PREVENTION STRATEGY OF TUBERCULOSIS AMONG HIV POSITIVE ADOLESCENTS IN HAWASSA TOWN, SOUTHERN ETHIOPIA

by

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I declare that **PREVENTION STRATEGY OF TUBERCULOSIS AMONG HIV POSITIVE ADOLESCENTS IN HAWASSA TOWN, SOUTHERN ETHIOPIA** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.

30 December 2022

SIGNATURE **DATE**

YUSUF ABDU AHMED

DEDICATION

Dedicated to Abdu Ahmed Tura, a visionary and passionate father who helped me to design my entire academic journey and professional career from early elementary school to PhD study. I shall never, ever forget you until my last breath. May the Lord Creator Allah forgive all your sins and rest your soul in the highest stage of paradise.

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Prevention strategy of tuberculosis among HIV positive adolescents in Hawassa town, Southern Ethiopia

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ABSTRACT

The study aimed at identifying the determinants of tuberculosis infection among human immunodeficiency virus (HIV) positive adolescents and subsequently develop a prevention strategy for tuberculosis (TB) among HIV positive adolescents in Hawassa town, Ethiopia. The study was conducted from 10 September 2021 to 28 February 2022 in Hawassa town, which is located in the southern part of Ethiopia. The study adopted a sequential exploratory mixed methods study design. A qualitative study was conducted in the first phase, followed by a quantitative study in the second phase.

Data for the qualitative phase was collected through face-to-face interviews as well as focus group discussions using an interview guide. Data was collected from adolescents who were diagnosed with TB/HIV or only HIV and treated in chronic care centres, and their guardians. Qualitative data was further collected from key informants who were public officials and focal persons for the TB/HIV prevention/control programme in their institutions.

The quantitative data was collected through a structured questionnaire from 321 TB/HIV patients of whom 107 were cases and 214 were controls from four conveniently selected health facilities in Hawassa. Qualitative data was analysed thematically and manually, while quantitative data was analysed using SPSS version 26 and Epi Info version 7.2.5.

The study revealed a consistent increase of tuberculosis infection among the adolescents living with HIV owing to failure of good governance and leadership; deterioration of school health services; critical budget shortages; and poor motivation of health professionals. Factors that were found to be independently associated with tuberculosis infection were taking isoniazid preventive therapy (IPT) AOR=0.09, 95% CI (0.01, 0.69) which shows that IPT has a preventive effect against tuberculosis; WHO clinical stages III and IV AOR= 3.64, 95% CI (2.95, 4.49); previous history of tuberculosis AOR=222.18, 95% CI (127.06, 389.59) and history of smoking AOR=112.4, 95%CI (146.83, 940.15). The study concluded that all stakeholders must work together to improve the execution of services for TB/HIV prevention. The contribution of this study is the development of an alternative integrated TB/HIV preventive strategy, which would promote TB/HIV prevention for better health outcomes.

KEY CONCEPTS: adolescents**;** alternative preventive strategy; determinants of tuberculosis; factors independently associated with tuberculosis; integrated TB/HIV prevention strategy; isoniazid prophylaxis therapy (IPT); mixed research methods; sequential exploratory mixed methods study design; unmatched case control study; WHO HIV clinical stages

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AIDS	Acquired Immunodeficiency Syndrome
ART	Antiretroviral Therapy
BCG	Bacillus Calmette–Guérin
BMI	Body Mass Index
CD4	Cluster of differentiation 4
CDC	Centers for Disease Control and Prevention
CPT	Cotrimoxazole Preventive Therapy
CSA	Central Statistical Agency
DOTS	Directly observed treatment
Epi info	Statistical software for epidemiology developed by Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia (US)
FGD	Focus Group Discussion
HIV	Human Immunodeficiency Virus
INH	Isoniazid, Anti TB Drug
IPC	Infection Prevention Control
IPT	Isoniazid Preventive Therapy
KII	Key Informants Interview
MDR-TB	Multidrug-Resistant TB
MoHE	Ministry of Health of Ethiopia
PLWHA	People Living with HIV AIDS
PLHIV	People living with HIV
PMTCT	Prevention of Mother to Child Transmission
PrEP	Pre-Exposure Prophylaxis
PV	Pharmacovigilance
RHB	Regional Health Bureau
SNNPR	Southern Nations, Nationalities and People Region
SPSS	Statistical Package for the Social Sciences

STI	Sexually Transmitted Illness
TB	Tuberculosis
UNAIDS	United Nations Programme on HIV/Aids
UNISA	University of South Africa
VCT	Voluntary Counselling and Testing
WHO	World Health Organization

CHAPTER 1
ORIENTATION TO THE STUDY

1.1. INTRODUCTION AND BACKGROUND TO THE STUDY

Tuberculosis (TB) and human immunodeficiency virus (HIV) constitute the leading burden of infectious disease in developing countries. According to the World Health Organization (WHO 2021c:1-15), there are more than nine million new active cases of TB and nearly two million deaths per year. Overall, there are 2.6 million new cases of HIV infection and close to 1.8 million deaths due to acquired immunodeficiency syndrome (AIDS) per year (Girardi 2020:13-24). TB and human immunodeficiency virus (TB/HIV) co-infections can cause typical diagnostic and therapeutic challenges and have a significant influence on health care systems in African and Asian countries with large populations of co-infected individuals. TB is a serious health problem, particularly for people living with HIV (PLHIV). HIV mostly affects the body's defense mechanism and exposes people to various opportunistic infections, including TB. According to Melgar, Nichols, Cavanaugh, Kirking, Surie, Date, Ahmedov et al (2020:328-329), globally the disease is becoming the major cause of death among individuals who are infected with HIV.

The two pathogenic microorganisms mycobacterium tuberculosis and HIV activate one another, speeding up the destruction of immunological functions and causing millions to get severely sick and lose their life (Bell & Noursadeghi 2018:80-90). Infection with tuberculosis accounts for 26% of deaths related to HIV infection, most of which (99%) occur in Asian and sub-Saharan African countries (Girardi 2020:13-24). According to recent studies, annually nearly four million people lose their lives due to tuberculosis. In 2018, most of the deaths (1.2 million) were registered among people with HIV negative status. In the same year a total of 251 000 deaths were registered among HIV positive people (WHO 2019b:27).

HIV is the factor that is most frequently acknowledged as influencing the emergence of latent TB infection to active illness by increasing the risk of reactivation by 20 times. Similarly, TB has been well known to exacerbate HIV infection. Moreover, for susceptibility to TB/HIV, genetic factors play a non-negligible role (Brighenti & Joosten 2018:125-144).

1.1.1. The global status of TB/HIV co-infection

Being infected with HIV is becoming the common health problem throughout the world, especially in developing countries like Africa, South East Asia and Latin American countries. Since the start of the problem, nearly 35 million people have lost their lives. Up to 2015 it was registered that more than 37 million people had been living with HIV. The highest burden of the disease (71%) is in African countries (UNAIDS 2020a:10-12). HIV primarily affects cell mediated immunity at which T-lymphocytes are targets for the multiplication of the virus and gradually their number declines, exposing individuals to bacterial, protozoal, fungal, etc., infections. The most common fatal bacterial infection is tuberculosis (Collora, Liu, Albrecht & Ho 2021:35-36).

Although there is a decrease in mortality and morbidity numbers due to TB/HIV, the global burden of the disease is still high. Of the total of 1.3 million deaths due to tuberculosis, 214,000 were HIV infected people who were registered in 2020. TB is known to manifest early among PLHIV. Its number is high in developing countries like Ethiopia. Until recently, there has been remarkable progress in controlling its fast transmission, but due to the emergence of COVID-19, the disease is returning to its initial state (WHO 2021b:1-2). In most Sub-Saharan African countries, the highest burden of the disease is attributed to poverty and lack of knowledge (Gunda, Maganga, Nkandala, Kilonzo, Mpondo, Shao & Kalluvya 2018:1-8).

According to the global TB report (2019:1-4), achieving the United Nations (UN) high-level target of treating 40 million people with TB between 2018 and 2022 required treating about seven million people in 2018 and about eight million people in subsequent years. Ten countries accounted for about 80% of the gap, with India 25%, Nigeria 12%, Indonesia 10%, and the Philippines 8% accounting for more than half of the total. In those countries, intensified efforts are required to enhance reporting of detected TB cases and access to diagnosis and treatment. The percentage of notified TB patients who had a documented HIV test result in 2018 was 64%, up from 60% in 2017. In the WHO African Region, where the burden of HIV-associated TB is highest, 87% of TB patients had a documented HIV test result. A total of 477,461 TB cases among HIV-positive people were reported, of which 86% were on antiretroviral therapy. TB incidence has been falling since 2013, by 2% globally and by 4% in Africa. However, in 2017, globally 10 million additional TB cases were reported, about 25% in Africa and 87% in thirty countries with a high TB burden, including Tanzania. Of all cases mentioned, 90% were older than 15 years of age, 64% were males and 9% were HIV positive (WHO 2018:27). The reported cases

include 51% of the estimated 920,000 new TB cases who are among PLHIV. Out of 1.5 million people enrolled at care and treatment clinics in 2017, 8% were diagnosed with TB in the same year. Africa accounted for 72% of all HIV associated TB cases in 2017. Among all African countries, Tanzania has been mentioned as having high numbers of TB cases and being one of the countries with a high TB/HIV burden. In 2017 it was estimated that 154,000 new cases of TB were also HIV positive, but with only 93% of TB patients in Tanzania having test results for HIV, of which 36% were co-infected with HIV, the true burden of TB among HIV positive people could be underestimated in this country (Mollel, Maokola, Todd, Msuya & Mahande 2019:305-306).

Since 2019, the number of PLHIV in India has been increasing. Once individuals acquire the infection, the probability of developing opportunistic infections like tuberculosis is 20 times higher. In this country TB has been registered as the first cause of death (Ministry Health of India [MoHI] 2020:40&41). According to the 2019 Global TB Report, among all causes of TB deaths, 24% were due to TB/HIV dual infection. This has made the country the third highest HIV burdened country with 0.22 point prevalence (Thekkur, Kumar, Chinnakali, Selvaraju, Bairy, Singh, Nirgunde et al 2019:1-5).

According to the United Nations Programme on HIV/Aids (UNAIDS) (2020a:154-210), the Asian and Pacific regions were residence for close on 5.8 million PLHIV in 2019. China, India and Indonesia account for almost three-quarters of the total number of PLHIV in the region. It is increasingly clear that Asia and the Pacific regions are following behind regions in Africa in their HIV response. In 2019, 75% of PLHIV in this region were aware of their status. Among those aware, 80% were on treatment, of which 91% were virally suppressed. In terms of treatment coverage, this accounts for 60% of all PLHIV being on treatment and 55% being virally suppressed (Gunda et al 2018:1-8). The epidemic is concentrated and ever increasing among key populations, particularly commercial sex workers and men who practice homosexual activities. In 2019, a quarter of a million people became infected with HIV in the region (Morishita, Yamanaka & Islam 2020:24).

According to the UNAIDS global AIDS report (2019:231), in Latin America in 2018, nearly 100,000 people acquired HIV, a 7% increase compared with 2010. Half of the countries in the region had an increased incidence between 2010 and 2018, with the largest increase reported in Costa Rica (21%), Brazil (21%), Chile (34%) and Bolivia (22%) Fourteen percent (14%) of new infections in 2018 were among men who have sex with

men (MSM): among 15 countries in the database, prevalence of more than 20% was registered in two countries.

In South American countries, PLHIV are not always subject to TB testing, even if they show symptoms of the disease. As a result, most people in Latin America and the Caribbean who are co-infected with TB and HIV do not know their status and are not receiving treatment that could cure or reduce illnesses and prevent deaths from these diseases. Experts recommend that the best way to address these problems is to have increased collaboration between healthcare providers and TB and HIV programmes through joint monitoring and surveillance (Morishita et al 2020:24).

Due to the rapid expansion of antiretroviral drugs treatment, there has been significant progress in reducing TB-related deaths among PLHIV (MoHE 2018a:18). According to the 2016 United Nations Political Declaration on Ending AIDS, the aim was to reduce TB-related deaths among people living with HIVPLHIV by 75% by 2020. Furthermore, all nations that are members of the WHO and the UN have pledged to eradicate TB as a public health issue by 2030. To achieve such a goal, TB deaths must reduce by 90% and incidence of active TB by 80% from 2015 levels. But there has been unexpectedly slow progress in eliminating TB, and there are still significant gaps in preventing, diagnosing and treating TB (WHO 2020a:5-15).

1.1.2. Status of TB/HIV in Sub-Saharan African countries

East and Southern African regions are the most affected parts, where more than 6% of the world population live. In 2018, there were 800,000 new HIV infections, just under half of the global total. South Africa accounted for more than a quarter of the region's new infections in 2018. Seven other countries that accounted for more than 50% of new infections are Mozambique 150,000, Tanzania 72,000, Uganda 53,000, Zambia 48,000, Kenya 46,000, Malawi 38,000 and Zimbabwe 38,000. Overall, new infections in the region have declined by 28% since 2010 (Dye & Williams 2019:405-406). Nearly 310,000 people died of AIDS-related illnesses in the region in 2018, although the number of deaths has fallen by 44% since 2010. In 2018, more than 80% of people living with HIV (PLWHIV) were discovered to be aware of their status; 78% of them were following their treatment and more than 85% who had been following antiretroviral treatment had shown significant decline in viral load test results (Gunda et al 2018:1-4). Three countries – Botswana, Eswatini and Namibia – have now reached coverage above 90% for the three key focus areas in the HIV care cascade (Chamie, Napierala, Agot & Thirumurthy 2021:225-236).

The HIV treatment cascade is a model that outlines the steps of care that PLHIV go through from initial diagnosis to achieving viral suppression, and this shows the proportion of individuals living with HIV who are engaged at each stage (Haghighat, Toska, Bungane & Cluver 2021:1-9). Based on the standard criteria, Rwanda is close to reaching the 90% coverage. However, progress is poor in countries such as Madagascar, Mauritius and South Sudan. Fewer than 25% of PLHIV know whether they have HIV, while eight countries in the region are still not reporting data on viral suppression (Marsh, Eaton, Mahy, Sabin, Autenrieth, Wanyeki, Daher & Ghys 2019:212-213).

