 2011 EDHS showed that 90 % of households not treat their drinking water (87 % urban and 91 % rural) and 9 % use appropriate treatment methods (27).

Table 5: Percentage of households using water treatment methods by residence (3).

Water treatment methods	**Treating before drinking (%)**		
	Urban	Rural	Total
Boiling	2.8	2	2.2
Bleach/chlorine added	6.1	2.5	3.2
Strained through cloth	0.5	1.9	1.7
Ceramic, Bio-sand, composite, other filter	1.6	0.9	1.0
Solar disinfection	0.0	0.1	0.1
Let it stand and settle	0.0	0.3	0.3
Other	0.4	0.1	0.2
No treatment	88.4	92.1	91.3
Using appropriate treatment methods (boiling, bleaching, filtering, and solar disinfection)	10.5	5.5	6.5

Source: EDHS key indicators report, 2016

According to the findings preventive interventions like hand washing with soap at critical times, coverage and utilization of improved toilet facilities and water, and household water treatment and safe storage methods are low. The HEWs provide promotion and education on hygiene, sanitation and household water treatment and safe storage practices to the community and households.
In addition, they conduct demand creation and facilitation to access improved sanitation and hygiene products and services, follow up and identify challenges in proper utilization of improved sanitation and hygiene products in the community and household, and expected to be role model to the community and households by improving hygiene and sanitation facilities (52). According to a case study on sanitation infrastructure sustainability challenges in Ethiopia indicated that falling down of toilet, shortage of locally appropriate, durable and affordable hygiene and sanitation technology options and material were the main reasons for low coverage and utilization of improved

sanitation and hygiene facilities (53). Lack of improved water supply was another challenge, a study in Northern Ethiopia indicated out of 39 health posts 5% of health posts had water supply in 2012 (54). Relatively high cost for combined flocculant/disinfectants chemicals, lack of attention by the government and implementing partners for creating awareness, community mobilization and funding on household water treatment and safe storage products, and weak engagement of the private sector on social marketing are causes for low coverage and utilization of household water treatment and safe storage practice (55).

In LMICs 58% of total diarrheal deaths and 5.6% deaths among under-five children are occur due to inadequate WASH. As indicated above the HEWs (rural and urban) spent 30% of their time on hygiene and environmental sanitation. In addition, a 2014 study on how do HEWs in Ethiopia allocated their time focusing on rural HEWs showed that HEWs spent 11% of their time on hygiene and environmental sanitation, 38% on family health and 10% on disease prevention and control (43).

Exclusive breastfeeding and adequate complementary feeding

In the first 6 months of life breastfeeding is sufficient and beneficial for infant nutrition. Exclusive breastfeeding in Ethiopia is 58 % in infants under 6 months of age. The rest percentage of infants 0-5 months of age consume 17 % plain water, 11 % complementary foods in addition to breast milk, 5 % non milk liquids (juice, juice drinks, soup, or other liquids), 5 % other milk and 5 % do not consume breastfeed at all. The recommended complementary feeding after 6 month was 4.5% and it is recommended that a child continues to breastfeed until age 2. In Ethiopia, the percentage of children who are currently breastfeeding among children aged 12-17 months was 91% and 76 % among children age 18-23 months (3).

As recommended 16% of children with diarrhea are received more fluid as usual. Around 35%, 49%, 28% and 13% children with diarrhea are offered the same amount of fluid as usual, less fluid as usual, somewhat less and much less respectively. Seven percent of children with diarrhea were not given any fluid at all. Similarly, children with diarrhea are given less food than usual (48%), somewhat less (25%) and much less (16%), and 7% of children were not given any food at all. As recommended 10% of children with diarrhea receive increased liquids and continue feeding (27).
According to EDHS 2000 that was before the introduction of HEP indicated that 17%, 35% and 48% of children with diarrhea were given fluid the same amount as usual, more than the usual amount and less than the usual amount respectively. Regarding to food, around 87% (9 in 10), 11% and 2% of children with diarrhea were offered less than the usual amount, the same amount and more than the usual amount food respectively (56).

The HEWs had major contribution to promote exclusive breastfeeding, complementary feeding and optimal breastfeeding to the households and community starting from the implementation of HEP but the coverage was low as mentioned in the above. A study conducted on HEWs knowledge and their knowledge sharing to the mothers about optimal infant and young child feeding in Northern rural Ethiopia indicated that HEWs had a knowledge gap on recommended complementary feeding practices such as optimal duration of continued breast feeding, minimum of meals per day and minimum dietary diversity for children aged 6-23 months period and these associated with the knowledge gap on mothers. About 50%, 68% and 53% out of 96 sampled HEWs correctly know about optimal duration of continued breast feeding, minimum of meals per day and minimum dietary diversity respectively (57). In addition, the evidence indicated that early initiation of complementary feeding was due to lack of knowledge of mothers and their perceptions about inadequate breast milk production (58).

