

**PREVALENCE OF LEPROSY AND ITS ASSOCIATED RISK FACTORS
AMONG SKIN DISEASE PATIENTS VISITING BISIDIMO HOSPITAL,
BABILE WOREDA,EASTERN HARARGHE**

M. Sc. THESIS

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DECEMBER 2020

HARAMAYA UNIVERSITY

**Prevalence of Leprosy and its Associated Risk Factors among Skin Disease
Patients Visiting Bisidimo Hospital, Babile Woreda, Eastern Hararghe**

**A Thesis Submitted to the School of Biological Sciences and Biotechnology
Postgraduate Program Directorate,
HARAMAYA UNIVERSITY**

**In partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE IN MICROBIOLOGY**

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December 2020

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As thesis research advisors, we hereby certify that we have read and evaluated the thesis prepared by **Lidiya Alemayehu** Entitled “**Prevalence of Leprosy and its Associated Risk Factors among Skin Disease Patients Visiting Bisidimo Hospital, Babile Woreda, Eastern Hararghe**” and recommend that it be accepted as fulfilling the thesis requirement for the degree of **M.Sc. in Microbiology**.

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DEDICATION

This thesis is dedicated to my father Alemayehu Negash and my mother Hana Girma for their love; encouragement and financial support that helped me complete this work on time.

STATEMENT OF THE AUTHOR

By my signature below, I declare and affirm that this thesis is my original work, I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this thesis. Any scholarly matter that is included in the thesis has been given recognition through citation.

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BIOGRAPHICAL SKETCH

The author, Lidiya Alemayehu was born on Dec 8, 1998 in Harar city, Harari regional state, Ethiopia. She attended her elementary school at Keladamba Primary School and Aboker Primary School from 2004-2011 in Harar city. She also attended her secondary school education at Junior Secondary School from 2012-2013 and preparatory school education at Aboker Preparatory School from 2014-2015. She joined Haramaya University in 2016 G.C. and graduated in July 2018 with B.Sc. degree in Biology. Soon after graduation, she directly started her M.Sc. studies in Microbiology at Haramaya University in 2019 G.C.

ACKNOWLEDGEMENTS

I express my deep sense of appreciation and heartfelt thanks to my major advisor Dr. Ameha Kebede, for his keen interest, constant supervision, valuable guidance, kindness, encouragement, and constructive criticisms from the initial stage of the thesis research proposal development to the completion of the write-up of the thesis. I am also greatly indebted to my co-advisor, Dr. Meseret Chimdessa, for his valuable comments, suggestions, and support during the course of the thesis research work.

I would like to thank staff members of Bisidimo General Hospital for their encouragement, collaboration, and warm social partnership on various occasions during my study time. I am especially very thankful to Dr. Ahmed Nure for his kindness and sustained support throughout my study period. My appreciation is also extended to Mr. Abraham for his wholehearted support during the thesis research work. In addition, I would like to thank, Mrs. Helen and Mr. Biniyam for their excellent assistance in data collection.

Finally, I would like to express my special thanks to my family for supporting me financially and encouraging me morally throughout the research work.

ACRONYMS AND ABBREVIATIONS

AARB	Alcohol-acid resistant bacilli
AFB	Acid fast bacilli
ATP	Adenosine tri-phosphate
BGH	Bisidimo General Hospital
CI	Confidence interval
CSA	Central Statistics Agency
DNA	Deoxyribonucleic acid
FMOH	Federal Ministry of Health
HIV	Human Immuno Deficiency Virus
LL	Lepromatous leprosy
MB	Multibacillary group
MDT	Multi Drug Therapy
PB	Paucibacillary group
PCR	Polymerase Chain Reaction
PGL1	Phenolic Glycolipid 1
SSS	Silt-skin smears
TT	Tuberculoid-tuberculoid leprosy
WHO	World Health Organization
ZN	Ziehl-Neelsen

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ABSTRACT

Leprosy or Hansen's disease is still a public health problem in some African and Asian countries including Ethiopia. Even though its prevalence has declined after introduction of MDT, the disease is still one of the problems that persist in developing countries not decreased. The objectives of this study were to determine the prevalence of leprosy among skin disease patients, to assess its associated risk factors of leprosy in Bisidimo General Hospital, Babile woreda, Eastern Hararghe. A hospital based cross-sectional study was carried out for two months (Dec 2019-Feb 2020) on 422 skin disease patients selected using stratified random sampling technique. Skin smear samples collected from study subjects were examined using Modified Zeihl Neelsen method. In addition, five years retrospective analysis of clinical records was carried out. Structured questionnaire was used to gather relevant information on socio-demographic characteristics of study participants, people's awareness and risk factors for leprosy. The largest proportion of study participants was in the age group of 15-30 years old and the proportion of study participants was lowest in the older age groups. The overall prevalence of leprosy among skin disease patients of the study area was (12.3%). The results showed that there was a statistically significant difference between age groups of the study subjects in the prevalence of leprosy ($P=0.003$). Prevalence of leprosy was higher in males (24.7%) than in females (6.8%) in the first age group (15-30 years) and significantly higher ($P=0.003$) in both sexes (16.%) of the same age group than in other age groups, 31-45 (7.7%), 46-60 (7.8%) and >60 (21.2%). Most of the respondents (74.6%) had poor knowledge towards leprosy, (25.3%) of the respondents had good knowledge of leprosy. Significant relationship exists between leprosy and the risk factors like age, sex, family size, contaminated water source, poor personal and environmental hygiene and balanced diet ($P<0.05$). Generally, prevalence of leprosy was higher and awareness was lower among the study participants. Thus it is recommended that the local health sector should give continuous education to raise awareness, knowledge towards transmission, cause, and prevention of leprosy through community based education and improvement of contact and personal sanitation.

Key words: Bisidimo, Leprosy, Prevalence, Risk factors, Zeihl Neelsen method

1. INTRODUCTION

Leprosy (also known as Hansen's disease) is a chronic infectious disease that is caused by *Mycobacterium leprae*, an acid-fast, rod-shaped bacillus. The disease mainly affects the skin, the peripheral nerves, mucosa of the upper respiratory tract, and the eyes. Leprosy is curable and treatment in the early stages can prevent disability. Its morbidity is low because a large portion of the population is naturally resistant to the disease.

The origin of leprosy is not exactly known. However, Indian writings describe the presence of a disease that resembles leprosy around 600BC (Howard, 2010). Leprosy is prevalent in all countries of the South-East Asia and Africa and in most countries of the Eastern Mediterranean Region (WHO, 2012). According to WHO (2015), it is widely prevalent in thirteen countries; , India, Brazil, Indonesia, Ethiopia, Bangladesh, Democratic Republic of Congo, Nepal, Myanmar, Nigeria, Sri Lanka, Tanzania, Madagascar and the Philippines that contributed 94% of all new leprosy cases worldwide (WHO, 2015). Although the prevalence of leprosy has decreased noticeably after the introduction of MDT in the beginning of the 1980 (Lastoria, 2014), new cases are recorded in some of these countries. In Ethiopia, rate of new cases of leprosy with grade two disabilities was 10.2% in 2014 (WHO, 2015).

Leprosy transmission occurs by close contact with an infected individual and through inhalation of the bacilli contained in nasal secretions. The main route of transmission is the nasal mucosa and other transmission routes, such as blood, breast milk, and insect bites (Cairns *et al.*, 2014). It is assumed that infected individuals, even those who did not develop the disease, may have a transitional period of nasal release of bacilli (Lastoria, 2014).

Leprosy is mostly diagnosed based on clinical features. However, in some situations, laboratory exams are necessary to confirm the diagnosis of leprosy or classify its clinical forms. Thus, a range of laboratory techniques may be employed for the diagnosis of leprosy, including skin smear microscopy, histopathology, serology, immune histochemistry, polymerase chain reaction (PCR), imaging tests, and blood tests (Lastoria *et al.*, 2014).

Skin smear microscopy, histopathology, serology, immune histochemistry, polymerase chain reaction (PCR), imaging tests, and blood tests Leprosy is a curable disease with well-defined etiology, but lacks better diagnostic tools, (Skin smear microscopy, histopathology, serology, immune histochemistry, polymerase chain reaction (PCR), imaging tests, and blood tests.

Lacks of preventive and therapeutic strategies (the use of multiple drugs, two or three special antibiotics (Rifampicin, Dapsone and sometimes Clofazimine).

Leprosy has no specific vaccine against *M. leprae* (Goulart and Goulart, 2008). Leprosy is a curable disease with well-defined etiology, but lacks better diagnostic tools, preventive and therapeutic strategies. Due to early diagnosis and protection of those populations at risk, especially for the house hold contacts of leprosy patients, it is given priority in disease control programs in order to disrupt transmission and reduce physical and social disabilities (Goulart and Goulart, 2008).

The standard treatment for leprosy involves the use of multiple drugs, two or three special antibiotics (Rifampicin, Dapsone and sometimes Clofazimine).The duration of treatment, dose and number of antibiotics depend on the type of leprosy (PB or MB) and age of the patients. After taking MDT, leprosy is no longer transmittable to others but to cure their disease they need to take all the antibiotics as prescribed by their doctors (CDC, 2013). The behavior of individuals also helps the transmission cycle to continue, as many people are unwilling to seek medical care even after being diagnosed because of misconceptions, stigma and superstitions (Sileshi, 2015).

In Ethiopia, some research have done on leprosy, but there is little information on the current status of the prevalence, awareness on cause and transmission of leprosy and associated risk factors of leprosy among skin disease patients visiting Bisidimo Hospital.

Thus, the present study was initiated to bridge gap on the information on the prevalence of leprosy and risk factors related to leprosy among skin disease patients in the study area.

General objective

The overall objective of the study was to determine the prevalence of leprosy and associated risk factors of among skin disease patients visiting Bisidimo Hospital in Bisidimo, Babile *woreda*, Eastern Harerghe.

Specific objectives

1. To determine the prevalence of leprosy among skin disease patients visiting Bisidimo General Hospital, Babile *woreda*, Eastern Harerghe;
2. To assess the socio economic status of skin disease patients visiting Bisidimo General Hospital;
3. To identify the risk factors associated with prevalence of leprosy among skin disease patients visiting Bisidimo General Hospital.

2. LITERATURE REVIEW

2.1. Definition of Leprosy

Leprosy (also known Hansen's disease) is a chronic infectious disease that is caused by *Mycobacterium leprae*, an acid-fast, rod-shaped bacillus. The disease mainly affects the skin, the peripheral nerves, mucosa of the upper respiratory tract, and the eyes. Leprosy is curable and treatment in the early stages can prevent disability. Its morbidity is low because a large portion of the population is naturally resistant to the disease. It is not predominantly age or gender specific disease (Lastoria, 2014).

2.2. Historical Background of Leprosy

Leprosy has been known since the biblical times over 3000 years ago. There are doubts whether leprosy is originated in Asia or Africa. The term leprosy is a tribute to the Norwegian physician Gerhard Armauer Hansen, who identified the bacillus *Mycobacterium leprae* as the cause of the disease in 1873 (Susannah, 2015). Leprosy was known at around 600BC when a disease resembling leprosy was discovered in India (Susannah, 2015). However, the origin of leprosy was not precisely known until most ancient evidence of leprosy comes from a 4,000-years-old human skeleton that was covered in India in 2009 (Robbins *et al.*, 2009). Symptoms that are used today to describe leprosy were documented in Chinese books in 400 BC (Howard, 2010). Greek writers described a disease that may have been leprosy in the 2nd century BC (Susannah, 2015). In Egypt archaeological studies of skeleton have shown that leprosy was prevalent during the 2nd century BC and claimed that leprosy conceivably originated in Egypt (Robbins *et al.*, 2009).