In its high TB/HIV prevalence, Botswana was identified to have a high public health emergency in 2005. Although the incidence of TB is still among the highest in the world (300 per 100,000 in 2017), there has been a sustained decline in the number of TB cases since universal access to antiretroviral therapy (ART) was introduced in 2001. However, mortality in patients with HIV associated TB is almost double that of HIV negative TB patients (Muyaya, Musanda & Tamuzi 2019:1-9).

In Sub-Saharan African countries, the age distribution of tuberculosis and HIV infection has been studied but diagnosis of tuberculosis among small children has been found to be difficult. This challenge was considered one of the major public health problems of the recent era. This was principally identified in resource poor countries like the Democratic Republic of the Congo. This country was one of the 30 countries severely affected with tuberculosis (Gunda et al 2018:1-4). According to the 2016 World Tuberculosis Report, children aged under 15 were found to be affected with all forms of tuberculosis. In the same year, the prevalence of both TB and HIV were so high that it was difficult to control these dual infections in most developing countries in Africa. Even if the success rate was poor, special attention was given to eliminating TB/HIV dual infection among adolescents by identifying their typical characteristics. The indirect outcome of adult tuberculosis is responsible for its transmission in the community and makes its control difficult (Mukuku, Mutombo, Kakisingi, Musung, Wembonyama & Luboya 2019:2-3).

1.1.3. TB/HIV in Ethiopia

According to various studies conducted in Ethiopia, the burden of tuberculosis and HIV infections has caused the country to be included in the 30 high TB/HIV-burden countries. In 2018 the incidence of HIV infection was nearly 0.2 cases per 1000 of the population and it was nearly two per 1000 for tuberculosis. It was concluded that the number of TB cases among HIV infected individuals was much higher than among HIV negative people

with an estimated TB incidence rate of 164 per 100,000 TB, 112/100,000 TB cases within those with HIV. According to the Federal HIV/AIDS Prevention and Control Office [FHAPCO] (2018:3-7) estimates, 613,000 adults (0.9% of the adult population) were HIV positive. However, this distribution was highly heterogeneous, with the lowest prevalence (0.1%) in the Somali region and highest in the Gambela region (4.8%), in the Southern Nations, Nationalities and Peoples' (SNNP) region (16.1%) and Addis Ababa (18%). Amhara and Oromia regions were identified as having the majority of people living with TB and HIV infection with a prevalence of 30% and 26% respectively (Tesfaye, Alebel, Gebrie, Zegeye, Tesema & Kassie 2018:1-5).

Research suggests that TB incidence is high in areas where HIV is highly prevalent. Until recently there have been various efforts in identifying the incidence, prevalence and determinant factors of tuberculosis among HIV positive people, and this has been used as a major tool in the prevention and control of TB/HIV dual infection. This was not a simple process. Rather, lack of evidence was one of the major challenges (Gelaw, Assefa, Magalhaes, Demissie, Tadele, Dhewantara & Williams 2020:839-840).

In developing countries like Ethiopia, the distribution and severity of TB/HIV dual infection is somewhat different from other countries. This is because there are differences in socio-economic factors, culture, educational status and health access (Teweldemedhin, Asres, Gebreyesus & Asgedom 2018:1-5). Victims of TB/HIV co-infection have been experiencing mental, social and physical problems which have compromised their quality of life (Alemu, Yesuf, Zerihun, Getu, Worku & Bitew 2020:59-66).

Based on the WHO recommendation, integrated TB and HIV collaborative activities were launched in 2004 and updated in 2012. These activities aimed at reducing the burden of HIV among TB patients and the burden of TB among people living with HIV AIDS (PLWHA). Subsequently, the combined TB and HIV service has been extended to the three-tier health care system in Ethiopia. Nevertheless, there is limited knowledge regarding the burden of TB and HIV co-morbidity and its combined service implementation at regional/city level in the country is limited (Gelaw et al 2020:839-840).

1.1.4. Determinants of TB/HIV co-infection

According to various studies conducted in different parts the world on determinants of tuberculosis, latent TB infection can progress to active TB infection due to a number of reasons which compromise the ability of the body to defend against invasion of micro-organisms. These factors are: being on advanced WHO’s HIV clinical stages: stages III

and IV (Tilahun, Shibabaw, Kiflie, Bewket, Abate & Gelaw 2019:514), haemoglobin level less than 11 mg/dl (Gunda et al 2018:1-5), CD4 count less than 200cell/mm for PLHIV, increased viral load test result (Nugus & Irena 2020:2-5), and poor ART retention (Temesgen, Kibret, Alamirew, Melkamu, Hibstie, Petrucka & Alebel 2019:1-5) were found to be independent factors in causing tuberculosis among susceptible individuals. A previous history of TB was found to be another determining factor for the occurrence of HIV (Alemu et al 2020:59-66).

Among behavioural characteristics, cigarette smoking and drinking alcohol have been found to be associated with an increase of tubercle bacilli. Frequent exposure to industrial fumes/smoke has been mentioned as predisposing individuals for development of TB (Nugus & Irena 2020:1-6). However, completion of a full course of tuberculosis treatment and taking isoniazid prophylaxis treatment have been proved to be some of the preventive measures against tuberculosis (Gezae, Abebe & Gebretsadik 2019:106-107). Taking co-trimoxazole prophylaxis significantly reduces the occurrence of TB among HIV patients (Asgedom, Tesfaye, Nirayo & Atey 2018:696-697).

Pulmonary tuberculosis cases with comorbidities are twice as likely to have a highly infectious period (Asemahagn, Alene & Yimer 2019:228-229). Illiterate patients were found to be more than twice as likely to develop TB compared to subjects who can at least read and write in the local language. Patients with household income of less than 1000 Ethiopian birr (ETB) per month were more likely to develop TB compared to those who had higher income. Those patients living in house with no windows or only one window were almost twice as susceptible to be infected with tubercle bacilli than individuals who had more winfows (Alemu et al 2020).

According to studies conducted by Tesfaye et al (2018:2-4) and Shimeles, Enquselassie, Aseffa, Tilahun, Mekonen, Wondimagegn & Hailu (2019:2-9), poor socio-economic status such as overcrowding, low educational level, malnutrition; host factors such as smoking, drinking alcohol, extreme old age and clinical factors such as a history of hospital admission, body mass index (BMI) lower than 18 kg/m^2, having contracted diabetes mellitus, chronic renal failure, and a contact history with chronic coughing were among the determinant factors of tuberculosis in different parts of Ethiopia. Bacillus Calmette–Guérin (BCG) vaccination was found to increase the protective effect among susceptible individuals (Tilahun et al 2019:513-514).

1.1.5. Transmission of tuberculosis and HIV

TB spreads from person to person through the air. Individuals with pulmonary TB who cough, sneeze, or spit propel the TB microorganisms into the air (Nugus & Irena 2020:2-5). For successful transmission of the disease, minute microorganisms known as droplet nuclei with a size of about 1.5 microns can remain suspended in the air for several hours. Mycobacterium tuberculosis is transmitted through the air, not by surface contact (Churchyard, Kim, Shah, Rustomjee, Gandhi, Mathema, Dowdy et al 2017:629-635). Transmission occurs when a person inhales droplet nuclei containing M. tuberculosis, and the droplet nuclei passes through the mouth or nasal passages, upper respiratory tract, and bronchi and finally reach the alveoli of the lungs (Gofur 2022:2-6).

According to evidence generated from different studies, the transmission of tuberculosis varies in different age groups. Small children are known to transmit the disease less than young adults. They do not produce adequate sputum. The bacterial load in their sputum is not usually strong enough to transmit the infection to healthy susceptible individuals (Thomas 2019:109-121). Due to the difficulty in identifying TB in small children, special attention must be given to making an accurate diagnosis. Proper history, including the presence of a cough with its duration has to be assessed. Chest radiography outlines the presence of cavitation, lung opacities and filtration (Migliori, Tiberi, Zumla, Petersen, Chakaya, Wejse, Torrico et al 2020:15-25). TB cases who have productive sputum with significant bacterial load are highly infectious and spread the disease to many others (Sharma, Mandal & Mishra 2021:3-8).

For a person with a history of chronic cough and other symptom complexes of tuberculosis, a complete physical examination is conducted, followed by laboratory diagnosis for sputum microscopy, blood examination for complete blood count and erythrocyte sedimentation rate (ESR). Once an individual is diagnosed as a confirmed case of tuberculosis, the patient is given a complete course of anti-tuberculosis multi-drug regimens. Such cases are usually followed up for proper adherence to the drug. Sometimes, because of the negligence of either patients or health professionals, they may not take their medication properly. This may lead them to have the condition known as multidrug-resistant tuberculosis (MDR-TB). The worst threat that these patients cause to the community is transmission of drug-resistant tuberculosis (Luz, Veloso & Grinsztejn 2019:366-367).

A systematic review on 21 relevant papers found that the estimated MDR-TB incidence reduction was 90% with preventive treatment. Hence, preventive treatment of MDR-TB contacts with LTBI is currently recommended based on the above observation (Migliori et al 2020:15-25). As to the degree of transmission of the disease, patients who have a high load of tubercle bacilli in their sputum, TB cases who manifest cavities in their lungs on chest radiography, and patients who have a positive sputum culture are likely to transmit the infection more than those who have a negative sputum smear and normal radiography findings (Sharma et al 2021:3-8).

The human immune deficiency virus (HIV) is a single-stranded RNA virus. It can easily transmit from person to person through various means. Once a person is infected with HIV, the virus is available in all body fluids such as serum, vaginal secretion, seminal fluid, breast milk, etc. Exchange of those body fluids through sexual relations, blood transfusion, breastfeeding and common use of sharp and pointed materials can successfully transmit the disease among healthy susceptible individuals. The transmission of the disease can be prevented through proper administration of ART. Antiretroviral drugs are well known in suppressing viral load in the serum. Early introduction of all HIV infected people to ART and putting them in other chronic care support improves their health and is crucial in the prevention and control of the disease (Calabrese & Mayer 2019:211-213).

The risks for HIV-1 transmission are associated with different transmission routes and their relative contributions to its prevalence worldwide (Theron, Limberis, Venter, Smith, Pietersen, Esmail, Calligaro et al 2020:1435-1443). Among those routes of transmission, sexual transmission contributes to more than 68% worldwide followed by mother to child transmission during childbirth and breastfeeding. Heterosexual transmission of HIV has a lower risk than homosexual transmission (Stansfield, Mittler, Gottlieb, Murphy, Hamilton, Detels, Wolinsky et al 2019:68-76).

HIV can be transmitted from mother to child during pregnancy, childbirth or through breastfeeding. If left untreated throughout these stages, there is about a 45% chance of an HIV positive mother transmitting the virus to her child (Kassa 2018:1-9). However, there are treatment options to prevent this from happening. If pregnancy occurs and there has been potential HIV exposure, the healthcare provider advises getting tested for HIV as early as possible. Taking medication called antiretroviral therapy as prescribed can

reduce the viral load so that the baby has a chance of less than 1% of contracting HIV (Omonaiye, Kusljic, Nicholson & Manias 2018:1-20).

The global health community in collaboration with international organisations such as the WHO and other concerned bodies have been active in improving the reproductive health of women, including stopping HIV from being transmitted from mother to child through a programme known as “prevention of mother to child transmissions” (PMTCT). Since the start of this programme numerous mothers have been utilising the service worldwide and the rate of its utilisation has been increasing from year to year from 3% in 2003 to 76% in 2018 (Kassa 2018:1-6). In contrast, more than half of all pregnant women were not utilising the PMTCT service. This phenomenon has enhanced the efforts of the global health community to focus on scaling up of biomedical measures parallel to identifying the social barriers that have been interfering with adherence to PMTCT service. However, “Despite technical means and political will, the percentage of pregnant women involved in PMTCT interventions is not increasing as fast as public health authorities, health professionals, and scientists would expect” (Tabassum, Saeed, Akgül, Farman & Chaudhry 2020:2-4).

1.2. STATEMENT OF THE PROBLEM

Hawassa in the southern part of Ethiopia is one of the main areas in which the Ministry of Health of Ethiopia has strengthened the prevention and control of TB/HIV dual infection through the establishment of TB/HIV clinical care units and implementation of a national HIV prevention road map (Ethiopian HIV AIDS Prevention and Control Office [EHAPCO] 2018:14). Despite all the efforts by the Ethiopian government to reduce the rate of TB/HIV infection in the country, the number of cases increases yearly. The prevalence of TB/HIV dual infection cases has reached 18.2% among adolescents, which is significantly higher than the national figure, revealing that young peoples’ problems receive less attention in research efforts (Fekadu, Teshome & Alemu 2015:902; Snair 2020:9&10).

Having worked as a public health officer clinician in the southern region of Ethiopia and as head of an outpatient department and clinical year college students’ supervisor in Sidama Zone of different health facilities for more than twenty years, the researcher has observed and noted with concern the escalating HIV prevalence rates among the local adolescents. Most of these adolescents have been developing TB in various forms. Fekadu et al (2015:901) confirm that the magnitude of TB and its association to HIV has been increasing with alarming numbers in Ethiopia.

TABLE 1.1: DISTRIBUTION OF NEWLY ENROLLED TB/HIV DUAL INFECTION CASES AMONG ADOLESCENTS LIVING IN HAWASSA, SOUTHERN ETHIOPIA, 2018-2020

Age	Years		
	2018	**2019**	**2020**
10-14	553	1065	864
15-19	583	920	966
20-24	2438	4461	2386
Total	3574	6446	4216

(Ministry of Health, Ethiopia, District Health Information System (DHIS) 2020)

Table 1 above shows that there was an increase in numbers among all the adolescents' age groups. The overall percentage increase in two years (18 and 19 years) is above 80%. In 2020 there is a relative decrease in the number of TB/HIV cases. As it has been studied in many other countries, the possible explanation for this dramatic change could be the effect of COVID-19 on the regular clinical activities of health institutions at which chronic care centres' service is being declined (Singh, Sunuwar, Shah, Karki, Sah, Adhikari & Sah 2021:1-14). In the researcher's view, the National TB/HIV Prevention Coalition Intervention programme has not been implemented properly or was not the appropriate approach for prevention of tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia. It is in the light of the above that the researcher sought to investigate the determinants of TB among the adolescents in Ethiopia followed by developing an alternative prevention strategy.

1.2.1. Context of the research problem

This section focuses on the historical background of TB/HIV prevention in Ethiopia. It assesses existing developments of TB/HIV prevention in the country and is followed by the research objectives.