Vitamin A supplementation

"Vitamin A is an essential micronutrient for the immune system that plays an important role in maintaining the epithelial tissue in the body". Vitamin A deficiency contributes to increase the severity of infections like diarrheal diseases among children's aged less than 5 years old. According to the 2011 EDHS 53% of children aged 6-59 months received vitamin A supplementation and the coverage in urban and rural areas was 57 and 53 % respectively. Regarding mother's education and wealth quintile; vitamin A supplementation for children whose mothers have no education and more than a secondary education was 51% and 72% respectively. In addition, received vitamin A supplementation was 45% among children whose mothers in lowest wealth quintile and 58% of whose mothers in the highest wealth quintile (27).

Measles vaccine

The 2016 EDHS key indicator performance report showed that the proportion of children in the age group 12-23 months who have received measles vaccine was 54 %. The mother's education and wealth status have an influence on the coverage of vaccine. About 49 % of children received measles vaccine among mother's who have no education when compared to 80 % of children among mothers who have more than a secondary education. Similarly, 47 % of children whose mothers in the lowest wealth quintile received measles vaccine compared with 75 % of children whose mothers in the highest wealth quintile (3). In the 2000 EDHS the proportion of children aged 12-23 months received measles vaccine was 21% (56).

Rotavirus vaccine

According to 2016 EDHS key indicator performance report showed that rotavirus causes gastroenteritis which is an inflammation of the stomach and intestines. It has a consequence of severe dehydration and death. Sixty four percent of Children's in the age group 12-23 months have received 1st dose of rotavirus vaccine. However, it reduces to 56 % in the second dose of rotavirus vaccine. Fifty five percent and 46 % of children whose mothers in the lowest wealth quintile received first and second dose of rotavirus vaccine compared with 82 and 78 % of children whose mothers in the highest wealth quintile respectively (3). Rotavirus and cholera vaccine prevents around one third of occurrence of severe diarrheal diseases (24).

HEWs have contributed for the reduction of diarrheal diseases among under-five children in Ethiopia by providing vitamin A supplementation, measles and rotavirus vaccine. However, household wealth quintile and maternal education affects the utilization of available interventions. Mothers who have highest wealth quintile and more than a secondary education were more likely access these interventions (59).

Curative interventions

HEWs provide curative interventions for children with diarrheal disease by using ORS and zinc treatment. In spite of the effort done by the HEWs, the management of diarrheal diseases among under-five children through ORS and zinc is low coverage. For example 42% of children with diarrhea did not receive any form of treatment.

ORS and zinc treatment

ORS and zinc sulphate tablet/syrup are the essential medicines mostly used for the treatment of diarrheal disease at the health post level. However, they are less available in rural health post (39 and 30%) than urban health post (83 and 75%) respectively (60).

The 2011 EDHS report indicated that the prevalence of diarrheal diseases among under-five children was 13% in 2 week period before the survey. Thirty two percent of children with diarrhea received advice or treatment from health facility or health a provider to

care. Although diarrhea is common in children aged 6-23 months, children aged 24-35 months received more treatment or advice (39%) than other aged group from health facility or a provider to care. In addition, 54% children with diarrhea in urban, 29% in rural, 22% in mothers with lowest wealth quintile and 53% in mothers with highest wealth quintile received treatment or advice from health facility or providers. Moreover, 26% of children with diarrhea treated with ORS and 42% of children with diarrhea did not receive any form of treatment. Overall, the knowledge of mothers about ORS was 65%. Sixty one percent of rural mothers and 59% of mothers with no education have knowledge about ORS (27).

According to the 2016 EDHS key indicators report showed that the prevalence of diarrheal disease was 12 % (1227 cases out of 10225 total children) among under-five children before 2 weeks preceding the survey. Among these 43% of children received treatment from health facility or provider to care. Around 30% (3 in 10), 33% and 17% of children with diarrhea received ORS, zinc supplement and both ORS and zinc respectively (3).

In treatment of diarrheal diseases, HEWs have a role and capacity to do and better than other health professionals to enhance the uptake of fluids and home remedy for treatment of under-five children who have diarrhea (27). However, due to low availability of ORS, community's lack of information on the availability of treatment, expecting costs from visiting health posts, low education, living in rural areas and having lowest wealth quintile the service utilization is low (27) (37) (60).

In addition, the evidence shown that mother's residency, information on ORS and attending antenatal and postnatal care services are associated childhood diarrheal treatment. Mothers who live in urban areas are 1.68 times use health care facility for diarrheal treatment compared with mothers who live in rural areas (Adjusted Odds Ratio [AOR]=1.68, 95% CI 1.06-2.67). Mothers who had information on ORS, attended antenatal care and attended postnatal care are associated with 2.66, 1.34 and 1.53 times use health facility for diarrhea treatment compared with mothers no information, mothers never attended antenatal care and mothers with no postnatal care with AOR=2.66, 95% CI 1.93-3.67, AOR=1.34, 95% CI 1.74 and AOR=1.53, 95% CI 1.02-2.30 respectively (61). According to EDHS 2016 the percentage of women receiving antenatal care from skilled health provider was 62% and about 32% (3 in 10) of women received antenatal four visits. Around 17% of mothers receive postnatal care in the first 2 days after birth (3).