Leprosy is assumed to have been introduced in Europe from India by the troops of Alexander the Great at 300 BC and its incidence was high in Europe. Leprosy is believed to have been introduced in Latin America during the colonization period by French people in the United States and by Spanish and Portuguese people in South America. African slave traffic was the major cause of the spread of leprosy in the Americas. The first cases were reported in Brazil in 1600 in the city of Rio de Janeiro (Luiz *et al.*, 2015).

Although the presence of leprosy is historically documented in the literature, the exact time of its diagnosis was not known in Ethiopia. However, researches reveal that leprosy is believed to have originally spread from neighboring countries like Egypt and countries around the Red Sea, because of Ethiopia's well-built trade relations with these areas (Sori, 2019).

2.3. Epidemiology of Leprosy

The prevalence of leprosy has decreased worldwide from more than 5 million cases in the mid-1980s to less than 200,000 cases in 2015. A total of 175,554 registered prevalence of leprosy cases were reported to WHO in the beginning of 2015 with 213,899 new case detections from 121 countries (WHO, 2015).

According to WHO (2009), the detection of new cases of leprosy has declined from 514 718 in 2003 to 244 796 in 2009, but the rate of decrease is getting smaller each year. Among 244 796 new cases in 2009, 16 African and Asian countries that reported 1000 or more new cases accounted for 93% of the total (WHO, 2010).

These countries with the number of leprosy cases detected in 2009 are include: India (133, 717 cases), Brazil (37,610 cases), Indonesia (17,260 cases), Bangladesh (5239 cases), the Democratic Republic of Congo (5062 cases), Ethiopia (4417 cases), Nepal (4394 cases), Myanmar (3147 cases), China, 1597 cases (Koichi *et al.*, 2012). However, the number of new cases reported at the end of 2014 (3.78 per 100,000 populations) was almost at the same level as in the previous year (3.81 per 100,000 populations). The registered prevalence rate in the beginning of 2015 was 0.31 per 10,000 populations which is less than that of 2014 (0.32 per 10,000 populations) (WHO, 2015).

The highest new leprosy cases detection was reported from eight countries. From these countries: Brazil (31,064), Ethiopia (3,758), India (125,785 new cases), and Indonesia (17,025). Brazil, India and Indonesia reported greater than 10,000 new cases in 2014 and they accounted for 81% of new leprosy cases worldwide.

Ethiopia, Democratic Republic of Congo, Madagascar, Nigeria, Tanzania, Bangladesh, Myanmar, Nepal, Sri Lanka and Philippines reported between 1000 and 10,000 new cases in 2014 and they accounted for 13% of new leprosy cases in the reported year. The remaining 108 countries all together contributed only 6% of all new leprosy cases (WHO, 2015).

In Ethiopia, in 1982, there were 80,927 registered leprosy cases, but after the introduction of MDT in 1983, the registered prevalence dropped to 59,822 cases in 1984 (WHO, 2005). Leprosy registered prevalence declined rapidly and reached 12,041 cases at the end of 1990 and increased to 16,670 cases in 1991. In 1992 the registered prevalence slightly dropped to 15,673 cases and reached 12,698 in 1993. However, after 1994 the registered prevalence had decreased slightly and dropped to 3,758 registered cases after 2 decades in 2014. This means since 1994, the registered prevalence on average had declined by 293 cases every year (WHO, 2015). According to the reports of the Ministry of Health Ethiopia, leprosy notification rate in Ethiopia remained stable over the last few years at between 4000 and 5,000 new leprosy cases recorded annually. On average 4,018 new leprosy cases were detected for the last 33 years in Ethiopia. In 2013, new cases of leprosy in Ethiopia were 3224 and in 2017 annual national detection remain constant between 3000 – 4000 cases (FMOH, 2017).

2.4. Transmission of Leprosy

The transmission of leprosy occurs through close contact with humans who have untreated or drug resistant leprosy (Scott, 2006). The major mode of transmission is inhalation of the bacilli contained in nasal secretion or droplets. Less commonly, transmission can occur by skin erosions. Another transmission route of leprosy is through blood, vertical transmission, breast milk, and insect bites. It is assumed that infected individuals, even those who did not develop the disease, may have a transitional period of nasal release of bacilli (Lastoria, 2014). It is accepted that household contacts are at a greater risk of developing leprosy or to transmit the disease to the population. According to Van Beers (1999), the risk of a person developing leprosy is nine times greater among household contacts and up to four times greater among contacts with neighbors (Van *et al.*, 1999).

It was believed that man is the only natural reservoir host of *M. leprae* and the only source of infection. However, recent studies indicated zoonotic transmissions; for example, a nine striped armadillo (*Dasypus novemcinctus* L) is also natural reservoir of *M. leprae* (Turman *et al.*, 2005). In the southern region of the United States of America, such as in Louisiana and Texas, cases of leprosy among native born Americans with no history of foreign exposure has been commonly reported (Truman *et al.*, 2011). In these regions, a wild armadillo infected with *M. leprae* has been confirmed. A comparative genomic analysis of *M. leprae* obtained from 50 patients and 33 wild armadillos from southern USA, confirmed that both humans and armadillos were infected with the same strains of *M. leprae* (Truman *et al.*, 2011). A case-control study conducted in Brazil show that direct contact with armadillos is a risk factor for leprosy in Brazil (Deps *et al.*, 2008).

2.5. The Microbiology of *M. leprae*

Mycobacterium leprae is an acid fast, non-motile, which belongs to the class Actinomycetales and the genus *Mycobacterium* based on the chemical composition of the cell wall, staining properties and cell structure, antigenic characteristics of mycobacteria and a lipid-rich cell envelope (Monot *et al.*, 2005, Shinnick, 2006). The morphology of the bacterium is straight or rod shape or curved bacillus and has a length of 4 to 8µm and 0.3 to 0.5µm diameter. *M. leprae* exists as single or cluster. The cell of *M. leprae* is bounded by unique cell wall which defines the cell shape and provides protection from environmental stress. It does not have flagella, spores and capsules (Shinnick, 2006). The cell wall has two layers, the outer and inner layers. The outer layer has lipopolysaccharide made up of branching chains of arabinogalactan esterified with long chain of mycolic acids. The inner layer is made up of peptidoglycan. The cell membrane is composed of lipids and protein like other bacteria and also within the cytoplasm there are few organelles (Vissa and Brennan, 2001).

2.6. Metabolism and Growth of *M. leprae*

M. leprae grow in optimum temperature at 30-33°C, which may account for the peripheral nerves of host cell. *M. leprae* doubling time is thought to be 14 days. Toxin production by *M. leprae* has not been identified (Wheeler, 1988). The key metabolic pathways have been lost due to this genomic downsizing (Scollard *et al.*, 2006).

Catalase enzyme which breaks down peroxides appears to be absent in *M. leprae*. *M. leprae* cannot synthesis purines and hence dependent on the host for purines (Wheeler, 1987, Scollard *et al.*, 2006). *M. leprae* does not have an iron binding compounds, the siderophores, and mycobactin, an Iron chelating compounds (Wheeler, 1988). *M. leprae* is dependent on its host for iron provision. Interestingly, it can synthesis its own ATP and it does not depend on its host to get ATP (Lee *et al.*, 1986).

2.7. Pathology

Leprosy affects skin, eyes and nerves. It may also affect other body parts such as mucosa (nose, mouth and pharynx), kidney, smooth muscles, vascular endothelium, and reticulo-endothelial system. The bacillus has low pathogenicity and only some infected people develop signs of the disease and this depends on the immune response of the host. In most people the immune system is able to eliminate leprosy during the early infection stage before symptoms develop (Bryceson and Pfaltzgraff, 1990).

The portal of entry for *M. leprae* is widely supposed to be the nose and skin. After the bacilli get into the body either through the nasal discharge or the skin, they are taken up by histiocytes in the skin and by the Schwann cells in the nerve upon which they usually provoke an inflammatory response of lymphocytes and histiocytes. The mode of the arrival response is greatly variable. An early lesion may occur as a vague, ill-defined, a dark skin (hypo pigmented) or a light skin (erythematous) patch with an aesthesia (Kumar and Kumar, 2010). The earliest lesions of nasal mucosa cause mild, non-specific symptoms, so the histopathological features of this lesion are not known (David and Scollard, 2014). Most indeterminate lesions will restore spontaneously, if the host immunity is strong. The clinical form and the subsequent outcome of the disease depend on the nature and extent of the host's immune response (Ridley, 1988).

When the host immunity is strong, the clinical form of the diseases is that of tuberculoid leprosy (TT). This disease is localized to one or few sites in the skin and few in the large peripheral nerves. It is characterized by granulomatous inflammation and destruction of nerve fibers. The lesion is characterized by clear margins and do not show the presence of acid-fast bacteria. (Schlesinger, 1991, Sampaio *et al.*, 2011). If the host immunity is weak; the disease develops in

to the lepromatous leprosy (LL) form. This form of leprosy is marked by numerous bacterial growths both in the skin and in the nerve. In the skin, macrophages fail to differentiate and they laden by the bacilli. The disease is clinically characterized by multiples of lesions all over the body which progress to nodules if untreated. It is characterized by symmetrical loss of sensation followed by loss of motor nerves (Ridley, 1988, Walker *et al.*, 2006).

2.8. Immunology of Leprosy

2.8.1 Innate immunity response

Innate immunity is the first barrier to be infected, represented by the integrity of epithelia, secretions, and surface immunoglobulin A (IgA). In addition, neutrophil cells, dendritic cell, and activated macrophages can destroy bacilli. Macrophages have been identified as key players in the pathogenesis of leprosy. It has been demonstrated that during an inflammatory response, bone marrow derived monocytes enter the tissue in large numbers and take part in the defense against the pathogens (Roberta *et al.*, 2018).

The endothelial cells trigger monocytes to become M2 macrophages and that IFN- γ activates endothelial cells to induce monocytes to differentiate into M1 macrophages by a mechanism regulated by Jagged 1 (JAG1), a protein localized in the vascular endothelium(Kibbie *et al.*, 2016).There are a lot of evidences that show tissue macrophages are independent from blood monocytes and different phenotypes or functions are the result of different macrophages origin(Davies and Taylor, 2015).Macrophages present in lepromatous skin cells there is an up regulation of IL-27 (Teles *et al.*, 2015), a paradoxal cytokine that may activate IFN- β and IL-10 that contribute for the blockade of antimicrobial pathways (Teles *et al.*, 2013).

Effective innate immune response modulated by dendritic cells, the cells phagocytosis *M. leprae* and express antigens derived from the bacteria, such as phenolic glycolipid 1 (PGL-1).*M. leprae* infection decreases the capacity of DCs in inducing T-cell responses by a mechanism that involves PGL-1 (Hashimoto *et al.*, 2002), it impairs dendritic cells maturation and activation, thereby facilitating *M. leprae* survival (Spencer *et al.*, 2011).Cells of the innate immune system are equipped with germline encoded pattern recognition receptors (PRRs), which recognize pathogen associated molecular patterns (PAMPs), which are shared among groups of pathogens (Modlin, 2010). The family of toll like receptors (TLRs) is the major and most extensively

studied class of PRRs. TLRs is thought to play a crucial role in the recognition of microbes and subsequent induction of the immune responses.

These receptors are expressed on immune cells, such as monocytes, macrophages, dendritic cells (DC), and granulocytes, and at sites of host-pathogen interaction such as airway epithelium and skin (McInturff *et al.*, 2005). Activation of TLRs results in up regulation of the production of inflammatory mediators such as TNF- α , IL-6 and IL-12 and microbial killing mechanisms like nitric oxide (NO) production (Dearman *et al.*, 2009). TLR2 is activated by bacterial lipoproteins including mycobacterial antigens (Kang and Chae, 2001). Neutrophils also play important roles in host defense against infectious agents upon phagocytosis; they produce oxidative and non-oxidative microbicides for destruction of these agents (Smith, 1994).