1.2.2. The current development of TB/HIV prevention in Ethiopia

TB is the current global challenge. A number of prevention and control strategies have been developed to eliminate its burden worldwide. Ethiopia is a high TB burden country and shares the challenges in controlling TB, drug resistant TB and leprosy. The globally recommended Stop TB Strategy and Global Strategy for Leprosy Prevention have been adopted in the country, with preliminary activities such as early case detection, provision of a full course of chemotherapy with standard patient care and support (Dutt 2021:11-28), followed by programme performance monitoring and evaluation (Floyd, Glaziou,

Zumla & Raviglione 2018:299-314). Effective disease prevention and control activities have been among the major focus areas of the programme through active case detection and management. Special emphasis has been given to smear positive pulmonary TB cases who discharge tubercle bacilli and spread the disease in the community. To implement these measures, a strategy known as directly observed therapy (DOT) has been used, aiming to achieve an effective tuberculosis programme such as: detection of nearly 70% newly diagnosed smear positive cases and maintaining a more than 80% cure rate. The programme was found to be successful in reducing the morbidity, mortality and transmission of the disease among individual patients and the community as a whole (Reguera, Pérez, Gutiérrez, Domínguez, Ordóñez, García, Martínez & Balaña 2019:1385-1404).

With time, another initiative incorporating HIV prevention has emerged as a “TB/HIV collaborative activity”. Its formal implementation started from 2002 (MoHE 2018a:1-10). The preparations were: establishment of a national TB/HIV advisory committee, TB/HIV proposal development, and advocacy workshops for policy makers and programme managers. Establishing includes setting up a coordinating body for TB/HIV activities at all levels, to conduct surveillance of HIV prevalence among tuberculosis patients, carry out joint TB/HIV planning, conduct monitoring and evaluation, decrease the burden of tuberculosis in PLHIV, establish intensified tuberculosis case finding, introduce isoniazid preventive therapy, ensure tuberculosis infection control in health care and congregate settings, decrease the burden of HIV among TB patients, provide HIV testing and counselling, introduce HIV prevention methods and co-trimoxazole preventive therapy, ensure HIV/AIDS care and support, and introduce antiretroviral therapy.

The implementation of TB prevention and control interventions is guided by the five-year TB Strategic plan, prepared in line with the HSDP IV and the End TB Strategies. In the last 10 years much effort has been made to control and prevent TB throughout the country. The recent scale-up of community TB care by health extension workers ensured access to directly observed treatment (DOTS) at grassroots level in the community. However, compared to the previous estimation of TB burden for the country, the programme has achieved a TB case detection rate of less than 36%, which is much lower than the minimum target (70%) (MoHE 2018b:8-12).

To take measure of those challenges, the Ministry of Health of Ethiopia’s (MoHE), regional and zonal health offices in collaboration with developmental partners throughout

the country have been implementing high impact initiatives such as to motivate, educate, mobilise and engage all community members for prevention and control of tuberculosis under the umbrella of the End TB Strategy and the second Health Sector Transformation Plan of the country (MoHE 2018a:18-25). Health extension programmes which are distributed to the grassroots level have a significant role in implementing TB/HIV prevention packages, including integrated TB/HIV care and support (González-Fernández, Casas, Singh, Churchyard, Brigden, Gotuzzo, Vandevelde et al 2020:1-7).

Ethiopia has detected and treated 1.5 million cases of tuberculosis over the past 20 years. It has reduced mortality by 63% and prevalence by more than 50% since 1990. Worldwide, mortality fell by 45% and prevalence by 41% during the same period (Deribew, Deribe, Dejene, Tessema, Melaku, Lakew, Amare, Bekele, Abera, Dessalegn & Kumsa 2018:519-526).

In recent years, Ethiopia has identified around 140,000 cases of tuberculosis, which probably amounts to two-thirds of the total burden. Roughly 90% of patients with drug-sensitive tuberculosis have been successfully treated. There were 597 cases of MDR-TB. Treatment success rates for MDR-TB are a remarkable 78%; worldwide, the rate is 48%. The country has adopted a new molecular biology technology known as gene expert (Xpert MTB/RIF) testing, which takes a few hours to diagnose tuberculosis and determine whether the bacillus is resistant to rifampicin (a proxy for MDR-TB) (MoHE.2018b:8-11). A laboratory diagnosis of tuberculosis would otherwise necessitate a technician reading a sputum-smeared slide through a microscope for 15 minutes. For an untrained or unobservant technician, the bacillus is easy to miss (Datta, Alvarado, Gilman, Valencia, Aparicio, Ramos, Montoya et al 2019:1-4).

1.3. RESEARCH QUESTIONS

1. How familiar are the adolescents and officials with the availability and accessibility of the TB/HIV prevention programme?
2. What are the challenges in the implementation of current interventions to address TB/HIV dual infection in Hawassa, Southern Ethiopia?
3. What are the determinants of tuberculosis infection among HIV positive adolescents in Hawassa?
4. What are the methods to address tuberculosis infection among adolescents living with TB/HIV in Hawassa through the current policies, strategies and guidelines as well as the clinical records in Hawassa?

5. What strategy can be developed to prevent tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia?

1.4. AIM OF THE STUDY

The main goal of the study was an investigation of the determinants of TB among HIV positive adolescents in Hawassa, Southern Ethiopia. The study aimed to do this by describing different determinant factors and identifying the gaps and challenges to develop a strategy for prevention of TB among HIV positive adolescents.

1.5. RESEARCH OBJECTIVES

1. To explore and describe experiences of adolescents on the TB/HIV prevention programme's availability and accessibility in Hawassa, Ethiopia.
2. To explore and describe experiences of the officials on the availability and accessibility of TB/HIV prevention programme for the adolescents in Hawassa, Ethiopia.
3. To explore and describe challenges associated with implementation of interventions to address TB/HIV dual infection in Hawassa, Southern Ethiopia.
4. To explore and identify the determinants of TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia.
5. To describe the determinants of TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia.
6. To develop a strategy that would prevent tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia.

1.6. STUDY APPROACH AND DESIGN

A research design is defined as the plan or strategy which the researcher uses to implement his or her study, and which is based on the researcher's approach to the study (Grinnell 2018:13).

The study adopted an exploratory sequential design based on mixed-methods design classifications (Creswell 2014:264). A mixed methods research design, according to Creswell (2015:2), is an approach to research in social, behavioural and health sciences, in which the investigator gathers both quantitative and qualitative data, integrates the two, then draws interpretations based on the strength of both sets of data to understand the research problem. Creswell (2015:18) further lists core characteristics of a mixed methodology as: involving collection and analysis of both qualitative and quantitative data

in response to the research question, a combination and integration of qualitative and quantitative data, and using specific methods of interpretation of the integration of the data. In the exploratory sequential mixed methods adopted in this study, data collection was conducted in two phases in sequence. The research question was explored qualitatively first, and from its analysis the researcher formed quantitative questions.

The exploratory sequential study addressed the research issues in a three-phase sequential mixed methodology (Kobeissy 2012), whereby a qualitative study was conducted in the first phase, followed by a quantitative study in the second phase. The third phase was a combination and integration of quantitative and qualitative phases (Berman 2017) and development of the envisaged strategy of tuberculosis prevention among adolescents living with HIV in Hawassa, Southern Ethiopia.

1.6.1. Phase I: Qualitative method

The qualitative research aimed at exploring and describing the experiences of the adolescents and key informants regarding the availability and accessibility of the TB/HIV prevention programme; observing and understanding institutions' day-to-day routine actions, events and processes in the environment in which they occur; and exploring and describing challenges that are faced in the implementation of interventions to address TB/HIV dual infection in Hawassa, Southern Ethiopia. The qualitative phase further critically analysed the clinical records of the adolescents who were on clinical follow-up and taking monthly antiretroviral and anti TB drugs in Hawassa. Furthermore, the researcher conducted focus group discussions with the adolescents to find out the measures that could prevent TB/HIV dual infection in the study area.

1.6.2. Phase II: Quantitative method

The quantitative research explored, identified and described the determinants of TB infections among the adolescents in Hawassa, Ethiopia, in the second phase of this study. Data from both phases was then combined in the final analysis to provide a more complete description of adolescents' experiences as well as the determinants of TB infection among the adolescents in Hawassa.

1.6.3. Phase III: Mixed method

Data from both phases was combined in the third and last phase. The findings informed development of the proposed strategy to prevent TB infections among adolescents living with HIV in Hawassa, Ethiopia.

1.7. SIGNIFICANCE OF THE STUDY

The results from the study provide information on the major determinants of tuberculosis among adolescents living in Hawassa town. The existing TB/HIV prevention strategy in the region, particularly in Hawassa town, was evaluated. Any gap in the prevention activity was identified. Better recommendations for improving the TB/HIV prevention service delivery in the study site and potentially in the southern region are indicated in the guidelines developed as one part of this study's output. The results provide key information for minimising the occurrence of TB among adolescents living with HIV by documenting perceptions, major risk factors and the gaps in the existing prevention strategies (Gelaw et al 2020:839-840).

Moreover, the study attempted to address representatives of almost all stakeholders in the prevention and control of TB/HIV as crucial informants, including government officials. Subsequently, those individuals are expected to promote, cascade and implement the revised TB/HIV prevention strategy. The study findings and recommendations could be a ladder to other innovations for future studies in this regard.

1.8. RATIONALE OF THE STUDY

According to the Federal HIV/AIDS Prevention and Control Office (FHAPCO) estimates, 613,000 adults (0.9% of the adult population) were HIV-positive. However, this distribution was reported in different regions of the country with different prevalence rates. In the Southern Nations, Nationalities and People's region (SNNP) where Hawassa town is located, TB/HIV prevalence is 16.1% (Tesfaye et al 2018). Research suggests that TB incidence is high in areas where HIV is highly prevalent. The number of adolescents who are affected by TB/HIV dual infection in some parts of the country including Hawassa town is increasing (Gelaw et al 2020:839-840). There is still an unacceptable gap between the current figure and what is expected.

As a clinical year college students' supervisor in Sidama Region of different health facilities, the researcher has observed and noted with concern the escalating HIV prevalence rates among the local adolescents. Most of these adolescents have been developing TB in various forms. The magnitude of TB and its association to HIV has been increasing in alarming numbers in Ethiopia (Fekadu et al 2015:901). Those reasons stimulated the researcher to conduct research to establish the determinants of and develop a strategy for prevention of TB among HIV positive adolescents.

1.9. DEFINITION OF KEY CONCEPTS

The following key words and phrases are frequently used in this study:

1.9.1. Adolescent

It is an individual who is undergoing significant physical and psychological changes in the age interval range from 10 to 24 years (WHO 2022a).

For the purpose of this study, an adolescent shall mean an individual between 24 and 15 years of age to ensure the inclusion of a range of young persons in the sample.

1.9.2. Acquired immuno-deficiency syndrome (AIDS)

AIDS refers to the stage of progression of HIV infection which is characterised by compromised body defence mechanisms due to destruction of cell mediated immunity by the HIV virus (Dasgupta, Mukhopadhyay & Saha 2018:208).

In this study, AIDS is a condition caused by HIV and is characterised by the suppression of the immunity system that leads to opportunistic infections and other diseases such as TB.

1.9.3. Human immunodeficiency virus (HIV)

HIV (an acronym for human immunodeficiency virus) is a virus that attacks cells which help the body fight infection, thus making a person more vulnerable to other infections and diseases. If left untreated, HIV can lead to the AIDS disease (Sato, Misawa, Takeuchi, Kobayashi, Izumi, Aso & Nagaoka 2018:1905-1917). In this study, HIV is a virus that harms individuals' immune system by destroying CD4-T lymphocytes that are responsible for protecting the body from infection and subsequently puts the body at risk of other infections.

1.9.4. Prevention

This refers to interventions that aim to delay or prevent the disease from occurring (Shaw, Gwyther, Holland, Bujnowska, Kurpas, Cano, Marcucci et al 2018:1223-1252). It is the process or a mechanism of protecting oneself from internal/external harm or injury that could significantly affect the body (Neiger, Thackeray & Fagen 2011:166-171).

In this study, prevention refers to anticipatory action or intervention designed to prevent or reduce the possibility of the spread of TB and HIV co-infection amongst the adolescents. Such interventions should minimise the damage that may result from TB and HIV co-infection if it does occur.

1.9.5. Tuberculosis (TB)

TB is an infectious disease caused by a bacillus called Mycobacterium tuberculosis and is mostly spread through droplet infection (WHO 2020c:2). For the purpose of this study, TB is one of the bacterial diseases which mostly affect the lungs. It also affects other parts of the body, including the spine, meninges, brain and other organs in the body. It is transmitted through inhalation of droplet nuclei consisting of tubercle bacillus.

1.9.6. TB/HIV co-infection

Van Woudenbergh, Irvine, Davies, De Kock, Hanekom, Day, Fortune and Alter (2020:104-120) indicate that TB and HIV co-infection occurs when people have both HIV infection and certain types of TB disease. When someone has these dual infections, each disease accelerates the progress of the other. HIV infection could accelerate the progression from latent to active TB and, accordingly, tubercle bacilli could also accelerate the progress of HIV infection.

For the purposes of this study, a TB and HIV co-infected person is one who has a confirmed diagnosis of TB and HIV through positive tests and is either on treatment for TB or HIV or for both TB and AIDS.

1.9.7. Strategy

Strategy is the unified, comprehensive and integrated plan that relates to the strategic advantage of the institution in relation to the environment. The strategy is designed to ensure that the objectives are achieved through proper implementation processes (Lazenby, Halpern, McAllister & Dean 2020:2056-2059).

In this study, a strategy refers to specific recommendations that will be created based on the study's findings to prevent tuberculosis infection among adolescents living with HIV in Hawassa, Southern Ethiopia.

1.10. OPERATIONAL DEFINITIONS

1.10.1. ART (anti-retroviral treatment) adherence

When a patient is diagnosed HIV positive and takes his or her treatment without interruption or according to the prescribed doses, dosing intervals, and other medication instructions (Mukumbang, Marchal, Van Belle & Van Wyk 2018:1-16).

1.10.2. TB contact history

A condition in which a healthy susceptible individual has been identified as sharing air space for a significant period (>15 hours per week or >180 hours for the whole infectious period) (Auld, Shah, Cohen, Martinson & Gandhi 2018:807-817).