In summary, HEWs have major role for controlling diarrheal diseases through promotive, preventive and curative interventions but unbalanced time allocation on health service packages and managerial activities, lack of tailored health service packages in urban areas and pastoral communities, lack and improper recruitment of HEWs in pastoral communities, additional activities other than regular work, lack of supplies and materials, shortage of improved water supply, living in rural areas, lowest wealth quintile and low knowledge of mothers, and lack of knowledge and skill of HEWs are challenges for the effective implementation of preventive and curative interventions.

3.3. HEWs relationship with the public health sector and local communities

HEP is parts of a formal health delivery system in Ethiopia and run by government salaried HEWs. In Ethiopian health delivery system one health center links with 5 health post to form primary health care unit. The health center provides technical and administrative support for each health posts (32).

In the implementation of HEP, it is expected that all government sectors, local administrators and communities to support and collaborate with HEWs. HEP is supported and financed by both the government (salary, management and supervision of the program) and community (non-monetary such as labor, food and accommodation). For

example health post construction, training and selection of model families, community mobilization during immunization campaign and construction of WASH facilities are some of the activities that HEWs want to collaborate (62). The evidence indicated there is a lack of coordination between health sector and other stakeholders such as water, education and agriculture sectors to implement HEP components (48).

HEWs had a bridge position between health sector and community that links the community to the health sector. So, to implement promotive, preventive and curative interventions effectively by increasing their performance to controlling diarrheal disease HEWs require strong relationship with public health sector and communities (63).

HEWs relationship with the public health sector

The evidence in Ethiopia indicated that referral system, supervision, training and performance review were major and common element areas that HEWs links with health sector. HEWs refer cases to the catchment health facility beyond their capacity. Health facilities supervise, giving feedback and provide training for HEWs to improve their performance. In addition, they review their performance with HEWs. However, there are implementation challenges that affect the performance and the relationship of HEWs with health sector as illustrated in table 6 (63). In addition, a study in Ethiopia indicated that as the HEWs mentioned low salary, long walking distance and topography problems, lack of residence at health posts, high workload and lack of support from the Kebele leaders are barriers that affect their performance to provide health service packages (54). These barriers may affect their relationship with the health sector.

Table 6: Common elements and implementing challenges of HEWs relationship with and health sectors

Elements that HEWs make relationship with the health sectors	challenges as indicated by the evidence
Referral	Lack of referral forms and feedback from health centers. Referring cases without referral forms sometimes cause improper handling of cases. This may also result mistrust of HEWs by the community.
	Lack of transport
Supervision	The supervisors lack problem solving skill and are not supportive rather they are fault founders and focuses on checking records and registers. They are not giving written feedback after supervision.
	Some health center supervisors lacks communication skill and knowledge on HEP. Some program managers are not friendly and respect HEWs.
Training	Unclear selection process, limited availability of training, for the upgrading program “the entrance exams considered too difficult and promotion after attending the training was not guaranteed. On the job training from health center was supposed to take place once a week but this was not happing”.
Conducting performance review meeting	The meetings are not conducts as planned.

Source: Kok et al. Human Resources for Health, 2015

HEWs relationship with local communities

The evidences on HEWs relationship with the community and health sector in Ethiopia indicated that the relationship between the HEWs and community is a “natural link”. This is because HEWs are selected from “the community they are supposed to serve and continuing to reside in that community”. The same study showed that HEWs are trusted and respected by the community, and HEWS have high self-esteem and positive attitude to the community (63).

A community based study on mothers experience and satisfaction with HEP in Western Ethiopia showed that most mothers (76%, 286/379) were satisfied and had a positive attitude and good relationship with HEWs. However, they criticize that HEP lacks curative services and HEWs had less capacity to handle health problems they encounter specially for curative services. Being HEWs female is very important to discuss maternal and child health problems freely but mother belief that for the success of HEP the involvement of male HEW is also important. This is because “mothers thought that men are more courageous and professionally competent to deal with complex matters” (64).

Another study indicated that in the planning of health extension services the participation of community and households are low. Community participation in HEP planning affects the utilization of services from HEWs. The evidence stated households who are participated in planning of HEP activities were 4.5 times more likely to use health extension service packages compared with those households who are not participated in HEP activities (65).

3.4. Evidences of factors that are shaping the effectiveness of community health workers

In this section the evidences of factors that are shaping the effectiveness of CHWs and community based interventions’ potential effect for controlling diarrheal disease are described. While HEWs are a cadre which is unique to Ethiopia, many other countries have similar cadres of CHWs. The evidences of factors that are shaping the effectiveness of CHWs are presented here, with a view to draw implications for the context of Ethiopia based on the findings.