2.8.2. The Adaptive immune response

The adaptive, also known as acquired, immune response requires the specific recognition of foreign antigens which activates the humoral response, resulting in B-cell maturation and antibody production, and the cell-mediated response, focusing mainly on T-cell activation. These different arms of the host response to pathogens are not equal to T-cell help is required for antibody maturation and isotype switching while B-cells can function as antigen-presenting cells in the induction of specific T-cells. Regulation of inflammatory cytokines and chemokines may lead to proliferation of T *helper* 1 (Th1) or T *helper* 2 (Th2) lymphocytes, which will promote cellular or humoral immune response to *M. leprae* (Modlin, 1993; Mendonca *et al.*, 2008).

Type I reaction is a naturally occurring delayed-type hyper-sensitivity response to *M. leprae*. *M. leprae* is characterized by “upgrading” of the clinical picture towards the tuberculoid pole, including a reduction in bacillary load. Immunologically, it is characterized by the development of strong skin test reactivity as well as lymphocyte responsiveness and a predominant Th1 response (Barnetson *et al.*, 1976). Pathogenesis of type II reaction is thought to be related to the deposition of immune complexes, increased levels of TNF- α , IL-1 β , IFN- γ , and other cytokines.

2.9. Diagnosis of Leprosy

The diagnosis of leprosy is mainly based on clinical features (i) definite loss of sensation in a pale (hypopigmented) or reddish skin patch; (ii) thickened or enlarged peripheral nerve with loss of sensation and weakness of the muscles supplied by that nerve; or (iii) presence of acid-fast bacilli in a silt-skin smear (WHO, 2010). Silt skin smear (SSS) test by taking the smear fixation, staining, and reading the results (Desikan *et al.*, 2006). Serological and polymerase chain reaction (PCR) are another methods to detect leprosy.

2.9.1 Silt-skin smear

Silt-skin smear is used to detect alcohol- acid resistant bacilli (AARB) in skin smears collected from standard sites (skin lesions, ear lobes, elbows). It is performed using the Ziehl-Neelsen staining technique, which consists of staining bacilli with red dyes and makes it possible to assess the morphology index (MI) and the bacterial index (BI) (Miranda *et al.*, 1991).

Morphology index (MI) determines whether the bacillus is viable or not and is represented by the percentage of intact bacilli with regard to the total number of bacilli analyzed in the study. Intact bacilli are completely stained red and can be observed before treatment. Fragmented bacilli show that small gaps and granular bacilli show great gaps with spots stained red. These two last types of bacilli comprise non-viable or killed microorganisms and are observed in treated patients (Lastoria, 2014).

The bacterial index (BI) represents the quantitative bacillary load or number of bacilli and is expressed according to logarithmic scale ranging from 0 to 6+. Smear is positive (+) in the multibacillary group (MB), which helps to establish a definite diagnosis of leprosy, but sensitivity is low in the paucibacillary group (PB), in which smear is often negative, with a limit of microscopy detection of 10^4 AARB bacilli per gram of tissue (Shepard, 1968).

Histopathological examination of tissue sections from suspected lesions is the gold standard for the diagnosis of leprosy. The use of skin biopsy reveals the clinical aspects of disease and used as confirmatory diagnosis of leprosy, but the procedure demands medical facilities and a histopathologist (Ridley and Joplin, 1966).

2.9.2. Serological testing

M. leprae can be serologically assayed based on specific antigens. Phenolic glycolipid (PGL-1) is opened new methods of monitoring *M. leprae* infections, Various studies have showed that paucibacillary patients have low or absent titers but multibacillary patients have high titers of *M. leprae* specific antibodies. It was reported that 20-40% paucibacillary and 90 to 95% multibacillary leprosy patients have a positive antibody in a PGL-1 based test (Geluk *et al.*, 2011). PGL-1 based test has not been widely implemented in field situations as screening tools.

2.9.3. Molecular base diagnosis

This molecular based diagnosis method has been developed as a sensitive diagnostic tool for identification of pathogens. The method of detection is most widely used to diagnose the infectious microbe by polymerase chain reaction (PCR), it is also used to detect *M. leprae* (Negra, 2016).

2.10. Treatment of Leprosy

Leprosy has no primary prevention, which means there is no specific vaccine against *M. leprae* (Goulart and Goulart, 2008). The house hold contacts of leprosy patients, who should be given priority in disease control programs in order to disrupt transmission and reduce physical and social disabilities (Goulart, 2008).

Leprosy is curable if treated with the proper treatment. Multi-drug combination therapy (MDT) used to treat leprosy was introduced in the beginning of 1982. The first-line agents are rifampicin, clofazimine and dapson. Paucibacillary patients are treated with rifampicin and dapson for six months and MB leprosy cases treated with three drugs: rifampicin, dapson and Clofazimine for 12 months. Rifampicin is a bactericidal antibiotic used to treat *Mycobacterium* infections such as tuberculosis and leprosy. Clofazimine has been used in the treatment of multibacillary leprosy since 1962. It is a bactericidal drug with both antibacterial and anti-inflammatory activity. The anti-inflammatory activity of clofazimine is through its immunosuppressive effects.

The lipophilic property of clofazimine enables it to accumulate in skin and nerves, while its anti-inflammatory activities are potentially useful in controlling leprosy reactions (Cholo *et al.*, 2012). The side effect of clofazimine includes increased skin pigmentation, and dryness, which occur as the drug becomes clinically effective (Ramu *et al.*, 1976).

Dapsone is a sulphur compound with bacteriostatic action, used in the treatment of leprosy. Its mode of action is via inhibition of the synthesis of dihydrofolic acid, (Vitamin B9), a precursor of tetrahydrofolic acid which serves as a cofactor in the metabolism of amino acids and nucleic acids. Haemolytic anaemia and skin reactions are among the few reported side effects of dapsone (Deps *et al.*, 2012).

2.11. Risk factors of Leprosy

Those living with poor conditions such as personal hygiene, contaminated water, and insufficient diet, or other diseases that compromise immune function are at highest risk for acquiring *M. leprae* infection. HIV may lead to increased susceptibility to leprosy as it is seen with tuberculosis (Goulart *et al.*, 2000).

3. MATERIALS AND METHODS

3.1. Study Area

The study was conducted in Bisidimo Hospital. Bisidimo, located in Babile woreda, East Harerghe at $09^{\circ} 13^{\circ}\text{N}$ latitude and $42^{\circ} 20^{\circ}\text{E}$ longitudes with an elevation of 1648m above sea level. The area is situated 550 km from Addis Ababa the capital city of Ethiopia. The town has an estimated population of 93,708, of whom 47,178 are men and 46,530 are women based on 2007 National census report (CSA, 2010). There are many hospitals in neighboring *woredas* around Babile but out of these, Bisidimo Hospital is selected because it is the leprosy treatment center providing curative service to the patients coming from different *woredas* of Eastern Harerghe.

3.2. Study Design

A cross-sectional survey was conducted to determine the prevalence of leprosy among skin disease patients who visited Bisidimo General Hospital, at Babile *woreda*, East Harerghe. Leprosy diagnosis was done through examination of clinical signs and skin smear test or using microscopic examination. Smear samples were collected from each study participants and medical examination was carried out. Moreover, questionnaire survey was conducted to assess the awareness and major associated risk factors of leprosy among the study participants. The collected skin smear samples were subjected to silt-skin smear examination after staining and the Modified Ziehl-Neelsen method was used.

3.3. Study Population

The study population included patients who visited Bisidimo Hospital from December, 2019 – January, 2020, with complaints of skin disease from both sexes and from age above 15, who were voluntary to participate and sign the consent form.

3.4. Exclusion Criteria

According to the information obtained from the patients of skin disease, those who had started medication for leprosy (MDT) at the time of data collection were excluded. The children under 15 were also excluded from the study.

3.5. Sample Size Determination

Since there was no previous published work on the same topic in the study area, P-value of 0.5 was taken to ensure the sample size large enough to satisfy the precision and confidence constraints. By taking this into consideration, the sample size for single population was calculated based on the 95% confidence interval (CI) and 5% sampling error using the formula described by Hassan (1991). In estimating the sample size (n), 50% prevalence, 95% CI for Z statistics which was conventionally accepted as 1.96 and 5% precision was used to determine the sample size using the following statistical formula:

$$n = \frac{Z^2 P (1-P)}{d^2}$$

Where: n = sample size

Z = Z statistic for a level of confidence (1.96) with 95% CI

d = precision (0.05)

p = expected prevalence or proportion (50%)

Based on the above formula, the sample size (n) was calculated as follows:

$$\begin{aligned} n &= \frac{(1.96)^2 (0.5) (0.5)}{(0.05)^2} \\ &= 384 \end{aligned}$$

Therefore; the calculated sample size for this study was 384. To minimize errors arising from the likelihood of non-compliance and non-responsive individuals, 10% of the sample size was added to the normal sample. Therefore, four hundred twenty two (422) patients were selected for the present study (Hassan, 1991). In general, the inclusion criteria were willingness to participate in the study and having complaints of skin disease.

3.7. Methods of Data Collection

The skin smears samples were collected by an experienced laboratory technician together with the principal investigator. Questionnaire survey was conducted by the principal investigator. Before collecting data, the questionnaire was translated to local languages.

3.7.1. Clinical examination of study participants

Each study participant was examined by the physician to obtain information related to leprosy. Signs and symptoms, such as presence of localized lesion, raised or flat skin, light or pigmented skin, painless ulcer, nerve damage and loss of sensation around lesion were examined and recorded by the physician.

3.7.2. Skin smear sample collection and processing

Skin smear samples were collected from skin disease patients selected as study participants. All study participants were oriented about the objectives of the study and the sample collection method. Then skin smear was collected from arms and earlobes of study participants (patients). Sterile blade was used to take the fluid part and skin smear samples were also collected from the most active margin of lesions incision 3-5 mm long and 2-3 mm deep by using blade (WHO, 1986). The collected samples were placed in sterile slide and labeled with the participant's code. Finally, all skin samples were processed and analyzed within 45 minutes.

d then translated to Amharic and Afan Oromo. After administering the questionnaire, the results of the questionnaire were translated back into English. The questionnaires contained two sections: The first section contained questions related to socio-demographic characteristics such as age, sex, and family size, access to pure water, diet, educational level, personal hygiene, and other information; the second section contained questions related to Knowledge of the people about the cause of leprosy, preventive methods and its mode of transmission. The questionnaires so organized were finally administered to the selected study participants. The data was collected from December, 2019 to January, 2020.

3.7.4. Retrospective study of the prevalence of leprosy from 2007 to 2011 E.C.

Information related to leprosy individuals who have been visited Bisidimo Hospital for the last five years (2007 to 2011) was collected systematically from patients' Health records and entered in the Review Format and was used to examine the trend of the prevalence of leprosy in the area. The principal investigator collected all these information by developing the format shown in Appendix IV. These data consisted of age, sex, year and number of persons infected per year.

3.8. Bacteriological Examination of *M. leprae*

3.8.1. Modified Ziehl-Neelsen method

Ziehl-Neelsen (ZN) method of acid fast staining technique was used to stain *Mycobacterium* species including *M. leprae*. Acid fast bacilli (AFB) in stained and acid washed smears were examined microscopically to assess the morphology and the number of bacilli in the sample.