1.10.3. Advanced HIV clinical stage

This is a stage which occurs in HIV diagnosed individuals with at least one of the manifestations such as serious opportunistic infections affecting single or multi body systems, cancer, or severe weight loss – greater than 10% (Prabhu, Harwell & Kumarasamy 2019:540-551).

1.10.4. Cases

Adolescents in chronic care centres who have been diagnosed as having both TB and HIV.

1.10.5. Controls

Adolescents in chronic care centres who have been diagnosed as having only HIV.

1.11. ETHICAL CONSIDERATIONS

In this study all the standard ethical concerns based on the Belmont Report were respected (Polit & Beck 2018:132). These are the principles of beneficence, justice and human dignity, ensuring the wellbeing of the participants by preventing injury to their bodies, minds, spirits, emotions, or psychological, social, economic and legal maltreatment (Brink, Van der Walt & Van Rensburg 2018:42). The researcher took care to structure the questionnaires in such a way as not to cause distress and related discomfort. At the time of data collection, the participants were observed for any sign of uneasiness, and they were given the full right to communicate their feelings and discontinue the interview at any time.

As to individuals' rights, the researcher considered respect to study participants based on the three universal conventions: the right to self-determination, providing additional protection to individuals who seem to have diminished autonomy, and to individuals who might not be regarded as autonomous (Rezaul Islam 2019:32). At the time of data collection, the researcher respected individuals' choice to participate or withdraw. The participants were properly informed to raise any questions and refuse providing information if they experienced any discomfort. The researcher did not use any forceful approach to gain the cooperation of the study participants.

As to respecting the principle of justice, the researcher endeavoured to treat all participants fairly and maintain their privacy. The individuals who participated in the study were chosen according to the demands of the research rather than their vulnerability. The private information of the clients was protected confidentially (Polit & Beck 2018:113-114). Confidentiality was maintained by withholding the information from non-research team members (Gray, Grove & Sutherland 2016:123). The participants were selected based on their regular follow-up care and treatment in antiretroviral treatment centres. The selection was conducted in such a way that adolescents or their guardians were capable of giving in-depth information which could answer the research questions. To ensure privacy, the researcher conducted the interviews in a private room and used code names instead of real names to maintain the confidentiality of the information.

Apart from the researcher, nobody had usage of the structured interview guides. After completing the interview, the audio recorder was kept locked. Because of the study's academic orientation, the final results were shared only with relevant staff members at the University of South Africa (UNISA). To strengthen the confidentiality issue, a confidentiality binding protocol was signed between the researcher and the study participants. To ensure all the applicable principles were maintained, informed consent was signed between the researcher and the participants or their guardians. Follow-up interviews were not considered with the same interviewees.

As to the application of informed consent in this study, the researcher took great care to communicate the necessary information to the level at which it was understood by participants of the study (Gray et al 2016:122&123). The four elements of informed consent were respected: explaining the necessary information, helping the clients to understand the information, proficiency of the participants to indicate their willingness to take part in the study, and the signing of an informed consent form. The form was completed for those younger than 18 years. Furthermore, the researcher sought ethical clearance prior to data collection from UNISA and also requested permission from the Southern Nations, Nationalities and People Region's (SNNPR's) Regional Health Bureau to collect data in Hawassa city**.**

1.12. SCOPE AND LIMITATIONS

Only one city, Hawassa Town, served as the site for this investigation, and the findings may help the country to adopt an alternative preventive TB/HIV strategy which will eventually contribute to better national achievement of the sustainable developmental

goals (SDGs). As a limitation, because data was collected from only one city, the conclusions might not apply to everyone nationwide. Private health facilities were not included because all TB/HIV treatment and care services are provided without charge in government health centres, and most users of the services are from low socio-economic status and prefer to get the service from government organisations. The study did not include former clients who had expired before the commencement of the data collection. Since those clients were enrolled in the chronic care centre, information on the disease prevalence might be distorted. However, since the findings were consistent, trustworthy, valid and based on a mixed methods study design with appropriate sample size determination, the limitations should not cause significant negative outcomes.

1.13. STRUCTURE OF THE THESIS

This thesis consists of six interrelated chapters, as follows:

1.13.1. Chapter 1: Orientation to the study

This chapter contains different subtopics. It starts with introduction of the research topic, the responsible causative agents of TB/HIV, with their global, regional and national distribution and historical background. Determinant factors of TB among adolescents living with HIV and prevention strategies against both infections are discussed. Background information both on TB and HIV from global to national levels is provided. The chapter includes a statement of the research problem, as well as the purpose and rationale/significance of the study. In addition, the chapter presents the foundations of the study, the study's scope and anticipated constraints, as well as the research design. Moreover, operational definitions of key concepts are provided.

1.13.2. Chapter 2: Literature review

This chapter presents a discussion of the basic facts in relation to determinant factors and prevention strategies of tuberculosis researched from relevant available literature. The purpose of reviewing relevant literature is to provide an overview of the global and local context of the problem under study. The experience of different countries with prevention of TB/HIV is described, and a rationale for using alternative preventive strategies at national and regional level is reviewed.

1.13.3. Chapter 3: Research methology

This chapter presents the different methodologies used to conduct the study, the significance and scope of the study, and the study design for both the qualitative and quantitative phases of the study. All components of the research methodology such as

the study population, sampling techniques, data collection procedures and attention to be taken during data collection in maintaining validity and reliability of the data collection tools are described. Finally, the overall ethical considerations employed for this particular study are discussed.

1.13.4. Chapter 4: Analysis, presentation and description of the research results

This chapter presents the findings, and an interpretation and discussion of both qualitative and quantitative phases of the study. All findings are discussed based on the objectives and research questions outlined in Chapter 1. They are compared with similar study findings from different parts of the world. Findings from the qualitative study are presented thematically and triangulated with the findings in the quantitative study. The analysis of the results will supplement the existing literature pool with new findings.

1.13.5. Chapter 5: Proposed alternative strategy for prevention of dual TB/HIV infection among the adolescents in Hawassa Town, Southern Ethiopia

This chapter comprises the proposed strategy for integrated TB/HIV prevention. The strategy was developed based on the overall objective of the study and the findings from both the qualitative and quantitative phases. In addition, the approach and process of strategy development including validation of the strategy are described. Finally, the vision, mission, goal and strategic objectives of the strategy are discussed sequentially.

1.13.6. Chapter 6: Conclusions and recommendations

This chapter summarises the overall output of the study. It presents conclusions, followed by limitations and recommendations. It promotes the implementation of an advanced TB/HIV prevention strategy among adolescents living in Hawassa city through adding to the body of already existing knowledge. Practical recommendations based on the findings are stated. Finally, conclusions are stated to summarise information on the overall findings, including the limitations of the study.

1.14. CONCLUSION

This chapter has provided an overview of the study, starting from the introduction down to conclusion and recommendations. The introduction outlined the prevalence, distribution and determinants of tuberculosis and HIV infection. It further provided background information on the study site – Hawassa town – and the research challenge. The objectives and significance of the study were mentioned, with special attention to the

integrated prevention and control of TB/HIV dual infection. Terms and operational definitions were included sequentially. The foundation of the study was outlined in the problem statement and conceptual framework. The mixed methods study design and triangulation of the findings were discussed in detail. Lastly, all the approaches for ethical considerations were outlined with their expected scope and limitations.

The next chapter, Chapter 2, will present a review of available relevant literature on the research topic.

CHAPTER 2
LITERATURE REVIEW

2.1. INTRODUCTION

The researcher offers the literature review on tuberculosis and HIV prevention in this chapter. The chapter begins by outlining the context. The determinants of tuberculosis among HIV positive adolescents are explored. The chapter will also assess the TB/HIV preventive measures and the challenges in the prevention of TB/HIV in different parts of the world. The alternative TB/HIV preventive measures that have been sought globally will further be presented.

Paul and Criado (2020:101717) describe a literature review as a document or section of a document that collects and analyses a topic from different sources and discusses views from those sources. A literature review is further defined as a comprehensive summary of previous research on a topic from scholarly articles, books, and other sources relevant to a particular area of research (Garrard 2020:1-10). According to the Bloomsburg University Library, “The review should enumerate, describe, summarize, objectively evaluate and clarify this previous research. It should give a theoretical base for the research and help you (the author) determine the nature of your research”.

It follows that a literature review is a section of a document that is based on research that has already been published in a particular field and the researcher collects key sources on a topic to be studied. It provides justification for the study in a particular subject area within a certain period (Paul & Criado 2020:101717). Similarly, a literature review is an overview of the previously published works on a specific topic. The term can refer to the full scholarly papers or sections of scholarly works such as a books or articles. Either way, a literature review is supposed to provide the researcher and the reader with a general image of the existing knowledge on the topic under review (Nakano & Muniz 2018:1-7).

The Royal Literary Fund (2021:1) outlined the four main tasks of literature review as follows: “A literature review

- demonstrates a familiarity with a body of knowledge and establishes the credibility of your work.
- summarises prior research and says how a project is linked to it.

- integrates and summarises what is known about a subject.
- demonstrates that the researcher has learnt from others and that his/her research is a starting point for new ideas".

2.2. PREVENTION OF TUBERCULOSIS

TB is one of the infectious diseases which is commonly caused by microorganisms known as Mycobacterium tuberculosis. It mainly affects the lung tissue, pulmonary tuberculosis, but can also reach to other parts of the body, thus called extra pulmonary TB (Ministry of Health of Ethiopia [MoHE] 2018a:24). According to Khan, Islam, Ferdous and Alam (2019:259-266), the infection can be transmitted via coughing, sneezing and laughing, which help to transfer mycobacterium to healthy susceptible individuals through aerosol droplets.

TB can be prevented, treated and cured. Dramatic reduction in tuberculosis deaths in many countries of the world during the past five decades provides convincing evidence that ending tuberculosis is feasible (Reid, Arinaminpathy, Bloom, Bloom, Boehme, Chaisson, Chin et al 2019:1331-1384). An inability to give sufficient attention to the condition will result in serious public health problems (WHO 2018:27).

2.2.1. Context of TB prevention

This section focuses on studies conducted in relation to prevention and control of tuberculosis. It starts from the historical background of TB prevention and proceeds to the current intervention scenarios under the categories: prophylactic, governance, clinical case management, socioeconomic conditions, programme collaboration, surveillance and contact screening. It also assesses successes and challenges in the effort to prevent the disease.

2.2.2. Historical background on prevention of tuberculosis

Robert Koch, a famous scientist, managed to isolate the tubercle bacillus and announced this result to the Society of Physiology in Berlin on 24 March 1882, which is regarded as a milestone in the fight against TB (Rodrigues 2020:1-30). In the following decades, the Pirquet and Mantoux tuberculin skin tests, the Albert Calmette and Camille Guérin (BCG) vaccine, Selman Waksman streptomycin and other anti-tuberculous drugs were developed. Koch had also contributed to the explanation of the infectious aetiology of TB. He received the Nobel Prize for Medicine in 1905 (World Heritage Encyclopaedia 2021).

After the establishment in the 1880s that the disease was contagious, TB was made a notifiable disease in Britain. There were campaigns to stop expectorating saliva in public places, and people infected with TB were pressured to enter care and treatment centres that resembled prisons. The centres for the middle and upper classes offered excellent care and constant medical attention. Whatever the supposed benefits of the fresh air and labour in the centres, even under the best conditions, 50% of those who entered were dead within five years (Barberis, Bragazzi, Galluzzo & Martini 2017:8-9).

At the beginning of the 20th century, tuberculosis was again one of the UK's most urgent health problems. A royal commission was set up in 1901, The Royal Commission, appointed to inquire into the relations of human and animal tuberculosis. Its remit was to find out whether tuberculosis in animals and humans was the same disease, and whether animals and humans could infect each other. By 1919, the Commission had evolved into the UK's Medical Research Council (Thorley 2021:348-356). In 1902, the International Conference on Tuberculosis convened in Berlin. Among various other acts, the conference proposed the Cross of Lorraine as the international symbol of the fight against tuberculosis. National campaigns spread across Europe and the United States to reduce the continued prevalence (World Heritage Encyclopedia 2021).

To eliminate tuberculosis of all forms, Cuba has been trying to implement the End TB strategy and practice patient-centred prevention by considering universally accepted key activities such as early diagnosis; treatment of all people with TB; treatment of people at risk; vaccination against TB; and collaboration between TB and HIV programmes, aiming to address risk reduction in both diseases simultaneously. Moreover, components like political commitment, universal health coverage, and adequate resources for health care have been a major part of the initiative in Cuba since late 1950 (Abreu-Suárez, González-Valdés, González-Ochoa & Suárez-Álvarez 2019:59-63).

In 1954, soon after the introduction of an isoniazid, anti TB drug (INH), New York paediatrician Edith Lincoln proposed a novel use for the drug. Lincoln had observed the remarkable effect of INH in her patients, including those with primary TB, who appeared to be protected from progression to chronic disease. She hypothesised that the drug might benefit even those with only positive tuberculin skin tests, in the absence of pulmonary disease. She took her idea to the United States Public Health Service, which conducted a series of random control trials (RCT) involving 70,000 people. The results were inspiring, supporting what became known then as INH prophylaxis and later as

treatment of latent infection. Overall, more than 50% of the expected cases of TB were prevented, with greater benefits in the young and the more recently infected. There seemed to be no significant side effects (Rangaka, Cavalcante, Marais, Thim, Martinson, Swaminathan & Chaisson 2015:2344-2353).

A national public health system was established in the early 1960s, providing free, universal, accessible and equitable coverage, later enshrined in the constitution and law. This commitment responds to the first principle of the End TB strategy: a national government-led and government financed programme, integrated into all levels of health care, with periodic monitoring and evaluation (WHO 2019d:1).

Prophylactic INH was broadly recommended by the American Thoracic Society (ATS) in 1967. Expectations were high: the ATS anticipated a reduction in TB morbidity of 50% to 75% with widespread use (Salazar-Austin, Dowdy, Chaisson & Golub 2019:2078-2085). In 1970, two cafeteria workers in the USA Capitol Building were found to have active TB. A tuberculin testing campaign was undertaken and several thousand workers who tested positive were started on INH. Within months, some of them had developed hepatitis and two had died of fulminant liver failure. Why this side effect had not emerged in the large-scale trials in the 1950s was initially unclear (Cummings 2007:683-692).