Findings showed that community based interventions through CHWs are effective to manage childhood illness such as diarrheal disease by up taking preventive and curative (ORS and zinc treatment) interventions. For example, community based interventions are associated with an increases in the uptake of ORS (Relative Risk (RR)=2.60, 95% CI 1.59-4.27), increase by 80% uptake of zinc for diarrhea treatment, increase the care seeking behavior of community for diarrhea by 9% and decrease inappropriate uses of antibiotics for diarrhea by 75%. The finding suggests that regular refresher training is needed for CHWs in order to manage and diagnose diarrheal disease consistently (36).

Factors that are shaping the effectiveness of CHWs

Evidences illustrated that strong health system, remuneration, active involvement of communities, manageable workload (number of tasks and catchment population), problem solving and continues supportive supervision, fulfilling the necessary supplies and equipment, and giving appropriate respect increases the performance and effectiveness of CHWs for management of childhood illness such as diarrhea (66) (67). A study conducted in Uganda on the performance of 393 CHWs in the management of childhood infectious diseases revealed that CHWs who served households ranges from 100-200 and more than 200 were associated with less performance on management of childhood illness compared with households 100 or less with AOR=0.24, 95% CI 0.12-0.5 and AOR=0.22, 95% CI 0.10-0.48) respectively. In addition, CHWs who met their supervisor in previous month before the study was associated with high performance on

management of childhood illness compared with those who did not meet their supervisor with AOR=2.52, 95% CI 1.12-5.70 (68).

A synthesis of randomized control trials indicated that knowledge and skilled based training, clear roles and responsibilities, supportive supervision, referral and mentoring support from public health sector, and conducting outreach activity integrated with community and health center staff were improve the CHWs performance and effectiveness for improving child health by controlling childhood illness such as diarrhea (69) (70).

Another peer reviewed study also indicated provide a training for the health care workers and community on diarrhea treatment and disseminate appropriate and consistent messages to the community and household on the alternative use home based oral rehydration were vital for the control of diarrheal disease. This is because inappropriate and inconsistent message on home based oral rehydration to the community reduces the utilization of ORS. “Promotion of the ORS became weakened by the suggestion that alternative fluids could be used to prevent dehydration, which led to the false assumption that any water-containing liquid could effectively prevent or treat dehydration. By categorizing ORS and home fluids as appropriate treatment, program monitoring agencies have given countries a false sense of accomplishment, because this classification assumes all children receiving home fluids—irrespective of type of fluid or diarrheal severity—were being properly managed” (71).

The evidence indicated that joint ownership of CHWs programs, collaborative supervision and feedback, a balanced package of financial and non financial incentives and design practical performance monitoring system for CHWs from communities and health system are strategies that increase the performance of CHWs in providing community based interventions. Joint ownership CHWs programs indicated working together with relevant different stakeholders from the national to grassroots level. Conducting effective and timely collaborative supervision with the community and health sector can increase the status of CHWs in the community. Allowance and fee in exchange of services are examples of financial incentives. Better living conditions, supportive working environment, career development programs, special access to health care services for CHWs and her family at reduced cost/free, continuing education, mentoring and outreach support, performance review, ensuring an adequate supply and commodities, recognition of best performer CHWs are some examples of non financial incentives. Design practical performance monitoring system for CHWs is essential to improve their performance, because CHWs work different mix of programs and household or community characteristics (72).

Community based interventions’ potential effect for controlling diarrheal disease

Evidences shown that CHWs can reduce the incidence, severity and death of diarrhea in childhood through community based interventions by promoting the preventive interventions (clean home environment, access to safe water and adequate sanitation, good hygiene particularly hand washing, exclusive breastfeeding and good nutrition) and providing curative interventions (ORS and zinc treatment). For example, a randomized control trial in Pakistan routine weekly visit to households living in urban slum areas by CHWs to promote hand washing is associated with a 53% of diarrhea incidence reduction in childhood (73).

In summary, to prevent and treat diarrheal diseases in childhood does not require interventions which are complex or expensive technology. There are proven community based interventions to control diarrheal disease which are implemented at the community, household and health post levels by CHWs/HEWs (74) (75) as shown below. The list of interventions and their potential effects for controlling diarrheal disease are illustrated here based on conceptual framework.

Hand washing with soap

A community based cluster randomized control trail conducted in Eastern Ethiopia indicated that hand washing with soap and educational intervention on WASH associated with a 35 % of diarrhea incidence reduction in childhood (RR=0.65, 95 % CI 0.57-0.73) (76). A systematic review conducted on WASH for the prevention of diarrhea showed that washing hands with soap is associated with more than 48% reduction in incidence of diarrheal diseases (77).

Hand washing at critical times can reduce the risk of diarrheal diseases. In LMICs the proportion of people washing hand with soap after using a toilet facility was ranges between 13-17%. The evidence indicated that hand washing promotion among communities can prevent 28 % of diarrheal disease occurrence (RR=0.72, 95% CI 0.62-0.83) and hand washing education plus free soap provided prevents about 34 % of diarrheal disease occurrence (RR=0.66, 95% CI 0.56-0.78) in LMICs (78).