In the Modified Ziehl-Neelsen staining method, skin smears were prepared on the glass slide and allowed to dry before staining for few minutes. Then the slide was fixed with methanol for five minutes and the resulting fixed smears were covered with carbol-fuchsin for 20 minutes then this was heated gently until the vapour begins to rise from carbol-fuchsin.

Then the slides were washed with tap water for 20 seconds and decolorized with 1% acid-alcohol (3% HCL in 95% alcohol) for 3 minutes. After washing with tap water, the slides were counter-stained with 0.2% methylene blue for a minute. Finally, the slides were washed in tap water and allowed to air dry. Then the smears were examined under the light microscope using the 100x oil immersion objective and scanned systematically (Carbic *et al.*, 2018).

3.9. Data Analysis

Data collected from questionnaire survey, clinical information and laboratory results were subjected to statistical analysis using SPSS version 20 software. Frequency and cross tabulation were used to analyze those categorical data like age, sex, prevalence. Chi-square test (X^2) was used to associate responses on awareness with prevalence of leprosy and the different risk factors. P-values < 0.05 were considered statistically significant.

3.10 Data Quality Control

To ensure quality data, all the laboratory procedures including collection and handling of specimens were carried out in accordance with standard protocols (NCCLS, 1997; WHO, 1986). All the reagents were checked for contamination each time. To ensure general safety, disposable gloves were worn and universal bio-safety precautions (NCCLS, 2002) were followed at all times for identification of bacteria to diagnose leprosy. Furthermore, each slide was examined by the principal investigator together with experienced laboratory technician.

4. RESULTS AND DISCUSSION

4.1. Socio-Demographic Characteristics of Study Participants

The study participants involved in this research were 422 skin disease patients that were randomly selected from those visiting Bisidimo General Hospital. The data related to the socio-demographic characteristics of the study participants are in Table 1.

As shown in Table 1, out of the 422 total study participants, 243 (57.6%) and 179 (42.4%) were male and female, respectively. Regarding the distribution of study participants by age, 150 (35.5%), 130 (30.8%), 90 (21.3%), 52 (12.3%) were in the age group 15-30, 31-45, 46-60 and >60 years old, respectively.

With respect to family size, 167 (39.6%), 103 (24.4%) and 18 (4.3%), 134 (31.8%) of them had less than 5, 6-8 and greater than 8 family size, and no children, respectively. Income wise, 55 (13%), 156 (37%) and 211 (50%) people earn <500, 500-1000 and >1000 Birr/month, respectively. With regards to occupation, 19 (4.5%), 82 (19.4%), 71 (16%), 115 (27.3%), and 37 (8.8%) were daily laborers, students, farmers, house wives, and merchants, respectively. Regarding marital status, 129 (30.6%), 230 (54.5%), 47 (11.1%) and 16 (3.8%) were single, married, divorced and widowed, respectively. Data on other socio-demographic characteristics are also shown in Table 1 below.

Table.1. Socio-demographic characteristics of the study participants in BGH (n=422)

Characteristics	Frequency (%)	Characteristics	Frequency (%)
Age		Monthly income	
15-30	150(35.5%)	<500	55 (13%)
31-45	130(30.8%)	500-1000	156 (37%)
46-60	90 (21.3%)	>1000	211 (50%)
>60	52 (12.3%)		
Mean \pm SD	2.1 \pm 1		
Sex		Occupation	
Male	243 (57.6%)	Employed	19 (4.5%)
Female	179 (42.4%)	Daily labor	82 (19.4%)
		Student	71 (16.8%)
Residence		Farmer	115 (27.3%)
Urban	159 (37.7%)	House wife	37 (8.8%)
Rural	263 (62.3%)	Merchant	65 (15.4%)
		No job	33 (7.8%)
Marital status		Accesses to mass media	
Single	129 (30.6%)	Use mass media	221 (52.4%)
Married	230 (54.5%)	Not use mass media	201 (47.6%)
Divorced	47 (11.1%)		
Widowed	16 (3.8%)		
Family size		Water treating practice	
1-5	167 (39.6%)	By filtering	62 (14.7%)
6-8	103 (24.4%)	Treating with chemical	37 (8.8%)
>8	18 (4.3%)	By boiling	46 (10.9%)
No children	134 (31.8%)	Directly	277 (60.6%)
Educational status		Drinking water source	
Illiterate	92 (21.8%)	Tap water	152 (36.6%)
Read and write	125 (29.6%)	Spring Water	47 (11.1%)
Elementary school completed	81 (19.2%)	Pond	59 (14%)
High school completed	94 (22.3%)	Hand pump	114 (27%)
College and above	30 (7.1%)	Water tank	50 (11.8%)
Personal hygiene practice		Environmental hygiene practice	
Good	184 (43.6%)	Good	199 (47.2%)
Poor	238 (52.4%)	Poor	223 (52.8%)

4.2. Prevalence of Leprosy

A total of 422 skin disease patients were examined for clinical signs and symptoms. Of these, 76 patients (18%) showed clinical signs and out of which only 52 persons (12%) were positive for skin smear tests. The overall prevalence of leprosy among the skin disease patients in relation to sex and age is depicted in Table 2. The overall prevalence among the four age groups of skin disease patients was 12.3%, out of which 16.5% and 6.7% were males and females, respectively (Table 2).

Table 2. Prevalence of leprosy by age and sex among skin disease patients (n=422) at Bisidimo General Hospital from Dec- Feb, 2020.

Age group in years	Male		Female		Both sex		X ²	P-value
	No. Exam.	No. Pos. (%)	No. Exam.	No. Pos. (%)	No. Exam.	No. Pos. (%)		
15-30	77	19 (24.7)	73	5 (6.8)	150	24 (16)	8.860	0.003*
31-45	85	9 (10.6)	45	1 (2.2)	130	10 (7.7)	2.900	0.089
46-60	54	5 (9.3)	36	2 (5.6)	90	7 (7.8)	0.413	0.520
>60	27	7 (25.9)	25	4 (16)	52	11 (21.2)	0.767	0.381
All age groups	243	40 (16.5)	179	12 (6.7)	422	52 (12.3)	9.082	0.003

No. Exam = Number of Examined persons; No. Pos = Number of Positive persons.

The prevalence of leprosy for age group 15-30 years was 16%, out of which 24 and 6.8% were for male and female, respectively (Table 2). Similarly for the age group 31-45 years, it was 7.7%, out of which 10.6 and 2.2% were for male and female, respectively (Table 2).

However for the group 46-60 years the prevalence of leprosy was 7.8% out of which 9.3 and 5.6% were for male and female, respectively (Table 2). For the age group above 60 it was 21.2%, out of which 25.9 and 16% were male and female, respectively.

The results of the chi-square test showed that leprosy prevalence for age group 15-30 years was significantly higher ($P=0.003$) in males than females. Considering all age groups, prevalence was also significantly ($X^2=9.082$, $P=0.003$) higher in males than females. In the present study, among the study participants who showed signs for leprosy, the prevalence rate was higher in males than in females.

4.3. Clinical Signs and Disability

Out of the 76 skin disease patients showing signs and symptoms of leprosy, 29% had pink-colored skin, 23.7% had painless ulcer, 19.7% had sensory loss, 15.8% had nerve damage and 11.8% patients had nodules (TABLE 3). They showed disability 1 (40.8%) and disability 2 (38.2%) cases. Previously, a study conducted in Boru Meda, Ethiopia, by Agidew *et al.* (2015) showed that 4% of the patients had Grade 2 disability, while the remaining 96% had Grade 1 and Grade 2 disabilities. The study reported by Ganesan (2018) showed that the disability rate was higher than the present study. Previous research conducted in Brazil showed that 21.25% had Grade 1 deformities and 6.31% had Grade 2 or more severe deformities. Deformities of hands were most common (44.48%), followed by feet (39.76%), and face (15.74%) (Santoshedev *et al.*, 2019). A study also showed in Kenya that disability was present in more than half (52.9%) of the subjects for whom disability grading had been undertaken. Grade 1 disability accounted for 34.5%. The study done in Ethiopia was in line with the present study showing that among those with disabilities, patients with grade 1 disability constituted highest in number (Tigist *et al.*, 2014). This level of disability indicated the existence of problems in terms of early case finding and treatment (Tigist *et al.*, 2014).

Table 3. Clinical signs and disabilities among the examined skin disease patients in Bisidimo General Hospital.

Clinical signs and disabilities of leprosy among study participants		
Clinical Sign and symptom	Frequency	Percent (%)
Nodules	9	11.8
Pink colored skin lesion	22	29
Sensory loss	15	19.7
Nerve damage	12	15.8
Pain-less ulcer	18	23.7
Total	76	
Disability Grade		
Grade 0	16	21
Grade 1	31	40.8
Grade 2	29	38.2
Total	76	

4.4. The Frequency of Awareness on Leprosy among Study Participants

Out of the 422 respondents, 231(54.3%) of them had at least heard about leprosy. However, 191 respondents had no idea about leprosy. While 100 (28.7%) respondents knew about the symptoms of leprosy, 322(76.3%) of them had no knowledge about symptoms of leprosy (Table 4).

Table.4. Responses on awareness towards leprosy among study participants.

Characteristics	Frequency	Percent
Have you heard about leprosy?		
Yes	231	54.7
No	191	45.3
Did you know symptom of leprosy?		
Yes	100	23.7
No	322	76.3
Did you know the transsmision mecanisim of leprosy?		
Yes	147	34.8
No	125	65.2
Did you know the cause for leprosy?		
Yes	110	26.1
No	312	73.9
Is leprosy treatable?		
Yes	198	46.9
No	224	53.1
Did you know the prevention and control method of leprosy?		
Yes	112	26.5
No	310	73.5
Is leprosy heriditable?		
Yes	98	23.2
No	324	76.8

Of the entire respondents, only 147(34.8%) knew about the methods of transmission of leprosy. Similarly, only 110(26.1%) of the respondents had knowledge about the transmission mechanism of this disease.

From the total study participants, 198(46.5%) believed that leprosy is treatable, but 224(53.1%) didn't believe leprosy is treatable (Table 4). In this study, 112(26.5%) of the respondents knew about prevention and control methods while 310(73.5%) were unaware of them. Out the total participants,98(23.2%) of the respondents believe that leprosy is not heritable. However, 324(76.8%) of the respondents believe that leprosy is heritable. This finding was in line with that of Tekle Haimanot *et al.* (1992) who reported that 90.3% of their study participants at least heard about leprosy while 47.8% of them believed that leprosy is heritable. Similarly, the study reported by Atinkut *et al.* (2018) in Gindeberet *woreda*, indicated that 48.7% of their respondents knew about the cause of leprosy and 48.7% believe that leprosy is heritable while 67% were unaware of the symptoms of leprosy. On the contrary, the present study disagrees with research report from Kuyera town, Ethiopia, where 100% of the study participants were found at least to have heard about leprosy and 69.26% to have known about the symptoms. Their research also indicated that 77% of the respondents believed leprosy is heritable and 92.9% knew that leprosy is treatable (Tesema, 2015).

4.5. Knowledge on the cause, transmission and treatment of leprosy

About 37.5% of the study participants knew that leprosy is caused by germs. About 20.5, 13.4, 17, 8.9 and 2.7% of the respondents believed that leprosy is caused by living with lepers, occurs spontaneously, hereditary traits, poor personal hygiene and divine punishment, respectively. The study conducted from Ethiopia by Atinkut *et al.* (2018) indicated that 48.7% of the respondents believed that leprosy is caused by germs while 28 and 10.5% believed that the cause for leprosy is hereditary, and God's punishment. In the present study, 25% of the respondents believed that deformity is the symptom of leprosy while 20%, 21%, 18%, and 13% thought that nodule, skin patches, loss of sensation and swelling, respectively, as the symptoms of leprosy.