The ultimate analysis demonstrated that associations including alcohol, excessive drugs use and age had been contributing factors, which led to the recommendation of an age limit of 35 for INH prophylaxis. Over time, that limitation was been reconsidered and revised in light of emerging evidence about INH safety, including the preventability and reversibility of hepatic toxicity with close clinical monitoring (Cole, Nilsen, Will, Etkind, Burgos & Chorba 2020:1-2). Today, the ATS endorses targeted tuberculin testing and nine-month INH treatment of individuals at high risk of developing TB, regardless of age (Chung, Lee, Koo, Min, Yeo, Park, Park et al 2020:1-8).

Associations established for care and prevention of TB have been advocating for the distribution of a disease prevention protocol aimed at limiting the spread of TB. Such a protocol includes bans on public spitting and requirements that active TB cases be reported to health officials. Reporting requirements prevent physicians from concealing TB diagnoses and allows public health officials to monitor TB patients (Anderson, Charles, Olivares & Rees 2019:143-175).

As a measure to eliminate tuberculosis, thirty-one European countries have evolved the existing platform to design a better tuberculosis prevention strategy to reduce the burden of tuberculosis after being notified on an unexpected number of people (nearly 60,000 TB cases) living in European Union countries. A panel of international experts, consisting of the European Respiratory Society and European Centre for Disease Prevention and Control have revised the European Union Standards for Tuberculosis Care on the basis of other developed countries' published evidence. The standard principles of patient-centred approaches have remained unchanged (De Vries, Van de Berg, Van Dam, Hasanova, Pareek, Van der Werf & Podlekareva 2021).

The second edition of the European Standard on Tuberculosis care and treatment includes 21 standards in the areas of diagnosis, treatment, TB/HIV co-infection, public health measures and prevention. As the formal adoption of the European Union standards for Tuberculosis care (ESTC), the current version of the standards is available in all European Union (EU) languages. Thus, it has helped to facilitate its endorsement by European national medical associations in general and incorporate it into European health professionals' training curriculum in particular (Migliori, Sotgiu, Rosales-Klintz, Centis, D'Ambrosio, Centis, Tadolini, Van Den Boom et al 2018).

India has a large private health sector with a diversity of providers including authorised local and traditional medicine practitioners, as well as non-licensed practitioners with wide variations. Usually, most TB patients primarily visit private health service providers before seeking the service from government institutions where there is no service charge (Kasthuri 2018:141). In India, 80% of qualified doctors, 95% of dispensaries and 60% of hospitals are in the private sector. In 2006 private sector expenditure on health was 80% of total health expenditure. Regulation of the private sector has not kept pace with expansion, despite concerns about quality of care, and the government has made efforts for systematically engaging all care providers in TB control through a public-private mix DOTS approach (Yadav, John & Menon 2019:448-460).

Abreu-Suárez et al (2019:59-63) report that "Cuba joined the Ibero-American Network for Infantile TB, formed to highlight the historical neglect of TB in children, describe the problem in country members, and strengthen multicenter collaboration…. Cuba is currently part of a comparative study among participating countries to characterize TB in youngsters who were aged <15 years in 2013–2017."

2.2.3. Continuum of tuberculosis care and prevention in the present era

2.2.3.1. Prophylactic drugs and vaccines

As to tuberculosis preventive treatment for individuals in their adolescent and younger years, it is reported that the coverage of preventive treatment in 2017 was only 23%. Despite its proven efficacy, tuberculosis preventive treatment is still being underutilised. As propagated by the End TB Strategy, targets can only be achieved by addressing the pool of tuberculosis infection. Urgent action is needed to scale up the implementation of preventive treatment (WHO 2020d:115-120). It is also indicated that linking small children with child-friendly anti-tuberculosis drugs which are widely available; developing tuberculosis vaccines that are more effective; and synthesising new drugs for resistant forms of tuberculosis that have low toxicity in children could bring a desired outcome for prevention and control of tuberculosis among these age groups (Carvalho, Cardoso, Martire, Migliori & Sant-Anna 2018:134-144).

According to Fiore-Gartland, Carpp, Naidoo, Thompson, Zak, Self, Churchyard, Walzl, Penn-Nicholson, Scriba and Hatherill (2018:61-68),

> *"Current diagnostic tests for Mycobacterium tuberculosis infection have low prognostic specificity for identifying individuals who will develop tuberculosis disease, making mass preventive therapy strategies targeting all MTB-infected individuals impractical in high-burden TB countries. There are general considerations for a risk targeted test and treat strategy based on a highly specific investigative test that can identify individuals who are most likely to progress to active TB disease as well as individuals with TB disease who have not yet presented for medical care".*

According to the WHO Stop TB programme, daily treatment with isoniazid prophylaxis therapy for subjects at high risk of active tuberculosis with other recommended preventive measures in national programmes and in the guidelines of the WHO stop TB programme is an effective preventive measure both at individual and collective levels. It is aimed to provide universal access to TB diagnosis and treatment. To end tuberculosis in high-burden countries, it is needed to prevent cases of TB disease arising from the large reservoir of latently infected persons and thereby interrupt transmission (WHO 2019b:9-27).

High-burden countries need to note the call of the United Nations High Level Meeting on TB to prioritise scaling up TB preventive treatment (Reid et al 2019:1331-1384). To date, there is new short and ultra-short course regimens that address many of the barriers to

scaling up isoniazid preventive therapy (IPT). The time has come to scale up the new short-course TB preventive treatment (TPT) regimens in high-burden countries in order to interrupt transmission and end the TB epidemic (Churchyard & Swindells 2019:1-3).

According to the study conducted on prevention of tuberculosis by LaCourse, Richardson, Kinuthia, Warr, Maleche-Obimbo, Matemo, Cranmer et al (2020:6), INH has proven benefits for treating latent TB infection and preventing active TB disease among individuls living with HIV. The findings from adults and adolescent studies in Botswana, South Africa and Ivory Coast suggest INH prophylaxis therapy (IPT) may prevent Mycobacterium tuberculosis (Mtb) infection for tuberculosis skin test (TST) in negative adults living with HIV. IPT may both prevent Mtb infection and progression to TB disease (Alemu et al 2019:59-66). IPT has had variable protective efficacy to prevent TB disease and mortality in South Africa. Moreover, INH prevented TB disease by 70% and decreased mortality by 54%. However, IPT did not show a significant protective effect on active TB (LaCourse et al 2020:6-7).

Risk-targeted strategies may offer a rapid, ethical and cost-effective approach towards decreasing the burden of TB disease and preventing transmission and would also be critical to achieve TB elimination. A design named Correlate of Risk Targeted Intervention Study could provide proof-of-concept for this strategy. A similar study in South Africa enrolled “1500 high-risk and 1700 low-risk individuals, as defined by biomarker status, … randomizing high-risk participants to TB preventive therapy or standard of care treatment. All participants [were] monitored for progression to active TB with primary objectives to assess efficacy of the treatment and performance of the biomarker” (Fiore-Gartland et al 2018:61-68).

The study conducted by González-Fernández et al (2020:25438) reports that there are several new approaches to ensure that TPT is accepted in HIV programmes. The authors continue:

> *“The new tuberculosis preventive therapy regimens are safe and effective and can be used with current ART, with attention being paid to potential drug-drug interactions between rifampicin and some classes of antiretroviral drugs. More research and development are needed to optimise tuberculosis preventive therapy for small children, pregnant women and drug-resistant TB cases. Effective programmatic scale-up can be supported through context adapted demand creation strategies and the inclusion of tuberculosis preventive therapy in client-*

centred services, such as robust collaboration between the TB and HIV programmes that could represent a unique opportunity to ensure that TB is a preventable and curable health problem" (US National Library of Medicine 2021a).

TB will no longer become the number one cause of death in PLHIV. From the statistical analysis findings, it is concluded that the combination of TB prevention and TB treatment is the most cost-effective strategy to implement. This is achieved by the combination of different preventive activities such as chemoprophylaxis for latent TB, TB treatment and administration of vaccine (Purwati, Riyudha & Tasman 2020:3030).

The discovery of Mycobacterium tuberculosis-specific immune dominant antigens (vaccine) has contributed to the development of interferon gamma-release assays, which have been shown to have high sensitivity and specificity for TB disease. This finding has made a significant advancement in the synthesis of a new type of vaccine used as additional strategy to eliminate tuberculosis around the globe (Martini et al 2018:241-242).

2.2.3.2. Governance, policy and strategy

Ogbuabor and Onwujekwe (2019:11), in their study in Nigeria, disclosed that effective governance for TB control demands adequate policy coordination; predictable TB financing and collaborative programme design followed by effective implementation of those strategies. Moreover, an environment having a stronger and legal regulatory body which requires a human rights based approach as primary prerequisite would bring full-blown success.

Appropriate human resource utilisation, establishing clear communication channels and timely service entitlements are considered to bring successful outcomes in the integration of TB control with other programmes (MoHE 2018a:172-180). It is also necessary to ensure effective organisation of service delivery; an adequate and motivated health workforce; regular and uninterrupted drug supply; and stronger roles for citizens in policy engagement and oversight of health facilities. Furthermore, following a strategy on a functional TB surveillance system and adherence to ethical standards against TB care are crucial for overall achievement (WHO 2019a:1).

In the process of all forms of tuberculosis prevention, practising infection prevention techniques takes the major role (Dramowski, Woods & Mehtar 2021). When those activities are supported with political commitment, financial investment, broader

socioeconomic growth, good governance and health system development, tremendous achievements in drug sensitive and MDR TB could be achieved (Heffernan & Long 2019:31-35). As the available tools to diagnose and treat tuberculosis evolve, ongoing evaluations of cost-effectiveness, feasibility and impact should be assessed in the light of TB elimination strategies.

All possible strategies and supportive policy issues have to be implemented to use available resources and research outputs for dramatic transformation from tuberculosis associated landscapes to safe ones. This could be achieved through administering highly tolerable novel regimens, providing corresponding point-of-care to drug sensitive tuberculosis cases and offering INH preventive therapy to those who are at risk, such as PLWHA (UNAIDS 2018a:4-7).

According to study findings in Peru, a fragmented health service delivery strategy deters delivering a health care that respects the various dimensions of the right to health, rendering marginalised populations such as indigenous people vulnerable to preventable diseases and without access to treatment (Sidebottom, Ekström & Strömdahl 2018:1-14). Achieving control of the TB epidemic in vulnerable populations such as indigenous communities requires not only the implementation of new diagnostic tests and new TB drugs, but also a solid health system with good governance that internalises the human rights approach in each of its activities and processes (Gianella, Pesantes, Ugarte-Gil, Moore & Lema 2019:1-13).

If all nations of the world make an honest commitment, reaching an elimination threshold for drug resistance TB could become a major global health accomplishment. Beside all possible efforts mentioned, ensuring their sustainability could be an important milestone on the path toward total TB elimination (US National Library of Medicine 2021a).

2.2.3.3. Clinical case management

According to Van der Westhuizen, Nathavitharana, Pillay, Schoolman and Ehrlich (2019:100118), prioritising patient experience has been a recent addition to the definition of high-quality care. In high TB burden settings, TB infection prevention control measures may be a TB patient's initial contact with the healthcare system, for instance, providing the service in a separate room or place may cause feelings of stigmatisation. Drawing on the principles of person-centred care through incorporating the experiences of people using healthcare services may give relief and minimise those ill feelings.

Health workers who have developed occupational TB also offer a unique perspective: they have both experience in TB infection prevention control and have played a role in implementing it in their workplace. They can be powerful advocates for person-centred TB infection prevention control (IPC) implementation (Peart, Lewis, Barton, Brown, White, Gascard & Russell 2019). Through framing TB infection prevention control as part of health system strengthening and consciously including person-centred perspectives in TB IPC design, measurement and guidelines, tuberculosis prevention can be made more feasible (US National Library of Medicine 2021b).

2.2.3.4. Socioeconomic factors

The United Nations High-Level Meeting (UNHLM) on TB aimed to provide concrete, achievable, reasonable goals that all countries can strive for. According to this meeting, early and reasonable investment towards meeting these targets will have paramount importance in the control of tuberculosis transmission and save resources in the long term. With targeted, proven strategies, smart investments based on sound science and accelerated research with a shared responsibility; tuberculosis can be controlled in the near future (Reid et al 2019:1331-1384).

Preventing future TB must not just be focused on finding and treating people with TB but should also include efforts to address social and other determinants of the disease. While efforts are being made to actively find people with TB and to provide TB preventive therapy, governments must ensure that the expansion of economies reach at the desired level (WHO 2020b:1-10). Moreover, adequate financial resources and political will are essential to remove tuberculosis from the list of the leading causes of death among children worldwide (Carvalho et al 2018:134-144).

The major drivers of TB, undernutrition, poverty, diabetes mellitus, tobacco smoking, and household air pollution have to be considered in its elimination strategy (Lee, Bing, Kiang, Bashir, Spath, Stelzle et al 2020:1427–1434). All measures must be addressed if the world is to expect to eradicate TB as a threat to public health by 2035. To make this strategic goal achievable, national TB programmes need to incorporate post-tuberculosis health and wellbeing interventions in the package of TB prevention services to grassroots level. This could be achieved by encouraging the research community to undertake research intended to control the economic and social determinants impacting TB survivors' long-term prognosis (Romanowski, Baumann, Basham, Khan, Fox & Johnston 2019:1129-1137).

According to the Action towards Universal Health Coverage and Social Protection for Tuberculosis Care and Prevention: Workshop to implement the End TB Strategy, a number of important decisions were made (Oh, Rahevar, Nishikiori, Viney, Choi, Biermann et al 2018:3). These are:

1. Conducting a national survey on TB patients' treatment cost. This survey is intended to examine the cost categories of TB patients that need priority, to mitigate their financial burden. Moreover, this survey will determine exaggerated costs due to tuberculosis in line with the End TB Strategy.

2. The National Tuberculosis Program and Ministry of Health should take the major responsibility in reducing the high financial burden of TB patients. This could be achieved through provision of decentralised health care service such as offering directly observed treatment (DOT), expansion of active case surveillance and subsidising patients' treatment expense with strong political commitment.

3. Specific actions have to be taken to mitigate the extra financial burden of MDR-TB patients compared with drug sensitive TB cases. General measures may not be sufficient for patients facing catastrophic costs.