Breastfeeding (including exclusive breastfeeding)

The risk of diarrheal incidence among not breastfeeding children aged 0-5 month and 6-11 month increases by 165% and 32% respectively in developing countries. In relation to diarrheal mortality not breastfeeding increases by 47% among 6-11 month olds and 157% among 12-23 month olds (36). A study on breastfeeding epidemiology, mechanisms, and lifelong effect in low and middle income countries showed that about 50% of diarrheal diseases can be prevented by increasing appropriate breastfeeding practices. Breastfeeding providing a major protection where communicable diseases such as diarrhea are common causes of death (79).

A systematic review on breastfeeding and the risk for diarrhea morbidity and mortality in developing countries found that the risk of diarrheal incidence among children aged 0-5 months not exclusively breastfeed is 2.65 times the risk of exclusively breastfeed children. The risk of diarrheal incidence among children aged 6-11 months who are not breastfeed is 1.32 times the risk of diarrheal incidence in the same age group who are breastfeed. In addition, the risk of prevalent diarrhea in children aged 0-5 months who are not exclusively breastfeed is 4.90 times the risk of prevalent diarrhea in children aged 0-5 months who are exclusively breastfeed and the risk of prevalent diarrhea in children aged 6-23 months who are not breastfeed is 2.07 times the risk of prevalent diarrhea in children the same age group who are breastfeed. Furthermore, the risk of diarrhea mortality in children aged 0-5 months who are not exclusively breastfeed is 10.52 times the risk of mortality in children aged 0-5 months who are exclusively breastfeed and the risk of mortality in children aged 6-23 months who are not breastfeed is 2.2 times the risk of diarrhea mortality in children aged 0-5 months who are breastfeed. This finding indicated breastfeeding protects diarrheal disease among children in the first two years of life (80).

Household water treatment at point of use

More than 45% reduction of diarrheal disease is associated with effective use of household water treatment such as boiling or filtration and safe storage in LMICs (23).

Improve water quality at source and using household water treatment and safe storage systems are associated with 47% reduction of diarrhea incidence. Chlorination, filtration, combined flocculation and disinfection, boiling and solar disinfection are the proven and field tested household treatment methods (75). A systematic review conducted on WASH for the prevention of diarrhea showed that household water treatment with bleach, flocculant-disinfectant and both flocculant-disinfectant and hand washing with soap is associated with a 54 %, 61 % and 55 % reduction of diarrheal diseases among under-five children respectively (77).

In LMICs distributing water disinfectants for households at the point of use is associated with an average of 25% reduction of diarrhea incidence (RR=0.77, 95% CI 0.65-0.91 and RR=0.69, 95% CI 0.58-0.82 for home chlorination products, and flocculation and disinfection sachets respectively). Approximately 50% reduction of diarrhea associated with filtration at point of use (RR=0.48, 95% CI 0.38-0.59). Among the filtration system ceramic filters, bio-sand system and Life straw filters with RR=0.39, 95% CI 0.28-0.53, RR=0.47, 95% CI 0.39-0.57 and RR=0.69 95% CI 0.51-0.93 respectively associated with diarrhea reduction in low income countries. Similarly using water solar disinfection (SODIS) "by distribution of plastic bottles with instructions to leave filled bottles in direct sunlight for at least six hours before drinking" associated with more than 30 % of diarrhea reduction (RR=0.64, 95% CI 0.42-0.94) (81). Access to safe water in terms of improving water quality at source and safe storage at home, and home purification of water is associated with 17% and 21% of diarrhea risk reduction respectively (74).
A cluster randomized control trial study in rural Ethiopia indicated household water chlorination Adjusted RR=0.42, 95% CI 0.36-0.48 associated with reduction of diarrheal incidence (82).

Routine vitamin A supplementation

A lives saved tool analysis indicated that biannual routine vitamin A supplementation for the children aged 6-59 months associated with a 32% reduction of diarrheal diseases (74). A meta-analysis on vitamin A supplementation for preventing morbidity and mortality in children from 6 months to 5 years of age indicated vitamin A supplementation is associated with a reduction of 28% diarrheal mortality (RR=0.72, 95% CI 0.57-0.91) and 15% diarrheal incidence (RR=0.85, 95% CI 0.82-0.87) (83).

Improving drinking water source

A 73% of diarrheal disease reduction in LMICs is associated with providing safe and continuous piped water supply. Twenty three percent reduction of diarrheal disease is associated with using drinking water from piped water on premises and 11% reduction associated with improved water source (23).

Water, sanitation and hygiene

A systematic review on WASH for the prevention of diarrhea study showed that hand washing with soap, improved water quality and improved excreta disposal are associated with a 48%, 17% and 36% reduction of diarrheal disease episodes respectively (77).

Improved sanitation (primarily construction of toilet) is associated with 69% of diarrhea reduction (74). According to the United Nation Water (UN-Water) Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) 2017 report illustrated that reduction of environmental risk including unsafe water and sanitation, and inadequate hygiene reduction can be prevent 26% and 25% of childhood deaths and total burden of disease among under-five children respectively (84).