Table.5. Beliefs regarding the cause, symptoms and mode of transmission of leprosy among study participants

Belief of the respondent toward leprosy	Items	Number of respondents (%) with “Yes” responses	
		No	%
Causes of leprosy	Divine punishment	3	2.7%
	Germs	42	37.5%
	Hereditary	10	8.9%
	Spontaneous occurrence	15	13.4%
	Living with leprosy patient	23	20.5%
	Poor personal hygiene	19	17%
Symptoms of leprosy	Nodules	20	20%
	Skin patches	21	21%
	Loss of sensation	18	18%
	Swelling	13	13%
	Deformity	25	25%
Transmission	Close contact	38	25.8%
	Sexual contact	26	17.68%
	Sitting together	12	8.16%
	Eating together	20	13.6%
	Mother to child	29	19.72%
	Shaking hand with the leper	22	14.96%
Treatment	Pharmaceutical drugs	182	91.9%
	Medicinal herbs	10	5.1%
	Religious prayers	63	

Tesema and Beriso (2015) reported that 69.26% of their respondents knew that leprosy can lead to deformity while 44.59% knew that leprosy is a cause for loss of sensation. Atinkut *et al.* (2018) also reported that 10.5%-48.2% of their respondents were unsure of various symptoms of leprosy.

In a study reported by Atinkut *et al.* (2018), 10.5%-48.2% of the respondents were found to be unsure of the various symptoms of leprosy. In this study, 25.8%, 17.68%, 13.6%, 19.72% and 14.96% of the study participants responded that leprosy is transmitted by close contact, sexual contact, eating together, mother to child and shaking hand with a leper, respectively. Respondents of this study also believed that leprosy is treatable. About 91.9% of the respondents think that leprosy can be treated with drugs and 5.1% think with medicinal herbs, while 3% believe treatment could be achieved through religious prayers. According to Tesema and Beriso (2015), the community believes leprosy is transmitted through sexual contact. These researchers indicated also that the majority of their study participants responded leprosy can be treated by drugs and medicinal herbs.

4.6. Awareness towards Leprosy among Study Participants

As can be shown in Table 7, the results showed that 315(74.6%) and 107(25.35%) of the study participants had poor and good awareness on leprosy. Table 6 also reveals that awareness significantly varied between age groups ($X^2=9.252$, $P=0.026$). As the age increased, their knowledge scores decreased. Younger age groups (15-30 and 31-45) had significantly higher awareness score while older age groups (46-60 and >60) had the lowest awareness scores. Awareness scores were not significantly different between male and female respondents. Regarding the residence, urban respondents had better knowledge of leprosy than the rural respondents ($P= 0.001$). With respect to their educational status, college and above respondents had better awareness than the others groups, i.e. illiterates, elementary and high school completes and those who read & write ($P= 0.003$). On the other hand farmers had poor knowledge and other groups while daily laborers had poor knowledge ($P= 0.019$) (Table 6).

The results of the present study showed most of the respondents had poor awareness towards leprosy. This finding was supported by Atinkut *et al.* (2018). A study conducted in Karachi Pakistan noticed also very poor attitude towards leprosy among the study participants in which 49.8% of the respondents were found to dislike buying food from leprosy patients (Nisar *et al.*, 2007). Similarly, Tekle Haimanot (1992) has reported largely negative attitude of the community towards leprosy patients, where only 17% of the community was shown to be willing to work together with leprosy patients.

This finding was also similar with various previous studies including Tesema and Beriso (2015) who found that age and education were significantly associated with level of knowledge towards leprosy among the community (Table 7).

Table.6. Association between socio-demographic characteristics of the respondents and awareness towards leprosy (n= 422).

Variable	Categories	Mean(SD)	Awareness towards leprosy		X ²	P-value
			Poor	Good		
Age	15-30	1.34(0.47)	99(66)	51(34)	9.252	0.026*
	31-45	1.24(0.40)	103(79.2)	27(20.5)		
	46-60	1.21(0.41)	71(78.9)	19(21.1)		
	>60	1.19(0.39)	42(80.8)	10(19.2)		
Sex	Male	1.26(0.44)	179(73.7)	64(26.3)	0.292	0.651
	Female	1.24(0.42)	136(76)	43(24)		
Residence	Urban	1.19(0.39)	104(65.4)	55(34.6)	11.498	0.001*
	Rural	1.29(0.45)	211(80.2)	52(19.8)		
Educational status	Illiterate	1.10(0.29)	83(90.2)	9(9.8)	15.965	0.003*
	Read and write	1.30(0.45)	88(70.4)	37(29.6)		
	Elementary	1.32(0.47)	55(67.9)	26(32.1)		
	High school	1.30(0.46)	66(70.2)	28(29.8)		
	College & above	1.23(0.43)	23(76.7)	72(3.3)		
Occupation	Employed	1.16(0.37)	16(84.2)	3(15.8)	15.118	0.019*
	Daily labor	1.35(0.48)	51(62.2)	31(37.8)		
	Student	1.35(0.48)	50(70.4)	21(29.6)		
	Farmer	1.20(0.40)	92(80)	23(20)		
	House wife	1.16(0.37)	32(86.5)	5(13.5)		
	Merchant	1.22(0.41)	46(70.8)	19(29.2)		
	No job	1.21(0.41)	28(84.8)	5(15.2)		

In the present study the urban dweller respondents had higher knowledge than rural dweller respondents. A study conducted in Ethiopia showed age and education was significantly associated with positive attitude among the community (Tesema and Beriso, 2015).

4.7. Assessment of Socio-Demographic Characteristics and Related Risk Factors for Leprosy.

The risk factors to leprosy such as source of water for drinking, water treatment practice, sex, family size, age, marital status, monthly income, educational status , occupation, residence, accesses to mass media, personal hygiene practice, environmental hygiene practice, balanced diet and biomedical knowledge were assessed in this study. The results are shown in Table 7.

In this study, age, sex, residence, family size, educational status, monthly income, drinking water source, personal hygiene practice, environmental hygiene practice, and balanced die were significantly associated with prevalence of leprosy ($p < 0.05$). Of the risk factors evaluated, only marital status, occupation and water treatment practices, biomedical knowledge were not statistically associated with the prevalence of leprosy ($p > 0.05$).

The data show that infection rate of leprosy was relatively higher in the lowest age category (16% for 15-30 years old age category) and the highest age category (21.2% for >60 years old age category)(Table 7).The result in this study disagrees with the previous findings from Egypt as reported by Hegazy *et al.* (2000) where leprosy appeared to be higher in the age group above 40 years old. Similarly, In Brazil, age is not statistically associated with increased risk of leprosy (Ligia *et al.*, 2006).

Table.7. Association between socio-demographic characteristics and risk factors of leprosy among skin disease patients at Bisidimo General Hospital.

Hansen's disease					
Risk factor	Frequency	No. Pops (%)	OR (95% CI)	X ²	P-value
Age					
15-30	150	24(16)	2.286(1.049-4.981)	9.932	0.019*
31-45	10(7)	7(7.8)			
46-60	90	11(21.2)			
>60	52				
Sex					
Male	243	42(16.5)	2.742(1.394-5.396)	9.082	0.003*
Female	179	12(6.7)			
Marital status					
Single	129	21(16.3)	1.935(1.012-3.699)	6.612	0.085
Married	230	21(9.1)			
Divorced	47	9(19)			
Widowed	16	1(6.2)			
Family size					
1-5	167	30(18)	1.831(0.874-3.837)	8.869	0.031*
6-8	103	11(10.7)			
>8	18	1(5.6)			
No children	134	10(7.5)			
Monthly income(in Birr)					
<500	55	11(20)	1.446(0.653-3.202)	6.658	0.036*
500-1000	156	23(14.7)			
>1000	211	18(8.5)			

Occupation						
Employed	19	2(10)	0.800(0.161-3.977)	6.244	0.396	
Daily labor	82	10(12.2)				
Student	71	11(15.7)				
Farmer	115	15(13)				
House wife	37	2(5.4)				
Merchant	65	5(7.7)				
No job	33	7(21.2)				
Water treatment practice						
Filtration	62	7(11.3)	1.442(0.349-5.958)	1.764	0.623	
Chemical treatment	37	3(8.1)				
Boiling	46	8(17.4)				
None	277	34(12.3)				
Drinking water source						
Tap water	157	10(6.6)	0.402(0.144-1.125)	9.956	0.041*	
Spring Water	47	7(14.9)				
Pond	59	12(20.3)				
Hand pump	114	18(15.8)				
Water tank	50	5(10)				
Personal hygiene practice						
Good	184	15(7.6)	0.493(0.261-0.929)	4.932	0.026*	
Poor	238	37(16)				
Environmental hygiene practice						
Good	199	15(8.5)	0.477(0.253-0.890)	5.415	0.020*	
Poor	223	37(15.5)				
Balanced diet						
Yes	169	14(8.3)	0.517(0.271-0.987)	4.110	0.043*	
No	253	38(15)				
Biomedical Knowledge						
Good	107	9(13.7)	1.721(0.809-3.66)	2.030	0.154	
Poor	315	43(8.4)				

No. Pos = Number of Positive; No. Neg. = Number of Negative

*P- value <0.05 was statistically significant

The data also show that 57.6% of the study participants were male, while 42.46% were female with prevalence of 15.6% and 7.8%, respectively. In the present study, the prevalence of leprosy in males was higher than in females. This was statistically significant ($X^2=9.082$, $P= 0.003$). In the study reported by Julia *et al.* (2018) males had greater risk of leprosy than female sex. However, studies reported by Anna *et al.*(2011), Jesudasan *et al.* (1998) and Moet *et al.* (2006) did not show any gender difference in the risk of contracting the disease between sexes. Nevertheless findings in a prospective study of Doull *et al.*(1945) and in a retrospective study of Ranade and Joshi (1995) showed that the risk of leprosy was lower in females than in males. According to Fine *et al.* (1997), Joilda *et al.* (2019) and Bakker *et al.* (2006), the risk of leprosy was higher in males than in females. Reports of most countries also showed (WHO, 2015) and (Prince, 2017) leprosy was detected more often in males than in females.

Residence was one of the risk factors for leprosy where 263 (62.3%) and 159 (37.7%) of the study participants were recorded as positive for signs and symptoms of leprosy from the rural and urban dwellers, respectively. Of these, 14.8% and 8.2% of the rural and urban dwellers were infected with the causative agent of leprosy, respectively. The association between the prevalence of leprosy and the residence of study participants (i.e. urban and rural) was statistically significant ($X^2= 4.059$, $P= 0.048$). Studies from India and Brazil also showed rural dwellers had higher risk of leprosy infection than urban dwellers (Kumar and Husain, 2013; Joilda *et al.*, 2019). This might be because of the rural dwellers do not have access to get a proper and continuous education of leprosy.

Family size was also analyzed as one of the risk factors because larger family sizes are more risky than lower sizes to leprosy. In this study, 167, 103, 18 and 134 of study participants were recorded to possess family sizes of 1-5, 6-8, >8 and no children, respectively. For these groups, the respective prevalence rate of leprosy was 18%, 10.7%, 5.6% and 7.5%. The association between family size and prevalence was statistically significant ($X^2= 8.869$, $P= 0.031$). In Indonesia where people lived with more family members the risk of leprosy infection was very high due to increased chance of family contact (Bakker *et al.*, 2006). Other studies also showed more family member had higher risk of leprosy infection (Moet *et al.*, 2006; Joilda *et al.*, 2019).

A study conducted in Malawi also showed that living in crowded household was a risk factor to leprosy (Ponnighaus *et al.*, 1994). This was probably due to people who lived with more family members have a chance to get contaminated each other.