2.2.3.5. Program collaboration and multi-sectorial activity

TB infection prevention and control (IPC) includes a set of ranked interventions to decrease the possibility of TB transfer, both in the medical, community and household situations. These interventions are commonly known as the hierarchy of TB controls. They are ranked in order of importance. These inter-connected control measures are cross-cutting programmes and disciplines. They require interaction and co-operation from multiple actors in the health care delivery institutions, including facility managers, healthcare workers, laboratory staff and clients. However, ensuring TB-IPC measures are adhered to by all healthcare staff as well as the co-operation of TB patients is crucial in the continuum of care (WHO 2019c:29-36).

Research conducted in Canada has revealed that joint performance measurement of tuberculosis programmes, enhancing screening and treatment for latent tuberculosis infection among people who manifest risk of infection was crucial in elimination of tuberculosis. Those measures were key drivers in the development of the Canadian public health-care system (Heffernan & Long 2019:301). Moreover, a carefully designed national strategy for tuberculosis elimination is obviously needed. The expected

requirements for such a strategy would be development of strong partnerships among identified partners working on tuberculosis programmes; federal tuberculosis activities; local communities, and immigrant communities from countries with high tuberculosis incidence. This should be better achieved with implementation of clear performance measurement and evaluation (Basham, Elias & Orr 2019:300-301).

According to the Action towards Universal Health Coverage and Social Protection for Tuberculosis Care and Prevention Workshop to implement the End TB Strategy, important decisions were made as follows:

> *"Multi sectorial stakeholders should be engaged in order to provide improved forms of social support for TB patients. Many social interventions for TB patients require collaboration with stakeholders beyond the health sector. If all key stakeholders take concrete actions to alleviate financial hardship for TB patients, significant progress towards social protection for TB patients could be made (Oh et al 2019:2-3)".*

Added to this fourth recommended action, the fifth reads as follows:

> *"A research platform should be established and operationalised. Research can be utilised not only to understand the main barriers and opportunities to progress towards UHC and social protection, but also to design and evaluate the impact of UHC and social protection".*

This shows that eliminating diseases with public health importance like tuberculosis needs the joint effort of all sectors to work together on the prevention of TB and other health problems (Peart et al 2019:30581).

As new tools, regimens and approaches emerge, midcourse adjustments to policy and practice must be adopted. The development and implementation of new tools and strategies will call for close collaboration between local, national and international partners, both public and private sectors, national health authorities, non-governmental organisations, the research community, and the diagnostic and pharmaceutical industry. India is a pioneer contributor to global knowledge through operational research and programmatic collaboration for combating tuberculosis infection (Moonan, Nair, Agarwal, Chadha, Dewan, Gupta, Ho, CS, Holtz, Kumar, Kumar & Kumar 2018:1135).

2.2.3.6. Surveillance and TB contact tracing

One of the common tuberculosis prevention strategies recommended by current studies is case finding, particularly among contacts of drug resistance TB patients. Once drug resistant TB patients are in care, providing prompt, high-quality treatment with effective

drug regimens in a patient-centred context can improve treatment success. Regimen design should increasingly incorporate new drug options and clinically relevant second-line drug sensitive treatment. Although there are limitations in the drugs or available diagnostic assays, it should not unduly limit access to drug resistant TB treatment in the short term and conducting contact tracing as a compulsory prevention action (Kendall, Sahu, Pai, Fox, Varaine, Cox, Cegielski et al 2019:535-536).

According to a study conducted in Brazil, it was revealed that an increased rate of TB notifications among ex-prisoners following release remained higher than that of the general population for several years. This finding is driven primarily by infections acquired within prisons, which manifest in the years following release. The study concluded that exit screening would reduce the burden of disease among ex-prisoners and its transmission from prisons into the community (Fiore-Gartland et al 2018:61-68). Exit screening could be even more effective in settings with low case-detection rates in prison. Entrance and active screening within prisons is the single most effective strategy for reducing TB incidence among prisoners who have significant contact with TB suspected cases (Padmapriyadarsini, Sachdeva, Nair & Ramachandran 2021:899-910).

Although there is progress in reducing mortality and morbidity due to tuberculosis, at the current pace of progress it remains unlikely that 2035 targets will be met. The scale-up of TB disease surveillance, initiation of tuberculosis preventive therapy among eligible persons and effective treatment need to continue further. Much more intensive efforts to find, cure and prevent all cases of TB are necessary to meet global targets and end the public health burden of TB (MacNeil, Glaziou, Sismanidis, Date, Maloney & Floyd 2020:281-285).

Small children are not usually considered for complex mechanisms currently involved in the control of tuberculosis: ensuring the early identification (through contact screening) and treatment of active tuberculosis and latent TB infection (LTBI) in children, using methods that are more sensitive and less invasive for the diagnosis of extra pulmonary tuberculosis and of tuberculosis has a non-negligible role in controlling paediatric tuberculosis (Ghanaie, Karimi, Azimi, James, Nasehi, Mishkar & Sheikhi 2021:1-8).

2.2.4. Challenges in TB prevention

According to the WHO, the burden of TB in children is largely due to the difficulty of making a diagnosis, given the clinical overlap of TB symptoms with other common childhood diseases and because bacteriologic confirmation is rarely obtained. Those

problems are intensified by lack of access to health care and poor quality health services in many countries (Ghanaie et al 2021:1-8).

The deficiencies in TB diagnostic apparatus currently available for the care of TB patients are evident for this challenge. The delay in detection of TB cases and the demands and costs of the current treatment approaches are becoming challenges against the ability to reduce the TB burden through the current 'prevention through case management' paradigm (Deutsch-Feldman, Pratt, Price, Tsang & Self 2021:409). Prevention through vaccines or preventive treatment remains inefficient. Improvement in these tools is vital to achieve success in conquering TB (Churchyard & Swindells 2019:1-4).

It is not uncommon that case definitions between and within countries are inconsistent, with deficient disease recording and reporting practices (WHO 2018). Estimates of the burden of childhood TB are usually calculated based on the percentage of children who are ill with the disease compared to the adult population, which is obviously not exact (Abreu-Suárez et al 2019:59-63).

TB transmission control is best achieved by diagnostic investigation of active and latent TB, followed by its antimicrobial treatment, incorporating biomedical approaches, psychosocial intervention, strengthening social protection, community participation and political commitment (Schwoebel, Koura, Adjobimey, Gnanou, Wandji, Gody, Delacourt et al 2020:452-460). However, in high TB burden countries, operational research conducted to cover such approaches is limited. Thus, the most appropriate interventions to control the epidemic at different healthcare levels cannot be identified. This scenario may result from the poor communication between researchers and TB and HIV coordinators, who prioritise activities in TB, TB/HIV care, or surveillance activities but not the research. In addition, favourable results obtained through research carried out in high burden countries, such as Brazil, usually do not have long-term sustainability and are not incorporated into the routine of the health system (Kritski, Andrade, Galliez, Maciel, Cordeiro-Santos, Miranda, Villa et al 2018:2-6).

According to the WHO (2021b), the WHO European Region faces important challenges in the struggle against TB. The major constraints are:

- the high rate of multidrug-resistant TB.
- the precipitous increase of HIV in Eastern nations and the sharp increase in HIV-related TB.

- the need to update the health sector to consider primary health care in TB/HIV control.
- giving less emphasis for political and financial commitment to prevention and control of tuberculosis.
- insignificant emphasis on promotion, communication and community mobilisation.

Due to an increasing threat of antimicrobial resistance and growing number of global migrations, TB is now widely recognised as a health security issue rather than a purely health issue. This makes TB an easier target for political attention. As for the political commitment, having the UN High-Level Meeting itself is not the only target; those initiatives must be followed up by actual commitments from political leaders. Overall, this issue indicates the amount of funding for medical supplies, vaccines and other important logistics for childhood tuberculosis case management and prevention is not at an adequate level of investment (Ghanaie et al 2021:1-8).

Forced mass displacement and systematic violations of humanitarian law have resulted in overcrowding and the destruction of key infrastructure, leading to an increased risk of both drug-sensitive and resistant TB besides restricting timely diagnosis, tracing contacts on time treatment, and follow-up (Buck 2017). Limited diagnostics also affects the diagnosis of multidrug- and rifampicin-resistant tuberculosis (Chakaya, Khan, Ntoumi, Aklillu, Fatima, Mwaba, Kapata et al 2021:7-12).

2.3. PREVENTION OF HIV

The human immune deficiency virus (HIV), the virus which is responsible for causing acquired immune deficiency syndrome (AIDS), is one of the most serious global public health issues. There is a universal commitment to prevent the transmission of new infections with HIV and targeting everyone with HIV to get access to HIV care and support (Bekker, Alleyne, Baral, Cepeda, Daskalakis, Dowdy, Dybul, Eholie, Esom, Garnett & Grimsrud 2018:312-358).

2.3.1. Context of HIV prevention

This section focuses on studies conducted in relation to various methods that have been used in the prevention and control of HIV/AIDS. It provides the background of HIV prevention and current intervention scenarios in the following categories: prophylactic, policy and strategy, clinical care management, socioeconomic interventions, stakeholders' collaboration, biomedical measures, and behavioural interventions. It also assesses the success and challenges in the effort to prevent those problems.

2.3.1.1. Historical background of HIV prevention

It is widely believed that HIV originated in Africa, in Kinshasa, in the Democratic Republic of Congo around 1920 when HIV crossed species from chimpanzees to humans. Until the 1980s, it was not known how many people were infected with HIV or developed AIDS. HIV was unknown and transmission was not accompanied by noticeable signs or symptoms (Pepin 2021:254-275).

When the first few cases of AIDS emerged, people believed the disease was only contracted by men who had sex with men. The Center for Disease Control and Prevention (CDC) called this “infection GRIDS”, or gay-related immunodeficiency syndrome. Shortly after, the CDC published a case definition calling the disease AIDS and certain measures were taken to control multi-sexual contact (CDC 2021b:1-8).

HIV prevention has been practised in different countries in different ways. The prevention was started with the CDC recommendation to avoid intravenous drug injecting and sharing needles. The United States Public Health Service issued the first recommendations for preventing mother to child transmission of the virus. The WHO and UNAIDS have emphasised that male circumcision should be considered in areas where there is high HIV and low male circumcision prevalence exists (Sharma, Paredes-Vincent & Kahle 2021:1-17).

During the last two decades, various advanced research studies have been done. According to the findings of one experimental study, Iniciativa Profilaxis Pre-Exposición (iPrEx), a clinical trial was launched to determine whether the antiretroviral medication emtricitabine/tenofovir (as tenofovir disoproxil fumarate) could safely and effectively prevent HIV acquisition caused by multisexual contact (Mayer, Molina, Thompson, Anderson, Mounzer, De Wet, DeJesus et al 2020:239-254). The trial showed a reduction in HIV acquisition of 44% among men who have sex with men and who took pre-exposure prophylaxis (PrEP). According to a similar study called “HPTN 052 trial”, early initiation of antiretroviral treatment reduced the risk of HIV transmission by 96%. Hence, new UNAIDS “Fast Track” targets called for the dramatic scaling up of HIV prevention and treatment programmes to avert 28 million new infections and end the epidemic as a public health issue by 2030 (Sharma et al 2021:1-15).

Recent research has clearly shown that virally suppressed people, after careful HIV/AIDS care and support, who live with HIV do not transmit HIV infection to partners. It verifies the assertion that “undetectable equals to untransmittable” (U=U) (UNAIDS 2020b:1-2).

UNAIDS also launched the ambitious 90-90-90 targets which aim for 90% of PLHIV to be diagnosed, 90% of those diagnosed to be accessing antiretroviral treatment, and 90% of those accessing treatment to achieve viral suppression by 2020. UNAIDS released its 2016-2021 strategy in line with the new sustainable development goals (SDGs) that called for an acceleration in the global HIV response to reach critical HIV prevention and treatment targets and achieve zero discrimination (Sharma et al 2021:1-12; UNAIDS 2020b:1-2).

2.3.2. Continuum of HIV care and prevention

2.3.2.1. Prophylactic drugs and vaccines

HIV/AIDS is a complex mix of diverse epidemics within and between countries and regions of the world. It is undoubtedly the defining public health crisis of our time. Research has widened the understanding of how the virus replicates, manipulates and hides in an infected person. Even while preventative alternatives and practical understanding of pathophysiology and transmission dynamics have increased, it is still challenging to develop a treatment or protective vaccine (Sharma et al 2021:1-12).

Preventing new infections is as crucial to lowering the individual and social burden of HIV as treating those who already have it (Collins, Gaiha & Walker 2020:471-482). Antiretroviral treatment has transformed AIDS from an inevitably fatal condition to a chronic, manageable disease in some settings (Helfand 2022). This transformation has yet to be realised in those parts of the world that continue to bear a disproportionate burden of new HIV-1 infection and are most affected by increasing morbidity and mortality (WHO 2019a:1-10).

According to Myers, Farhat, Guzman and Arya (2019:239-254), it was proposed that expanding pharmacists' roles in HIV prevention related to pre-exposure prophylaxis and post-exposure prophylaxis, as well as HIV testing and harm reduction are key factors for HIV prevention. This may be achieved through working within jurisdictions' pharmacist scope of practice laws, policies and ensuring appropriate HIV literacy through clients and health professionals' joint commitment. Moreover, it is necessary to strengthen health information technology and infrastructure (Bazzi, Biancarelli, Childs, Drainoni, Edeza, Salhaney, Mimiaga & Biello 2018:529-537).

Pre-exposure prophylaxis is very likely to reduce HIV transmission in populations that are able to perform high adherence to the medication. Besides, the successful cases of pre-

exposure prophylaxis (PrEP) in preventing HIV infection provide encouragement to introduce and implement the use of ART (Abu-Raddad, Akala, Semini, Riedner, Wilson & Tawil 2019:214-215). Studies have shown that early initiation of ART in individuals is more effective in reducing the risk of HIV infection (CDC 2021a:1-5). Although ART PrEP is useful in protection, the public health authorities should evaluate the economic aspects of PrEP use to ensure that it is available for all members of the population. Adherence to the medication by patients should be carefully monitored as it determines the efficacy of the administered drug. Although it has been proven that the use of ART PrEP is able to protect people against HIV infection, there is no 100% guarantee of these agents in prevention (Sidebottom et al 2018:1-14).