Zinc supplementation

According the systematic review on zinc for the treatment of diarrhea demonstrated that diarrhea mortality reduces by 23 % through treatment of zinc supplementation (85). In addition, zinc supplementation as preventive intervention it is associated with 18% non significant reduction of diarrhea related mortality (RR=0.82, 95% CI 0.64-1.05) in developing countries (36).

Rotavirus and cholera vaccine

Rotavirus and cholera vaccine has an effect for the reduction of diarrhea morbidity and mortality. A systematic review showed that approximately 74 % of rotavirus death can be prevented by providing rotavirus vaccine (86). Similarly another systematic review indicated that rotavirus causes severe dehydration diarrhea and providing rotavirus vaccine results 74%, 61% and 47% reduction of very severe, severe and hospital admission rotavirus infection in childhood respectively. Cholera vaccine is associated a 52% reduction of cholera infection (RR=0.48, 95% CI 0.35-0.64). “Relative risk of one or more adverse events was 1·42 (1·06–1·89)” (36).

Antibiotic for dysentery

A systematic review indicated that WHO recommended antibiotics, which are ciprofloxacin, ceftriaxone and pivmecillinam can prevent more than 99 % of deaths due to dysentery in children or the cure rate of using these antibiotics for diarrhea treatment is 99% (87).

ORS

A meta-analysis on the effect of ORS on diarrhea mortality indicated that an estimated 93 % of diarrheal mortality may prevent through providing ORS. However, there was no sufficient evidence on the effectiveness of recommended home fluids related with diarrheal mortality (88).

Chapter Four

4. Discussion

The existing HEWs health service packages implementation modality, available interventions provided by them, and their relationships with public health sector and community are identified and analyzed by using the adapted effect of interventions for diarrhea and pneumonia conceptual framework in controlling diarrheal disease among under-five children in Ethiopia. The evidences of factors that are shaping the effectiveness of CHWs for controlling diarrheal diseases from other countries which have a similar implications for context to Ethiopian HEWs are also identified.

Besides identifying the roles of HEWs for controlling diarrheal disease, the study is indicated the challenges of implementing preventive and curative interventions in the rural and urban areas and pastoral communities.

The Ethiopian FMoH introduced HEP since 2003 to achieve basic health care services for the poor and rural populations by providing promotive, preventive and curative health care services through HEWs focusing on maternal and child health at the household, community and health post levels. After the introduction of HEP many improvements have seen in child health because of work done by HEWs. However, diarrheal disease remains the major causes of death among under-five children in Ethiopia. To control diarrheal diseases preventive and curative interventions were identified in the national implementation plan for community case management of common childhood illness program building from HEP.

Health service packages and implementation modality

In this finding to control diarrheal diseases HEWs provide health service packages for urban, and rural areas, and pastoral communities at the health posts, communities and household levels.

The present finding revealed HEW spent less time on providing health education (13%) and more time waiting for clients at health post (25%) and travel between work activities (16%). This might be due to community preference and value on curative services, and lack of transportation which results travelling long distance to work.

In this study HEWs are not allocated a balanced time on each health service packages that are implementing at the household, community and health post levels. This may has an effect on control of diarrheal disease among under-five children. The reasons for lack of a balanced time allocation by HEWs on each health service packages might be the desired health needs of the community, absence of guide how to allocated their time, lack of knowledge and skill of HEWs on effective time management, and poor support and technical guidance from public health sector.

The findings demonstrate that the HEP and its implementation are not adequately addressed the health needs of people living in urban areas and pastoral communities due to their working and lifestyle conditions. This might be the HEP is not tailored to those areas, and in urban areas community are out of home due to work in the day time even at night and mobile lifestyles in pastoral communities (40).

This study finds that HEWs serves a catchment population of 3000-5000 or about 600-1000 households. The evidence in Uganda CHWs who served households ranges from 100-200 and more than 200 were associated with less performance on management of childhood illness compared with households 100 or less with AOR=0.24, 95% CI 0.12-0.5 and AOR=0.22, 95% CI 0.10-0.48) respectively.

Available interventions provided by the HEWS

The findings illustrate that HEWs are improved child health by controlling communicable diseases such as diarrheal disease among under-five children in Ethiopia. However, the outcomes are not the same across different geographical areas and socioeconomic status.

Despite major progress has been made to control diarrheal disease through HEWs, there is an inequity in access and utilization of both preventive and curative interventions continues to be a challenge in the country. The poorest children those living in rural areas and pastoral communities, and whose mothers no education has low access and utilization of preventive and curative interventions. The inequities between rural and urban, and lowest and highest wealth quintile have seen in all interventions. This might be due to low awareness and lack of access to preventive and curative interventions.

In these findings the major causes of diarrheal diseases among under-five children are inadequate and lack of improved WASH facilities. The proportion of households washing their hands at critical times, after using toilet and have improved latrine are 1%, 22% and 6% respectively, and the coverage of improved water is 57%. The reasons could be collapsing toilet, shortage of locally appropriate, durable and affordable WASH technology options and inadequate improved water supply. This finding is consistent with other LMICs, the 2014 WHO report, in 2012 58% of total diarrheal death and 5.6% of deaths among under-five children occurred due to inadequate WASH in LMICs (23).