Educational status was also one of the risk factors for leprosy. In this study, lower education level seemed to be more associated to leprosy infection than higher level of education (Table 7). The association was statistically significant ($X^2= 9.548$, $P= 0.049$). The finding of the present study was in agreement with study done in Brazil where greater risk was reported for individuals with lowest level of education than for those individuals who passed high school (Joilda *et al.*, 2019). Other studies so had shown that lower educational level is a risk for leprosy infection (Alamet *et al.*, 1998). This might be related to people with lower educational level have less knowledge of leprosy transmission, cause and prevention methods.

Income was another risk factor for leprosy infection. Patients with low income per month were at higher risk in the present study. As shown in Table 7, 55, 156 and 211 of study participants had <500, 500-1000 and >1000 monthly income, respectively. Out of these respondents, 11(20%), 23(14.7%) and 18(8.5%) were infected with leprosy. The data showed that as the income of the subjects increased the prevalence of leprosy infection decreased. These values showed statistically significant association ($X^2=6.655$, $P= 0.036$). A similar result was also reported by Anna *et al.*, (2011) and Joilda *et al.*, (2019) who showed that economic status had higher risk for leprosy.

Drinking water source was another risk factor to leprosy infection because clean water supply is vital to be in good health. If people can't get clean water they are likely to be exposed for other infections which may weaken the immune system (Ramesh and Chaitra, 2012). Out of 422 study participants, 157(37.2%) responded that they use protected water (tap water, bottled water, filtered water and boiled water) for drinking and domestic purposes. Of these, only 10(6.6%) of the respondents using tap water were found to be positive for leprosy infection. On the other hand, 265(62.8%) responded that they use unprotected source of water (spring, pond, hand pump and water from the tank). Out of these, 7(14.9%), 12(20.3%), 18(15.8) and 5(10%) were found to be positive for leprosy. These values were found to show statistically significant association with the number of respondents using different sources of water ($X^2=9.956$, $P=0.041$). This might be because of exposed for other infections which may weaken the immune system.

Significant association was also found between the prevalence of leprosy and sanitation practices (personal hygiene such as hand washing before and after meal, avoiding dirty things, washing feet, brushing teeth, changing clothes, washing clothes, bathing and washing hair). The results showed that 184 and 238 of the respondents had good and poor habit of personal hygiene, respectively. The corresponding prevalence rates for good habit and poor habit of personal hygiene were 15(7.6) and 37(16), respectively. These results showed statistically significant association between personal hygiene and prevalence of leprosy ($X^2=4.932$, $P=0.026$).

Environmental hygiene was also significantly associated with leprosy. Participants who had poor environmental sanitation practices were more likely to be infected by leprosy (15.6%) compared with those who had good sanitation practice (8.1%) because poor sanitation make it suitable to bacterial multiplication. The association was statistically significant ($X^2=5.415$, $P=0.020$) (Table 7). A study carried out in Indonesia reported that sanitation had significant association with leprosy and as a result people with poor environmental sanitation were at higher risk to infection with leprosy than those with good environmental sanitation (Aisah *et al.*, 2017). This result was in line with the research which showed significant relation between personal hygiene and leprosy (Muharry, 2014). This might be because of people who have poor personal and environmental hygiene make a suitable area for bacteria multiplication.

Balanced diet was another risk factor for leprosy. People who do not eat balanced diet were at higher risk of acquiring leprosy (15%) than those who eat balanced diet (8.3%). This association was also statistically significant ($X^2=4.110$, $P=0.043$). Previous studies have also shown association between food shortage and infection with leprosy. The relationship may be explained by the fact that consumption of inadequate food results in impaired host immune response against the causative bacteria (Oktaria *et al.*, 2018; and Wagenaar *et al.*, 2015). Other researchers have also reported similar results showing that insufficient food or lack of balanced diet was a risk factor for leprosy (Oktaria *et al.*, 2018).

The study participants who had poor biomedical knowledge were more likely to be infected by leprosy with prevalence rate 13.7% compared to those who had good biomedical knowledge about the parasite 8.4% (Table 8). This was also statistically significant ($X^2=2.030$; $P=0.154$).

4.8. The Trend of leprosy Prevalence in Bisidimo General Hospital in the last five years.

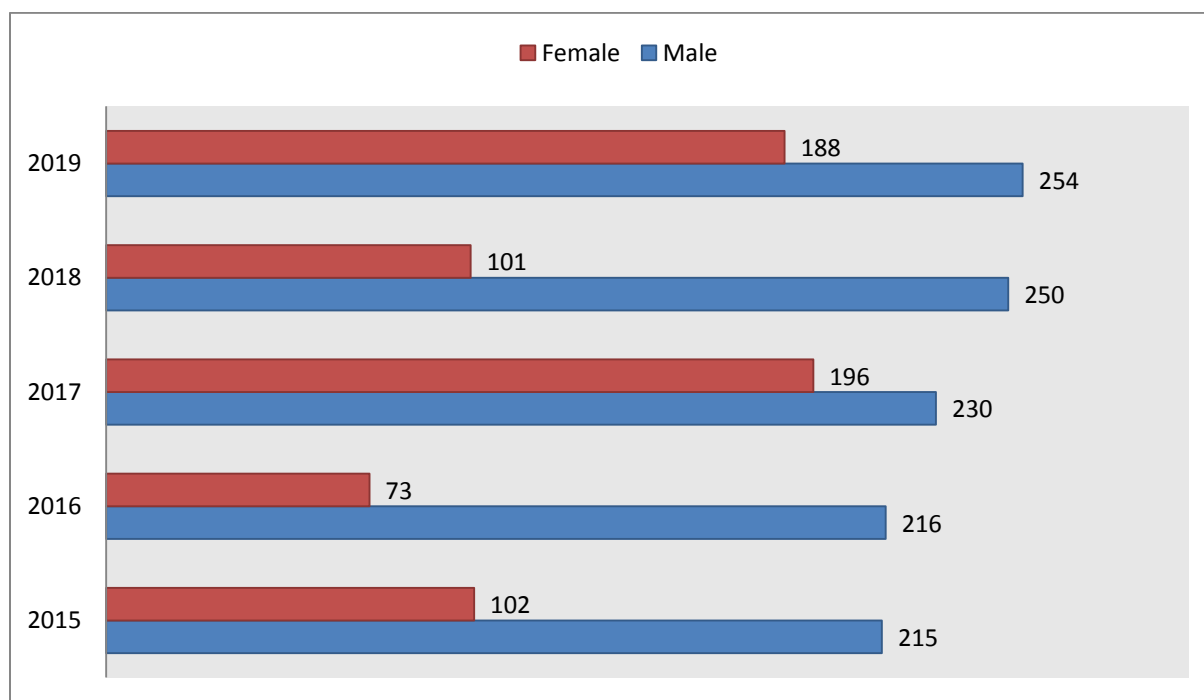


Figure.1. Trends of leprosy in Bisidimo General Hospital from 2015-2019.

Figure 1 depicts the prevalence of leprosy over the last five years in Bisidimo Hospital. As shown in the figure, in the last five years the prevalence of leprosy was fairly constant, it doesn't show decrease in the last 5 years. However, in years 2010 and 2011 there was a slight increase in prevalence as compared with the years 2007, 2008 and 2009. The data also shows that the prevalence rate was higher in males over those five years than in females. There is no specific reason for the prevalence rate of leprosy was higher in male than female.

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The objective of this study was to determine the prevalence of leprosy, to evaluate awareness of patients about leprosy and to assess the associated risk factor of leprosy among skin disease patients visiting Bisidimo General Hospital, since Dec 2019-Feb 2020.

A total of 422 skin disease patients were participated in the study, clinical sign and symptom were examined in association with physician and skin smear sample collected and processed for detection of *Mycobacterium leprea* by using Ziehl-Neelsen method. Questionnaire was used to gather information on demographic, awareness of patients toward leprosy and risk factors of leprosy. Moreover, five years retrospective data was collected to determine the trends of leprosy in study area. Data were analyzed using SPSS software version 20. The strength of association was measure by using chi-square(X^2), P –value and data related to risk factor were analyzed by using OR at 95% CI.

In this study, the overall prevalence of leprosy was 52(12.3%) among all age group and both sex. Out of these, 24.7% were for male and 6.8% were for female. In the present study clinical features manifested were nodules, sensory loss, nerve damage and pink colored skin among leprosy patients and 31(40.5%) of patient were with Grade 1 disability, 29(38.2%) of patients with Grade 2 disability and 16(21%) of patients with Grade 0 disability.

In the present study 315 study participants had poor awareness towards leprosy only 107 participants had good awareness toward leprosy. Among these participants with lower educational level, rural dwellers, young participants and farmers had poor knowledge of leprosy.

Associated risk factors of leprosy were also identified and assessed in this study. Among these, sex, age, residence, income, personal and environmental hygiene, level of education, drinking water source and balanced diet were risk factors that significantly increased the risk of leprosy among study participants. Regarding five years (2015-2019) retrospective data, the prevalence rate of leprosy was constant since 2015-2017 but in the last two years it showed increases and the prevalence were higher within male than female in Bisidimo General Hospital.

5.2. Conclusion

In conclusion, the overall prevalence of leprosy among individuals visiting Bisidimo General Hospital from Dec 2019-Feb 2020 was 12.3%; there was high prevalence among 15-30 years. Also there was high prevalence within male; female had lower prevalence in the present study, it shows leprosy is still one of the health problems in the study area.

Among clinical features manifested painless ulcer, pink colored skin, sensory loss, nerve damage and nodules were very common in leprosy diagnosed patients and 40.5% of patient were with Grade 1 disability, 38.2% of patients with Grade 2 disability and 21% of patients with Grade 0 disability. Therefore, the disability rate was higher in the present study.

Regards to awareness, most of study participant had poor awareness about symptoms, treatment, transmission, causes, prevention and control of leprosy and participants with lower educational level, rural dwellers, young participants and farmers had poor knowledge of leprosy. Only 107 participants had knowledge about leprosy.

Age, sex, residence, family size, monthly income, drinking water source, personal sanitation and balanced diet were significantly associated with increase in prevalence of leprosy among skin disease patient in study area. A trends of five years from 2007-2011 shown prevalence rate was increases and prevalence rate was higher in male.

5.3. Recommendations

The following main points are recommended to control and prevent the transmission leprosy. Present study indicate that leprosy among patients visiting Bisidimo General Hospital were prevalent. Therefore based on the finding of present study, the researcher recommended the following point.

- For better management of leprosy, local health sectors and community health worker should give continuous community based health education to raise the knowledge, and preventive method of leprosy.
- It is recommended for government health sector should provide MDT drugs for the patients in hospitals to decrease disability among the patients.
- Further studies should be done to determine the prevalence of leprosy in different parts of Ethiopia including the present study area.

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7. APPENDICES

7.1. Appendix I. Participant Information Sheet and Consent Form for Study Participants

Title of the Research Project:

Prevalence, Awareness and Associated Risk Factor of *leprosy* among Skin Disease Patients Visiting Bisidimo Hospital, Babile *Woreda*, Eastern Harerghe.

Name of Investigator: _____

Name of the Organization: Haramaya University, School of Biological science and Biotechnology, M.Sc. in Microbiology

Introduction

You are invited to participate in a research study conducted by M.Sc. candidate, from the Haramaya University. You must be 15 years or older to participate in the interview. Your participation is voluntarily. This research team includes one principal investigator, laboratory personnel and trained personnel as data collectors and two advisors from Haramaya University. Please take as much time as you need to read/listen the information sheet.