According to the study conducted on effectiveness of HIV pre-exposure prophylaxis drugs, a new pre-exposure prophylaxis (PrEP) combination, tenofovir alafenamide /emtricitabine (FTC), has been demonstrated to be non-inferior to tenofovir disoproxil fumarate / FTC, with improved bone and renal safety (Fields & Tung 2021:165-186). PrEP use is declining in some demographics, especially African American teenagers, despite an increase in its use globally. Although starting PrEP is a smart strategy for expanding access, stopping it is still difficult (Buchbinder & Liu 2019:8).

People who are at high risk can take pre-exposure prophylaxis, a daily pill that reduces their chances of acquiring HIV and people who have been exposed to HIV can take post-exposure prophylaxis, which consists of 28 days of ART and reduces the risk of infection if started no more than three days after exposure. Having an undetectable viral load is now a proven prevention strategy. Hence, people who are treated with ART and maintain viral suppression have no risk of transmitting HIV to others (Demeke, McCray & Dean 2020:21-22).

According to a cross-sectional study conducted on HIV prevention methods, HIV topical microbicides are products with anti-HIV activity, generally incorporating a direct acting antiretroviral agent which, when applied to the vagina, has the potential to prevent the sexual acquisition of HIV in women (Baeten, Hendrix & Hillier 2020:361-377). Topical microbicides may meet the prevention needs of individuals and groups for whom oral daily forms of pre-exposure prophylaxis have not been acceptable (Relaño-Rodríguez & Muñoz-Fernández 2020:9403-9404). Microbicides can provide personal control over HIV prevention and offer the possibility of discreet use, qualities that may be particularly important for receptive partners in sexual relationships who together account for the clear

majority of new HIV infections worldwide (Johns Hopkins University 2021). Although the promise of such a product emerged nearly three decades ago, proof of the concept has been demonstrated only within the last decade (Baeten et al 2020:361-377).

Implementation of dapivirine vaginal ring PrEP in KwaZulu-Natal among female sex workers would be a cost saving, whereas prioritisation of women at substantial risk or women aged 22 to 29 could have potential impact on HIV prevention at affordable economic value (Glaubius 2019:15). Furthermore, HIV medication resistance will not be significantly affected by PrEP implementation (Glaubius, Ding, Penrose, Hood, Engquist, Mellors, Parikh et al 2019:12-18).

According to a study conducted on US and African women, it was reported that an injectable product, TMC 278 LA (rilpivirine), was well regarded and preferred to other new HIV prevention items, and African women were more interested in using the technique in the future than US women, who perceived higher levels of HIV risk. Women's attitudes towards product attributes have influenced future interest in use more than pain experienced. Hence, the development of a long-acting HIV presentation injectable drug (LAI PrEP or MPT product) would provide an important new prevention tool (Tolley, Zangeneh, Atujuna, Musara, Justman, Pathak, Bekker et al 2019:25408).

Even if risk compensation occurs among PrEP users, clinicians should offer PrEP to patients at risk of HIV infection (CDC 2021a). Making PrEP more widely available, regardless of patients' intended condom use, will not lead to multi-sexual contact. Rather, it will promote patients' sexual health; clinicians' ability to offer patient-centred, evidence-based care; and public health efforts to combat the ongoing HIV epidemic (Marcus, Katz, Krakower & Calabrese 2019:510-511).

The discovery of the HIV virus in 1983 raised hopes that the development of a vaccine might be possible. It is now more than 25 years since the first trial to discover a vaccine but there is yet no effective vaccine (Laher, Bekker, Garrett, Lazarus & Gray 2020:1-14). However, in recent times, Collins et al (2020:471-482) revealed that persons with the ability of having competent and spontaneous control of HIV demonstrate that CD8 + T cells show a non-negligible promise of combatting the HIV replication. Numerous studies in spontaneous HIV controllers have highlighted the function, specificity and localisation of CD8 + T cells as important determinants of protection and the ability to have significant protection from specific human lymphocyte antigen alleles or gene variants. It represents a key step towards broad clinical translation and vaccine development.

Various researchers are still looking for a vaccine to reduce HIV infection more effectively and efficiently (Yap, Loo-Xin, Tan, Chellian, Gupta, Liew, Collet et al 2019:1339-1352). As one experiment-based immunological study reveals, experiments with both preclinical and clinical vaccines have improved our knowledge of how to develop T cell-based preventative and therapeutic strategies. This is intended for rational design of immunogens and careful selection of appropriate vectors to elicit functional effector-memory CD8 +T cell responses against protective epitopes in vulnerable viral regions. This represents a promising path towards preventive and therapeutic T cell-based HIV vaccines (Brisse, Vrba, Kirk, Liang & Ly 2020:3).

2.3.2.2. Policy and strategy

A study conducted in Ghana has revealed that good governance has a profound effect on health institutions' performance to the control of the deadly disease HIV/AIDS. The interventions in Ghana health delivery have brought a level of improvement in HIV/AIDS control. Through the implementation of systems and policies, the national HIV prevalence has admirably been reduced from 2.9% in 2000 to 1.6% in 2017 (Afriyie, Kong, Ampimah, Akuamoah, Vanderpuije & Xinlei 2020:22-35).

Hushie (2019:138-147) describes the role of civil society organisations in the effort to combat HIV/AIDS, which needs appropriate policy direction and implementation of major governance principles. Those directions should target strategic planning for service delivery, focussed expressions of interest, competitive tendering and contracting for service delivery, and adoption of results-based management. It has also identified predominant funding models that illustrate the application of these guiding principles to strengthen civil society organisations (CSOs) for a more effective response to HIV/AIDS.

Based on case studies in Samara and St Petersburg, the mix of vertical structures of governance (dominated by health authorities, including regional AIDS centres and drug control authorities), where both state and non-state actors collaborate on policymaking and implementation, could bring significant achievement in reduction of both morbidity and mortality due to HIV/AIDS. It was emphasised that sharing of responsibility under a strong network has a paramount importance in designing a disease preventive strategy (Aasland & Meylakhs 2018:422-436).

2.3.2.3. Clinical care and management

There have been dramatic and transformative advances in the HIV prevention and HIV care arenas over the past decade. The life expectancy and health outlook for persons

living with HIV infection who are diagnosed early, who are in care and reliably adherent to antiretroviral therapy regimens, and who are durably virally suppressed have dramatically improved (Kelly 2019). Research has clearly shown that virally suppressed people who live with HIV do not transmit HIV infection to partners, verifying the assertion that “undetectable equals to un-transmittable” (U=U) (UNAIDS 2020b:1-15). The HIV care continuum provides practical evidence that enables identifying key measures where interventions can be undertaken to improve HIV prevention, public health and clinical outcomes; and therefore, pre-exposure prophylaxis is highly effective for protecting at-risk persons from contracting HIV infection (Carneiro, Westmoreland, Patel & Grov 2021:634-644). In the United States and much of the world, HIV incidence is finally declining (Kelly 2019:94-95).

At the 2019 Conference on Retroviruses and Opportunistic Infections, a plan for ending the HIV epidemic in the United States was presented (Orkin, Arasteh & Hernandez-Mora 2019:1-3). As it was described at the conference, more rapid HIV diagnosis and treatment is a key component needed nationwide. Furthermore, substantial scale-up of HIV testing and treatment has led to substantial decline in HIV incidence. This was better achieved after giving emphasis for U=U (undetectable equals un-transmittable) as a powerful concept that can reduce stigma and encourage engagement in HIV self-testing and care. Hence, HIV testing remains a gateway to HIV prevention and treatment (Guilamo-Ramos, Thimm-Kaiser, Benzekri & Futterman 2019a:275-278).

2.3.2.4. Socio-economic interventions

Implementing test and tailored condom promotion with clients and regular partners and pre-exposure prophylaxis (PEP) would decrease close to 50% of new infections over 10 years, accounting for current programme limitations (DeHaan, McGowan, Fine, Vail, Merrick, Radix, Hoffmann & González 2022:1-20). This would require an average expenditure of money per year and would be cost effective even against a peak level cost effective threshold (Bórquez, Guanira, Revill, Caballero, Silva-Santisteban, Kelly, Salazar et al 2019:127-136).

Leddy, Weiss, Yam, and Pulerwitz (2019:1-14), in their paper review, reported that gender-based violence (GBV) can impede the uptake of HIV testing, care, treatment and PrEP. Placing great emphasis on the relationship between experiences of GBV and sub-optimal engagement in the HIV care continuum is highly significant. Although it can vary by geographic context and epidemic setting, considerable effort is required for controlling

GBV and this could have significant implication in prevention and control of HIV/AIDS (Skeen, Cain, Gamarel, Hightow-Weidman & Reback 2021:1-18).

According to the study conducted in two districts of Tanzania, compared to the general population, the rate of HIV infection among fishermen was up to three times greater in Muleba and Buchosa districts. Being older, using alcohol and a lack of formal education predisposed the increased likelihood of HIV infection (Kapesa, Basinda, Nyanza, Mushi, Jahanpour & Ngallaba 2018:1-9). In those districts key HIV/AIDS prevention and curative services were rarely used. Compared to the general population, fishing communities are at high risk of HIV and are a bridge population for HIV transmission. As such, they are a priority population for combination prevention. The fact that the observed shift following superior HIV combined preventive intervention was in the desired direction in this small group is heartening (Musumari, Techasrivichien, Srithanaviboonchai, Wanyenze, Matovu, Poudyal & Suguimoto 2021).

However, the findings suggest that delivery of combination prevention interventions remains challenging and achieving elevated levels of adherence could be even more challenging. Effective HIV prevention needs to consider underlying sociocultural, economic, political, legal and other contextual factors (Govender, Masebo, Nyamaruze, Cowden, Schunter & Bains 2018).

Guilamo-Ramos, Thimm-Kaiser, Benzekri and Futterman (2019b:8) commented that disparities in HIV prevention and treatment among important populations continue to be a national public health concern. While new HIV diagnoses are increasing among people under 30 years of age, in particular among racial, ethnic, and sexual minority adolescents and young adults, some prevention and treatment strategies too often inadequately consider certain communities' specific HIV service needs (Rojo, Carpenter, Venter, Turkova & Penazzato 2020:25576). To address this gap, it is necessary to characterise disparities among adolescents and young adults that are persistent and largely overlooked across the HIV prevention and treatment continuum. Identifying adolescents' and young adults' specific restrictions in existing resources helps to improve HIV service delivery at large (Zürcher, Cox, Ballif, Enane, Marcy, Yotebieng, Reubenson, Imsanguan, Otero, Suryavanshi & Duda 2022:180).

Moreover, as Rotheram, Fernandez, Lee, Abdalian, Kozina, Koussa, Comulada et al (2019:10759) suggest, "Using similar flexible and adaptable intervention approaches [for adolescents and adults] may provide a roadmap for communities to give attention to HIV

risk reduction among the youth". Whether or not the interventions are affordable, they can be implemented to help the youth obey the instructions in the HIV prevention and treatment programme. Shifting the paradigm for adolescents and young adults to differentiated HIV care is a promising approach that requires execution and assessment as a major target to end the HIV epidemic worldwide by 2030 (Guilamo-Ramos et al 2019a:275-278).

2.3.2.5. Stakeholders' collaboration

According to the study conducted in Peru, the impact and cost-effectiveness of various HIV prevention interventions by different stakeholders among transgender women sex workers (TWSW) in Lima was assessed on the assumption of obtaining practical, constrained, improved, and sufficient testing services. It was found that there was no change in the incidence of the infection. Finally, it was concluded that stakeholders' intervention needs timely and well-coordinated monitoring and evaluation measures (Bórquez et al 2019:127-136).

The study conducted in South Florida describes how stakeholders in HIV/AIDS prevention activities play a significant role for the community and need-based technical and financial assistance coming together. Moreover, they take part in policy development, implementation of good governance, programme monitoring and evaluation. All those collective efforts could address public problems consistently over the years despite some resource challenges (Agbodzakey & Taylor 2019:149-169).

2.3.2.6. Biomedical measures

According to a study conducted in Zambia, couples' voluntary counselling and testing (CVCT) is a cost-effective, feasible prevention strategy in Zambia. It was demonstrated that the effectiveness of providing CVCT without additional prevention intervention only partially reduced the probability of HIV transmission. The finding indicates the need for a major policy shift on supporting the development of CVCT indicators and budget allocation. Moreover, promotion of couples' voluntary counselling and testing in ART clinics was identified to be a highly effective preventive measure (Wall, Inambao, Kilembe, Karita, Vwalika, Mulenga, Parker et al 2019:217-227).

Since the 90-90-90 targets were announced in 2014, substantial progress has been made. Compiling country-level data from around the world, the Joint United Nations Programme on HIV/AIDS (UNAIDS) has summarised progress through the end of 2017. Although there has been progress in some countries, on a number of gaps and issues,

significant improvement has been shown (UNAIDS 2019:75-85). Gains in epidemic control have been widely slower among men and young people. This indicates that efforts made on existing interventions and programme implementation were not effective across demographic groups. This suggests that additional work will be needed to increase uptake of HIV testing and treatment among groups that lag behind in the current environment. Additional marginal gains towards the 90-90-90 targets will require engaging these harder-to-reach groups (Jones, Sullivan & Curran 2019:1-8).

2.3.2.7. Behavioural interventions

Since the first cases of AIDS were described, many studies have been conducted on the epidemiology of HIV infection and risk factors for the acquisition of HIV. Many studies have identified modifiable risk conditions, mostly behavioural factors, for HIV acquisition, and this has been the basis for the development of a number of preventive interventions (Kawuki, Kamara & Sserwanja 2022:2380).

Before the causative agent of AIDS was discovered, it was established that it must be an infectious agent that was transmitted through sexual intercourse. This led health authorities and organisations of men who have sex with men (MSM) in industrialised countries to recommend sexual behaviour change as a strategy to prevent the spread of the new disease (Williams, Gillespie, Couzens, Wood, Hughes & Hood 2022:1-8).

Protecting oneself from HIV begins with understanding how the virus is spread (Deutsch-Feldman et al 2021:409). There are several ways the virus might spread: during sex with a person infected with HIV; by sharing a contaminated needle, such as through intravenous drug use; from HIV mother to child either during pregnancy, labour or breastfeeding; or through a contaminated blood transfusion (Kelly 2019:94-95). According to an update from the CDC (2021b), for people who are HIV negative, strategies such as practising sexual abstinence, limiting the number of sex partners, never sharing needles, and correct and consistent condom use help to prevent acquisition of HIV.