In this study exclusive breastfeeding for children less than 6 month is 58% and recommended complementary feeding after 6 month is 4.5%. This could be due to lack of knowledge of mothers, mothers perceived inadequate breast milk product and HEWs lack of knowledge and skill on complementary feeding practice. This finding is comparable to a 2016 lancet in LMICs, exclusively breastfeeding in LMICs and low income countries was 37% and 47% respectively among children less than 6 months (79).

This study finds that about 30% (3 in 10), 33% and 17% of children with diarrhea received ORS, zinc supplement and both ORS and zinc respectively. Around 42% of children with diarrhea did not receive any form of treatment in 2011. In addition, 10% of children with diarrhea received adequate fluid and food as recommended. The reason could be the low availability of ORS and zinc treatment. The other possible justification might be those children live in the poor family and rural areas have low access and utilization of the services. This finding is comparable with a systematic review done in developing countries indicated 34% children with diarrhea received ORS in 2012 (89). A WHO 2014 report indicated in developing countries about 39% of children with diarrhea receive ORS with continued feeding as recommended.

Mothers who live in urban areas, have information on ORS, attended antenatal and postnatal care visits are use health facilities for childhood diarrhea treatment more than mothers who live in rural areas, have no information on ORS, never attend antenatal care and no postnatal care visits. These could be mothers who live in urban areas have more access to health facilities and information and are more educated. During antenatal and postnatal visits mothers get more information about childhood illness such as diarrhea and treatment places (61).

HEWs relationships with the public health sector and community

The present findings show that there is low respect for HEWs particularly from urban communities and lack of problem solving supportive supervision from health sector. This finding is consistent with a study done in LMICs indicated that health care professionals did not supervise CHWs regularly, if conducted the supervision was not supportive rather focus on fault findings. The reasons could be educational and wealth status, the health professionals have additional responsibilities such as administration and patient care, lack of problem solving and coaching skills, financial constraint to cover transport and perdiem, and unwillingness to supervise (72).

This study show that there is a lack of coordination between HEWs and other stakeholders such as water, education and agriculture sectors at Kebele levels to implement health service packages. Sometimes HEWs in addition to providing and promoting preventive interventions at community and household level, they are participating in different seasonal activities such as environmental protection (terracing), different campaign and tax collection. These might be increased the duties and responsibilities of HEWS which results decreasing their performance to achieve the required outcome that is controlling diarrheal diseases (48).

In general, in these findings as the effort done by the HEWs, the coverage and utilization of preventive and curative interventions used for controlling diarrheal disease are low. The main reasons were lack of focus on preventive activity, poor balance time allocation on health service packages, low demand on preventive interventions by the community and household (particularly urban and pastoral communities), no education and having lowest wealth quintile, community lack of information on the availability interventions, lack of knowledge and skills HEWs, inadequate services (WASH), poor supplies (ORS, Zinc treatment and improved WASH technology options), lack of proper supervision and administrative support, and lack of transportation.

Evidences of factors that are shaping the effectiveness CHWs

This study finds that manageable workload in terms of number of tasks and catchment population, problem solving, continues and collaborative supportive supervision and feedback, fulfilling the necessary supplies and materials, appropriate respect, knowledge and skilled based training, clear roles and responsibilities, referral and mentoring support, conducting outreach activity integrated with health staff, joint ownership of HEP, balanced package of financial and non-financial support and design practical performance monitoring system are the factors that increase the effectiveness and performance of CHWs to control communicable diseases such as diarrheal disease which have a similar implications for the HEWs in Ethiopia.

The FMOH prioritized equity and quality as a major transformation agenda in the HSTP. Prioritizing equity and quality in the policy document is not only an end unless they are translated into action by improving implementation modality and conducting timely and regular monitoring and evaluation. Assessing the roles of HEWs for controlling diarrheal disease and designing appropriate strategies may increase the performance of HEWs to play a role to control disease among under-five children. However, more additional research would be essential. For example, workload of HEWs, the reasons of poor and rural people are not fully accessing essential health interventions, and HEWs relationships with health sector and community.

Limitations of study findings

- Ethiopia is a very diverse country with a variety of contexts. As a result this study has limitations on analyzing the whole picture of HEWs health service packages implementation modality and existing interventions in relation to their role to control diarrheal diseases because most studies are done focus on HEWs in rural areas and concentrates in specific zones, district and communities.
- Lack of literatures on HEWs relationships with the community and health sector which limits the inference one can draw.
- The conceptual framework was very useful to identify and analyze the role of HEWs and interventions for controlling diarrheal disease among under-five children. However, adjustments have been made to make practical for this study.

Chapter Five

5. Conclusions and recommendations

The FMoH of Ethiopia national newborn and child survival five year strategy (2015/16-2019/20) indicated that community based health interventions both preventive and curative which are implemented through HEWs are the main approaches to control diarrheal diseases. However, there is a lack of study conducted on the role of HEWs to control diarrheal disease among under-five children by implementing preventive and curative interventions. Conducting a study on the role of HEWs to control diarrheal disease among under-five children in Ethiopia is crucial to improve diarrheal diseases control programs and contribute the end of all preventable child death by 2035 in the country and ending preventable child death from diarrhea by 2025 globally.