Purpose of the Research Project

You are asked to take part in the study so that we are able to determine the awareness of leprosy in the community and assess your knowledge about Leprosy and how to prevent and control it. Your knowledge, perceptions and practice towards Leprosy, will be assessed in detail, so that necessary measures must be taken by responsible bodies.

Procedure

In order to determine the Prevalence, Awareness and Associated Risk Factor of *Leprosy* among Skin Disease; we invite you to take part in this project. If you are willing to participate in this project, you need to understand and give your consent. The interview will be held by medical personnel's and trained person. Then, you are requested to give your response to the data collectors.

The interview will take approximately 20minutes and the place of interview will be in the field at the homes of inhabitants. You will be asked some questions regarding the awareness, attitude and practice about Leprosy.

Potential Risks and Discomforts

There are no expected risks to your participation. When you feel some discomfort at responding some questions, please tell freely. There is no special treatment or service you get by participating in this research and also if you don't want to participate, you can get all the services you got previously.

Potential benefits to subjects and/or to the society

You might not directly benefit from your participation in the study. The overall goal is to determine the prevalence and assess your awareness about Leprosy. The findings may provide better understanding for the society. In addition it may help responsible bodies, to develop better intervention to alleviate the problem, prevention and control measures, to eliminate the problem in the community at large.

Payment /compensation for participation

You will not receive any payment for your participation in this research study.

Confidentiality

Any information that is obtained in connection with this study and that can be identified with you will remain confidential. The information collected about you will be coded using numbers. The data will be kept in secret. When the results of the research are published or discussed in conferences, no information will be included that would reveal your identity.

Person to contact:

This research project will be reviewed and approved by the ethical committee of the HU, M.Sc. in microbiology. If you want to know more information, you can contact the committee through the address below. If you have any question you can contact any of the following individuals (Investigator and Advisors) and you may ask at any time you want.

1. Lidiya Alemayehu (B.Sc., M.Sc. fellow):

Cell phone: +251- 09 40 59 28 98.

E-mail: alemayehulidiya2@gmail.com

2. Ameha Kebede (PhD)

Cell phone: +251-09-11-83-46-81

E-mail: amehakebede@yahoo.com

3. Meseret Chimdessa (PhD)

Cell phone: +251-09-89-90-54-68

E-mail: meseretc2019@yahoo.com

7.2. Appendix II: Questionnaire for Collecting Laboratory Results

The purpose of this questionnaire is to get relevant information about the prevalence and pattern of leprosy among skin disease patient visiting Bisidimo General Hospital in Babile *woreda*, Eastern Harerghe. So you are kindly requested to give your response and indicate your response by putting tick mark on your response box. Thank you in advance

1. Date:

2. Study code: _____

3. Technician: _____

4. Sample Type: Skin smears Blood

7. Clinical features of leprosy manifested on study participants

a) Nodules

b) Pink-colored skin lesion

c) Nerve damage

d) Sensation loss

f) Painless ulcer

8. Leprosy causative agent identified by

a) Zeihl Nielsen Method _____

9. Number of bacteria in one oil immersion field

a) Bacterial index+1

b) Bacterial index +2

c) Bacterial index +3

d) Bacterial index +4

e) Bacterial index +5

f) Bacterial index +6

10. Leprosy disability among the study participant.

a). Grade 0

b). Grade 1

c). Grade 2

11. *Mycobacterium leprea* testing result a). Negative b). Positive

7.3. Appendix III. Questionnaire to be completed by Study Participants.

Prevalence, Awareness and Associated Risk Factor of *Leprosy* among Skin Disease Patients Visiting Bisidimo Hospital, Babile *Woreda*, Eastern Harerghe.

Introduction: My name is.....; I am working as data collector in this research project run by student of Haramaya University, School of Biological Science and biotechnology, M.Sc. in Microbiology. We are interviewing the patient of skin disease to assess your knowledge and awareness towards leprosy. I kindly request you to participate in the survey that will be appreciated & so much useful for the region and country for future planning and evaluating the existing prevention and control measures of leprosy.

Confidentiality & consent: I am going to ask you some questions that you are going to answer freely. Your answers are completely confidential. You do not have to answer any question that you do not want to answer, and you may end this interview at any time you want to. However, your honest answers to these questions will help us better understand your knowledge about leprosy. We will greatly appreciate your help in responding to this survey. The interview would take about 20minutes. Would you be willing to participate?

Write:

Date of interview -----

Name of interviewer -----

Signature of interviewer -----

1. Sex; - Male Female A

2. Where is your place of residence?

Rural Urban

3. If your answer is “Rural” or “Urban” in question number 2 answer the exact place of your address.

4. What is your marital status?

a) Single b) Married c) Divorced d) Windowed

5. If your answer is “married” in question number 4, how many children do you have?

6. How many family members do live in your home?

7. What is your Occupation?

a) Employed b) Daily labor c) Student d) Housewife e) Farmer

f) Merchant g) No job h) Others

8. What is your educational status?

a) Illiterate b) Read and write

c) Elementary School complete d) High School complete e) Collage and above

9. How much income do you get per month?

a) <500 Birr b) 500-1000 Birr c) >1000 Birr

10. What source of water do you use for drinking mostly?

a) Tap water b) Spring/River

c) Pond d) Hand pump e) Water tank f) Others

11. If you get it from one of the above source, how do you use it?

a) Directly b) By filtering c) by treating with chemical d) By boiling

e) Others

12. Do you keep your personal hygiene very well?

a) Yes b) No

13. If your answer is “yes” do you use detergents or soaps?

14. If “yes”, how do you use it?

a) Directly b) By washing it with clean water c) Both

15. Do you eat your food 3 times a day?

a) Yes b) No

16. Do you eat balanced diet?

a) Yes b) No

17. Do you wash your hand with soap before eating?

a) Never b) Sometimes c) usually

18. What is your environmental hygiene practice?

a) Poor b) Medium good c) Very good

PartII-Knowledge about Leprosy

22. Are you far from the hospital?

a) Yes b) No

23. Did you heard about Leprosy before?

a) Yes b) No c) Never

24. If your answer is “yes”, where did you heard about Leprosy?

a) Television b) Health Center Family and relatives Friends d)
Community health workers e) Others

25. Are you infected by other disease at this time?

a) Yes b) No

26. Do you know the sign and symptoms of Leprosy?

a) Very well A little bit c) Never

27. If you answer is “yes” mention the symptoms.

28. Do you know the cause for Leprosy?

a) Yes b) No

29. If your answer is “yes” in question number 28 mention the causes for Leprosy?

30. Do you know how Leprosy transmitted from one person to another person’s?

a) Very well b) Partially c) Never

31. If your answer is “yes” in question 30 mention the transmission methods.

32. Do your family members have knowledge about leprosy?

a) Yes b) No

33. Do you know how to prevent and control Leprosy infections?

a) Very well b) Partially c) Never

34. Do you know drugs used to treat Leprosy infections?

a) Very well b) Partially c) Never

35. Is Leprosy treatable?

a) Yes b) No

36. How to treat leprosy?

37. Do you believe leprosy is hereditary?

a) Yes b) No

7.4. Appendix IV

Amharic and Afan Oromo version questionnaire

Amharic version questionnaire

Prevalence, Awareness and Associated Risk Factor of *Leprosy* among Skin Disease Patients Visiting Bisidimo Hospital, Babile *Woreda*, Eastern Harerghe.

መግቢያ፡- ስሜ..... ይባላል፡፡ በ ሀረማያ ዩኒቨርሲቲ School of Biological Science and biotechnology, M.Sc. in Microbiology ተማሪ በተዘጋጅው መጠይቅ መሰረት መረጃ እስበስባለሁ ፡፡ ይህም በ ስጋ ደዌ በሽታ ላይ ያሎትን እውቀትና ግንዛቤ ለመረዳት ነው፡፡ ይህ መጠይቅ ለሃገርና ለአካባቢው ለወደፊት በሽታውን ለመቆጣጠርና ለመከላከል ጠቀሜታ ስላለው በዚህ መጠይቅ ላይ ተሳታፊ እዲሆኑ በትህትና እጠይቃለሁ፡፡

የጥናቱ ሚስጥራዊነትና ፈቃደኝነት

አሁን ለመጠይቅ በነጻነት እዲመልሱ በትህትና እጠይቃለሁ፡፡ ምንም እንኩን የሚሰጡን መልስ ለጥናታችን በጣም ቢያስፈልገንም መጠየቅ የማይፈልጉት ጥያቄ ካለ ግን ቃለምልልሱን ማቆም ይችላሉ፡፡ ይህን የመጠይቅ መረጃ በትግስት እዲሰጡ ይበረታታሉ፡፡ እባኩን ይህንን ለማድረግ ፈቃደኛ ኖት

የመጠይቁ ቀን

የተጠያቂው መለያ

የተጠያቂው ፊርማ

1. ጾታ:- ወንድ ሴት እድሜ

2. የመኖሪያ ቦታ
ከተማ ገጠር

3. በጥያቄ ቁጥር 2 ላይ መልሶት ከተማ ወይም ገጠር ከሆነ ትክክለኛ አድራሻዎትን ይናገሩ

4. የትዳር ሁኔታ

ሀ. ያላገባ ለ. ያገባ ሐ. የተፋታ መ. መበለት

5. በጥያቄ ቁጥር 4 ላይ መልሶት ያገባ ከሆነ ስንት ልጆች አሉት?

6. በቤቶት ስንት የቤተሰብ አባል ይኖራል

7. ስራ/ሽ ምንድነው

ሀ. ተቀጣሪ ለ. የቀን ስራ ሐ. ተማሪ መ. የቤት እመቤት ሠ. ገበሬ ረ. ነጋዴ ሸ. ስራ የሌለው ቀ. ሌሎች

8. የትምህርት ሁኔታ

ሀ. ያልተማረ ለ. ማንበብና መጻፍ ሐ. የመጀመሪያ ደረጃ ያጠናቀቀ መ. የመሠናዶ ትምህርት ያጠናቀቀ ሠ. የከፍተኛ /ኮሌጅ ትምህርት ያጠናቀቀ

9. ወርሀዊ ገቢ

ሀ. < 500 ለ. 500-1000 ሐ. >1000

10. የመጠጥ ውሀ ከየት ያገኛሉ

ሀ. የቧንቧ ውሃ ለ. የምንጭ ወይም የወንዝ ውሃ ሐ. የኩሬ ውሃ መ. የጉድጓድ ውሃ /ከርሰምድር ሠ. ከውሃ ማጠራቀሚያ ታንክ ረ. ሌሎች

11. ከላይ ከተዘረዘሩት የውሃ ምንጮች ሲጠቀሙ እንዴት ይጠቀማሉ?

ሀ. በቀጥታ እጠቀምበታልሁ ለ. በማጠለል እጠቀማለሁ ሐ. በኬሚካል አክማለሁ መ. በማፍላት እጠቀማለሁ ሠ.

በሌሎች መንገድ

12. የግል ንጽህንዎትን ይጠብቃሉ?

ሀ. አዎን ለ. አልመገብም

13. ከላይ መልሶት አዎ ከሆነ ሳሙና ወይም ሌላ ማጽጃ ይጠቀማሉ?

14. በቀን ሶስት ጊዜ ይመገባሉ?

ሀ. አዎን ለ. አልመገብም

15. የተመጣጠነ ምግብ ይመገባሉ?

ሀ. አዎን ለ. አልመገብም

16. ከመመገብ በፊት እጆትን ይታጠባሉ?

ሀ. በፍጹም ለ. አንዳንዴ ሐ. ሁል ጊዜ

17. የአካባቢ ንጽህና አጠባበቆት ምን ይመስላል?

ሀ. ደካማ ለ. ምንም አይልም ሐ. በደንብ

ክፍል II- ስለስጋደቁግንዛቤመጠይቅ

18. የመኖሪያአካባቢዎከሀኪምቤቱይርቃል?

ሀ. አዎንላ. አይርቅም

19. ስለስጋደቁስመተውያውቃሉ?

ሀ. አዎንላ. አላውቅም

20. በጥያቄቁጥር 19 ላይመልሶትአዎከሆነከየትናከማንሰሙ?

ሀ. ከቲቪ. ከጤናጣቢያሐ. ከጉደኛናከዘመድመ. ከጤናባለሞያዎችሠ. ከሌሎችምንጮች

21. አሁንሌላየጤናችግርአለበት?

ሀ. አዎንላ. የለብኝም

22. የስጋደቁንየበሽታምልክትምንእንደሆነያውቃሉ?

ሀ. በደንብላ. ትንሽትንሽሐ. ምንምአላውቅም

23. ለጥያቄቁጥር 22 መልሶትበደንብሆነምልክቶቹምንምንናቸው?

24. የስጋደቁበሽታመንስኤውምንእንደሆነያውቃሉ?

ሀ. አዎላ. አይ

25. በጥያቄቁጥር 24 ላይመልሶትአዎከሆነመንስኤውምንድነው?

26. የስጋደቁበሽታከሠውወደሠውእንዴትእደሚተላልፍያውቃሉ?

ሀ.አዎበደንብላ. ምንምአላውቅም

27. በጥያቄቁጥር 26 መልሶትአዎከሆነየመተላለፊያመገዶቹምንድናቸው?

28. ከቤተሰቦመሀልስለስጋደቁበሽታየግንዛቤያለውአለ?

ሀ. አዎንላ. የለም

29. ስጋደቁበሽታእንዴትመከላከልናመቆጣጠርእደሚቻልያውቃሉ ?

ሀ. አዎበደንብላ. ትንሽትንሽሐ. ምንምአላውቅም

30. ስጋደቁበሽታመድሃኒትእዳለውያውቃሉ?

ሀ. አዎላ. ትንሽትንሽሐ. ምንምአላውቅም

31. የስጋደቁበሽታየሚድንበሽታነው?

ሀ. አዎላ. አላውቅም

32. የስጋደቁበሽታ እንዴት ይደናገዳል?

33. የስጋደቁበሽታ በዘርይተላለፋል?

ሀ. አዎንሉ. አይተላለፍም

Afan Oromo Version

Gaafannoo Afaan Oromoo

Kabajamoo Hirmaattoota qoranno kanaa, kaayoon gaafannoo kanaa iddoo qoronnoon kun ittii gaggeeffamuutti wantoota dhukkubaa juuzaam beekumsa qabdaan beekuufi. Kanaafuu, gaafilee armaangadii huundumaaf deebii keessan akka nuuflaattan kabajaan isiin gaafanna.

1. Saala A. dubara B. dhiira
2. Umrii _____
3. Iddoo jireenyaa
A. baadiyyaa B. magaalaa
4. Deebisaan gaafii lakkofsa 3 ‘magaalaa’ yookin ‘baadiyyaa’ yoo kan jireenyaa keessan sirriiti deebii.

5. Yoo kan heerume
a. Kan fuudhe b. kan fuune c. wal hiikuu d. gursumma
6. Deebisaan gaafii lakkofsa 5 ‘kan fuudhe’ baayyinnii miseensoota ijoollee keessanii

7. Baayyinnii miseensoota maatii keessanii?

8. Hojiin isin keessanii maali?
a. hojjataa mootumaa b. barnoota c. qotee bulaa d. haadha manaa e. daladala f. hojii dhaabuu
9. Sadarkaan barnoota keessanii?
a. Hinbarannee b. qaroo c. jalqaba sadarka manabarnootaa d. lamaffa sadarka manabarnota e. koollejii
10. Yoo kan baatti galii
a. < 500 b. 500-1000 c. >1000

11. Bishaan dhugaatii eessa argatuu?
a. Madaa/ malkaa b. bishaan qulqulluu c. bishaan pumpi d. bishaan haroo e. bishaan tankeri
12. Bishaan dhugaatii akkam fayyadamaa?
a. Danfisa b. kallattidhaan c. dhamsaa gingilchaa d. chemicali xiinxala fayyadamaa
13. Qulqullina dhuunfaa keessanii nii hordaftuu?
a. Eeyyee b. miti
14. Deebisaan gaafii lakkofsa 13 ‘‘ eeyyee’’ saamunaafi bashaaniin fayyadamaa?
-
15. Guyyatti si’a meeqa nyaatta?
-
16. Nyatta madaalamaa hin nyaattu?
a. Eeyyee b. miti
17. Qulqullina beka jirrenya kessan?
a. Eeyyee b. miti
18. Nyatta durra harka kessan saamunaada indhiqatuu?
a. Eeyyee b. miti

Kutaa II. Beekumsa waa'ee dukuba juuzaam

1. Manna jirenya kessan muf buufata fayara hinfageessuu?

a. Eeyyee b. miti

2. Waa'ee dhukubaa juuzaam dhessani beektuu?

a. Eeyyee b. miti

3. Deebisaan gaafii lakkofsa 21''eeyee'' yoo ta'a eessan dhagassan?

4. Waan biirra esiin dhukuubu jirra?

a. Eeyyee b. miti

5. Maletoo dhukubaa juuzaam maal akka ta'a nibeeyteni?

a. Eeyyee b. miti

6. Deebisaan gaafii lakkofsa 24''eeyee'' meltoo ibsii?

7. Sababa juuzzam malii akka ta'a nibeeytuu?

a. Eeyyee b. miti

8. Deebisaan gaafii lakkofsa 26''eeyee'' sababa dhukkuba juuzaam ibsii?

9. Dhukkubni kun naamra namati akka darbuu nibeeytaa?

a. Eeyyee b. miti

10. Keerati darbuu yoo beeytee nu ibsii?

11. Mattin wa'ee dhukuba juuzaam hubannaa qabeenyii?

a. Eeyyee b. miti

12. Dhukuba juuzaam kerati ittistenifi to'achuuf nibeeytani?

a. Eeyyee b. miti

13. Qorichaa dukuba juuzaam maal akka tae nibeektuu?

a. Eeyyee b. miti

14. Dhukuba juuzaam feyyuu nidadhaya?

a. Eeyyee b. miti

15. Dhukuba juzaam sanyii nidarba?

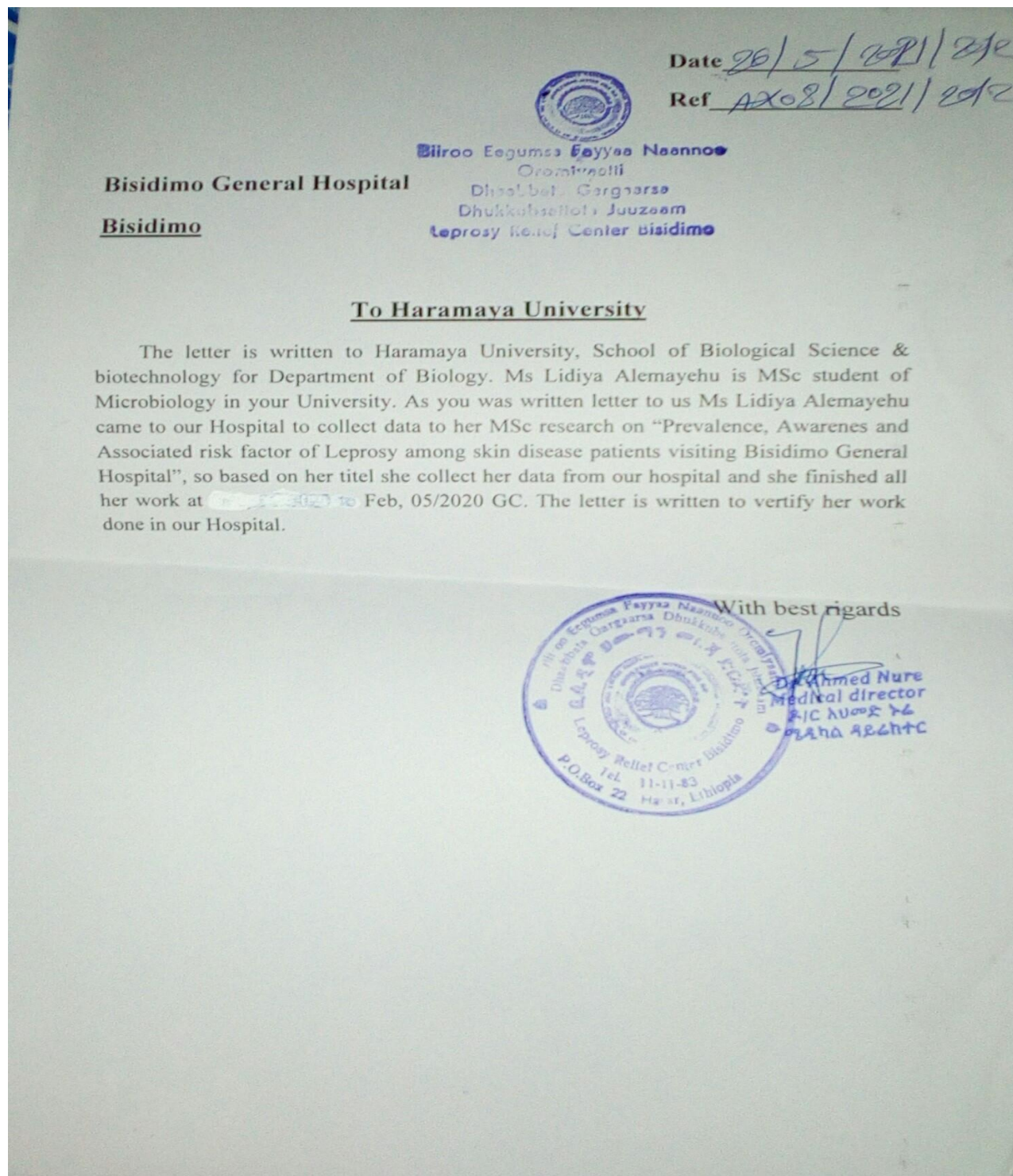
a. Eeyyee b. miti

7.5. Appendix V. Format used for Collecting Clinical Health Records

Five years retrospective clinical health records collecting form from Bisidimo Hospital
(Developed by the principal investigator)

Years	Sex	Age				Total examined
		15-30	31-45	46-60	>60	
January 2015	M					
	F					
2016	M					
	F					
2017	M					
	F					
2018	M					
	F					
March 2019	M					
	F					
Total	M					
	F					

Support Letter



Date 26/5/2021/212
Ref AX08/2021/212



Bisidimo General Hospital
Bisidimo
Biiroo Eegumsa Fayyaa Naannoo
Oromiyaa
Dhaabbat Gargaarsa
Dhukkubseffota Juuzoam
Leprosy Relief Center Bisidimo

To Haramaya University

The letter is written to Haramaya University, School of Biological Science & biotechnology for Department of Biology. Ms Lidiya Alemayehu is MSc student of Microbiology in your University. As you was written letter to us Ms Lidiya Alemayehu came to our Hospital to collect data to her MSc research on “Prevalence, Awareness and Associated risk factor of Leprosy among skin disease patients visiting Bisidimo General Hospital”, so based on her titel she collect her data from our hospital and she finished all her work at ~~Feb, 05/2020~~ to Feb, 05/2020 GC. The letter is written to verify her work done in our Hospital.

With best rigards

[Handwritten Signature]
Dr. Ahmed Nure
Medical director
ዶ/ር አህመድ ኑራ
ዶ/ር አህመድ ኑራ