Conclusions

HEWs have a major role to control diarrheal diseases among under-five children in Ethiopia through community based interventions. However, their roles are determined by health service packages implementation modality, available intervention, their relationship with the community and health sectors, and factors that are shaping their effectiveness.

Unbalanced time allocation for each interventions, less time spent on health education at the community and household level (13%), more time spent on travel for work (16%) and waiting for client at the health post (25%), additional activities (managerial and seasonal activity), not adequately adapted health service packages in urban areas and pastoral communities in the context of their working and lifestyle conditions are affecting the roles HEWs for controlling diarrheal diseases among under-five children.

In addition, the utilization of almost all the available interventions are low due to lack of adequate and improved services and supplies, lowest wealth quintile, lack of knowledge and skill, living in rural areas lack of proper support from health sector in terms of referral, training, supervision and performance evaluation, and low community participation in HEP planning activities. The utilization of available interventions for those children's who live in a poor family and rural areas are the main challenges. For their roles to be improved, HEWs need to be supported from the community and health sector, and their implementation modality and available interventions could be assessed.

The findings have important implications for other HEP program components which are implemented through HEWs by providing promotive, preventive and curative interventions at the household, community and health post levels.

Recommendations

Based on the findings on the roles of HEWs to control diarrheal diseases among under-five children in Ethiopia the following recommendations are provided.

At policy and program level

- Ministry of health should be developed a practical and realistic strategy to guide the average time allocation for each health service packages and managerial activities of HEWs.
- The health service packages that are implemented in urban areas and pastoral communities need to be revisited to tailor service provision in different contexts.
- Tracking mechanism should be designed to follow the quality, equity and sustainability of interventions.
- Ensure the availability of ORS, zinc supplements, and adequate and improved WASH facilities.
- Rapid assessment should be conducted on the workload of HEWs and their integration with different stakeholders in the Kebele, which may increase the performance of HEWs and service utilization of diarrheal control interventions.
- The implementation of preventive and curative interventions should be provided in an integrated way. These may help to maximize the controlling program for diarrheal diseases.
- The HEWs relationships with the community and health sector in terms of referral, supervision, training, remuneration and performance review should be assessed.
- To strengthen intersectoral collaboration, stakeholder mapping and action plan should be developed. These may help to improve the access and implementation of interventions for controlling diarrheal diseases. Such as upgrading transporting system, improved water supply and WASH technology options.

At community level

- Provide health promotion and behavioral change programs for targeted households and communities.
- Engage the community and religious leaders in the awareness creation activities at the community level and use local media for the dissemination of messages on diarrheal diseases control programs.

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Annex I

Conceptual framework of the effects of interventions for diarrheal and pneumonia

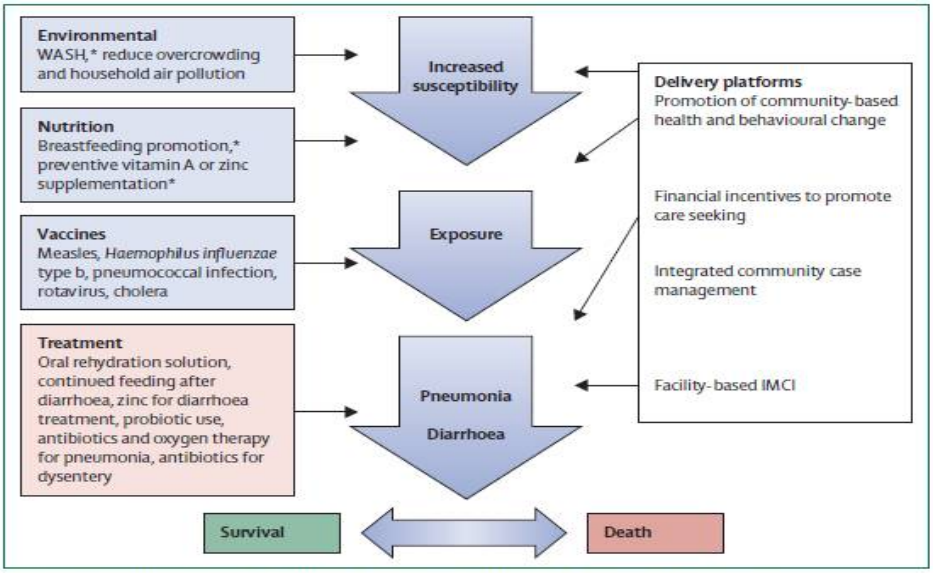

***Figure 1*: Conceptual framework of the effect of interventions for diarrhoea and pneumonia**
WASH=water, sanitation, and hygiene. IMCI=Integrated Management of Childhood Illness. *Interventions common to both diarrhoea and pneumonia.

Source: The lancet diarrhea and pneumonia intervention study group, 2013.