A chain of HIV prevention was used to determine challenges in effective condom use among young women who sell sex at high risk of HIV and identify programme gaps and potential growth avenues for condom use. This approach was very useful in identifying gaps but needs to be enhanced by qualitative enquiry to better understand why gaps exist (Chabata, Hensen, Chiyaka, Mushati, Busza, Floyd, Birdthistle et al 2020:25512).

Two observational studies have suggested that circumcision of HIV-infected men might reduce the risk of transmission of HIV to uninfected female partners, but this was not confirmed in adequate trials because the likelihood of transmission was elevated among couples who recommenced sex before the healing of the wound was complete (Olapade-Olaopa, Salami & Lawal 2019:1-7). Nevertheless, a trial in HIV-uninfected men showed there are benefits of circumcision to HIV-negative women, including a decreased incidence of genital ulcers and vaginal infections (Gray 2019:16).

2.3.3. Challenges in HIV prevention

Progress in treatment has been transformative, but significant gaps in care still remain. HIV continues to be a major global public health issue (Varas-Díaz, Rivera-Segarra, Neilands, Pedrogo, Carminelli-Corretjer, Tollinchi, Torres, Soto Del Valle, Rivera Diaz & Ortiz 2019). In the United States, it accounts for seven of the top ten states and nine of the top ten metropolitan areas with the highest rates of new infections. This is pointed evidence that the epidemic is ongoing for some communities. Globally, it is estimated that more than 36 million people are living with HIV with acute challenges faced by Sub-Saharan Africa and many low- and middle-income countries (UNAIDS 2019-23-35).

According to the CDC's (2019) remark on HIV risk behaviour, many people, even those who engage in high-risk behaviour, do not get tested because they do not believe they are at risk of HIV infection. Others misunderstand the testing process; they do not realise that rapid HIV tests can be done with a simple cheek swab or finger prick and results can be provided within 20 minutes. Some of them are concerned that other people will find out that they have tested positive. Although testing is completely confidential, some may avoid testing simply because they are afraid of getting a positive result. Today more than half of American adults have not yet been tested (Martini et al 2018:242-242).

The WHO reported four key challenges in the prevention and control of HIV/AIDS at the International AIDS Conference in Durban, South Africa, from 18–22 July 2016. The Organization has emphasised the need to renew attention on HIV prevention, whilst keeping the momentum going for expanding access to HIV treatment. It has also noticed the increasing appearance of resistance to antiretroviral drugs and the need for sustainable financing of the global response (UNAIDS 2021:18-27).

As has been revealed by a number of recent studies, many people have the information that consistent condom use is highly protective against HIV infection. Although women feel at risk of contracting HIV from their partners and many women know about condoms,

they are unable to use them because of the partner's refusal (Rotheram et al 2019:10759).

The other important challenge among different segments of the population is that most people still stigmatise people with HIV. This challenge continues to be a major barrier to testing, treatment and prevention of HIV. It continues to affect certain groups of people more than others. Focus on those populations must continue to ensure that they gain the benefits of the new HIV prevention and treatment tools (UNAIDS 2021:18-27).

Some biomedical HIV prevention trials lack compelling evidence to demonstrate a benefit in the use of vaginal microbicide gels, diaphragm as a cervical barrier, pre-exposure prophylaxis with antiretroviral medications and two types of HIV vaccines. Consequently, most people are still not encouraged to use those methods. Although several behavioural interventions have been shown to reduce self-reported high-risk behaviours and some have decreased the prevalence of some non-HIV sexually transmitted infection rates, none have shown a decline in the prevalence of HIV infection (Rotheram et al 2019:10759).

2.4. DETERMINANTS OF TUBERCULOSIS AMONG INDIVIDUALS LIVING WITH HIV

This section focuses on studies that have been conducted in relation to factors which determine the occurrence of tuberculosis such as host, socio-demographic, environmental and clinical factors. The magnitude and strength of several factors exposing PLHIV to the risk of contracting tuberculosis are assessed. The emphasis is on adolescents.

According to the Australian Public Health Association (APHA) (2022:1-4), determinants of health are a range of factors that influence the health status of individuals or populations. In all facets of life, health is affected by complex linkages between social and economic factors, environmental factors and personal behaviour. They do not exist apart from one another.

Several social determining factors combine to impact the health of individuals and communities. Whether or not people are healthy is influenced by their environment and social life (Alderwick & Gottlieb 2019:407). As the WHO explains,

> *"To a significant extent, factors such as where we live, the state of our environment, genetics, our income and education level and our relationships with friends and family all*

have considerable impact on health, whereas the more commonly considered factors such as access and use of health care services often have less of an impact (WHO 2021a:1-5)".

Determinants of health can extend beyond the scope of public health and conventional health care sectors; sectors like education, housing, transportation, agriculture, and the environment can all play a significant role in enhancing population health (US Department of Health and Human Service 2021).

As mentioned before, Mycobacterium tuberculosis (MTB) is caused by a bacterial pathogen called tubercle bacillus. In most cases, TB affects the lungs. However, almost all parts of the body can be affected by TB. The infection can spread to other people primarily through the air. Coughing releases the TB bacilli into the air from the lungs of an infected person. This TB-contaminated air can then be breathed in by others, who may then get TB infection (Long, Divangahi & Schwartzman 2022:22-32).

One in every four individuals alive today has a latent tuberculosis infection (Churchyard & Swindells 2019). Most TB infections, if they become active, can be successfully treated with antimicrobial medicines. The WHO (2015:56) estimates that 3.3% of new TB cases are multidrug-resistant, with specialists cautioning that multidrug-resistant TB strains pose a public health threat (WHO 2018:67).

TB is a major public health concern globally, especially in sub-Saharan African countries. It is the most prevalent opportunistic infection and principal cause of death among people living with HIV notwithstanding increased delivery of antiretroviral treatment (Nugus & Irena 2020:1-8). The reason for the resurgence of TB in Africa is mainly due to the link between TB and HIV, in addition to the lack of adequate resources (Abbara, Almalla, AlMasri, AlKabbani, Karah, El-Amin, Rajan et al 2020:53-59). Despite this evidence, in Ethiopia there is a dearth of information regarding the incidence and determinants of tuberculosis among PLHIV (Temesgen et al 2019:1-9). According to many studies around the world, the following factors have been found to determine the incidence of tuberculosis:

2.4.1. Behavioural factors

2.4.1.1. Global studies on behavioural factors for occurrence of TB

According to the systematic review of 420 articles on behavioural and social determinants of tuberculosis in Europe, America and other parts of the world, the incidence of tuberculosis is higher in chronic alcoholics (47–70%) than in the general population (37–

61%). Studies examining alcohol use in TB affected Roma population indicated that most often it was reported that there was higher occurrence of regular alcohol use, and abuse (18.1–35.7%) than among the general population (6.8–27.1%) (Pourakbari, Mamishi, Banar, Keshtkar & Mahmoudi 2019:333-348).

According to a study conducted in Malaysia and Brazil, the prevalence of TB is higher in individuals with diabetes mellitus than the general population, 0·3% and 0·38% respectively. In the same study conducted in prison, drug abuse was high among prisoners infected with TB, HIV and hepatitis C (Cormier, Schwartzman, N'Diaye, Boone, Dos Santos, Gaspar, Cazabon et al 2019:634-644).

In the study conducted among Brazilian prisoners who were identified as pulmonary TB cases, there was 7.2% alcoholism, 19.5% drug addiction and 24.6% smoking. Drinking alcohol and substance abuse were identified as risk factors for the incidence of most infectious diseases, including TB/HIV co-infection, compared to the general population (Saita, de-Paula-Andrade, Bossonario, Bonfim, de-Almeida Netto, Arcêncio et al 2021:265).

According to the study conducted in Spain, determining factors for the incidence of tuberculosis were identified as smoking tobacco (OR = 5.93; 95%; CI = 2.82-12.47), drinking alcohol (OR = 13.37; 95% CI = 1.77-101.08) and substance abuse (OR = 10.33; 95% CI = 1.34-77.97). Alcoholism presented a higher risk with pulmonary tuberculosis (PTB) (than the others) (Arnedo-Pena, Romeu-Garcia, Meseguer-Ferrer, Vivas-Fornas, Vizcaino-Batllés, Safont-Adsuara, Bellido-Blasco et al 2019:1-9).

In a systematic review consisting of three cohort studies and eighteen case control studies, excessive alcohol consumption was defined as ≥ 40-gram alcohol per day. A study revealed that in Russia and countries of the former Soviet Union, the incidence of alcohol use disorder (AUD) among tuberculosis patients varied conditional on the level of alcohol consumption. In Tomsk, Siberia, 60.2% had a lifetime history of alcohol use disorder; approximately 28% were females. In New York City, a cohort of individuals with AUD were followed for eight years and the incidence of tuberculosis was found to be 464 cases per 100,000 person-years, which was nine times the incidence found in the age-matched general population (Griswold, Fullman, Hawley, Arian, Zimsen, Tymeson, Venkateswaran et al 2018:1015-1035).

A case control study conducted in London on patients with pulmonary tuberculosis revealed 19 (86%) of 22 crack cocaine users were smear positive at diagnosis, compared with 302 (36%) of 833 non-drug using patients. It was found that smear positivity at the time of diagnosis of pulmonary tuberculosis was 2.4 times and 1.6 times more likely in patients who were cocaine users and in patients who were not known to use cocaine respectively, than in non-drug-using individuals. Moreover, there was also a substantial difference between the cocaine users and the users of other drugs in their smear positivity at diagnosis (Silva, Muñoz-Torrico, Duarte, Galvão, Bonini, Arbex, Arbex et al 2018:145-152).

2.4.1.2. Studies conducted in Sub- Saharan African countries on behavioural factors for occurrence of TB

In a study of Sub-Saharan African countries with a high TB burden, attributes for malnutrition (27%), smoking (23%), HIV (19%), diabetes (6%) and alcohol abuse (13%) were found and there was increasing evidence of tobacco's effect on TB. Recent studies show that tobacco smoking is a risk factor for latent tuberculosis infection. It favours the progression to active disease and lower rates of treatment success and higher TB related death. Moreover, smoking was found to be associated with lung cavitation and bilateral radiological findings. It predisposes to higher bacillary load, delay of smear and culture conversion, and predisposition for reactivation (Duarte, Lönnroth, Carvalho, Lima, Carvalho, Muñoz-Torrico & Centis 2018:115-119).

2.4.1.3. Studies conducted in Ethiopia on behavioural factors for occurrence of TB

According to Alemu et al (2020:59-66), among all TB/HIV co-infected individuals about 278 (49.1%) of the participants were addicted to tobacco, 312 (55.1%) to alcohol, 296 (52.3%) to khat, and 270 (47.7%) to shisha. The risk of developing tuberculosis was 112 times higher compared to those who had the normal values.

Belew, Wubie, Tizazu, Bitew and Birlew (2020:1-3) disclosed that drinking alcohol (AOR=2.33; 95%CI: 1.34, 4.07) was an independent predictor of increased TB infection compared to patients who did not drink alcohol. Moreover, as the study showed, the odds of TB infection among HIV infected adults and adolescents were 2.83 times higher in previous TB history in the family compared to non-TB history.

In the study conducted in Ethiopia, smoking was found to be an significant risk factor for developing TB (AOR = 4.43; 95% CI: 2.10, 9.3). There was strong association between

administration of BCG and risk reduction of tuberculosis by one-third (AOR = 0.34; 95% CI: 0.22, 0.54) (Shimeles et al 2019:1-4).

2.4.2. Socio-demographic factors

2.4.2.1. Global studies on socio-demographic factors for occurrence of TB

According to a systematic review conducted among tuberculosis infected people in European and Asian countries using a binary logistic regression model with definite TB cases as dependent variable and risk factors as independent variables indicated, socio-economic status, household size, contact with adult TB case (OR = 2.91), overcrowding (OR = 2.30), absence of cross-ventilation(OR = 3.27) and ingestion of unpasteurised milk were substantial determinant factors of tuberculosis among children ($P < 0.05$) (Attah, Oguche, Egah, Ishaya, Banwat & Adgidzi 2018:403-409).

According to a systematic review conducted in different parts of the world, two thirds of HIV negative tuberculosis new cases (59.6% [59.2–59.7]) and deaths (63.1% [62.4–63.6]) were in male individuals. Most of the new cases (89.5% [87.9–91.0]) and deaths (64.3% [63.6–65.0]) were in people who were younger than 60 years old for both sexes. Among all individuals living with HIV, 53.8% (52.4–54.9) of new cases of tuberculosis and 56.9% (56.2–57.6) of deaths due to tuberculosis were among males (Kyu, Maddison, Henry, Ledesma, Wiens, Reiner Jr, Biehl et al 2018:1329-1349).

According to the study conducted in a northeastern region of Peninsular Malaysia, the percentage of tuberculosis among paediatric patients was 8.4% (95% confidence interval: 0.08–0.09). The mean age of children and adolescents with tuberculosis was higher compared to those without tuberculosis. Children aged 10–19 years old represented most tuberculosis cases (91.0%). Most tuberculosis cases were children and adolescents (90.7%). Females were more susceptible to contracting tuberculosis (55.0%). TB cases showed a higher percentage for residents in non-urban areas (79.5%) and among children and adolescents with a good level of education (91.6%). In this study mean age was another determinant factor which affected the occurrence of TB/HIV co-infection. The prevalence of co-infection in the first study group had a mean age < 40 years (25%, 95% CI: 19-31%), which was significantly higher than the prevalence of co-infection in the second study group with a mean age ≥ 40 years (8%, 95% CI: 6-10%) (Awang, Husain & Abdullah 2019:112).

According to the study conducted in 26 Iranian provinces, among 339 prisoners evaluated for different health problems, TB was a very common infection among prisoners. Over-crowding, absence of adequate ventilation, malnutrition, poor personal hygiene, inadequate health care services, homelessness and poverty were some of the predisposing factors for the occurrence of TB among prisoners (Pourakbari et al 2019:333-348).

According to the study conducted in Maghreb countries (Algeria, Libya, Mauritania, Morocco and Tunisia), birthplace (OR = 0.56; 95% CI = 0.24-1.29) and being infected with HIV (OR = 0.55; 95% CI = 0.13-2.52) were inverse factors of pulmonary tuberculosis. Higher risk factors of tuberculosis were contact with TB patients (AOR = 2.06; 95% CI = 0.74-5.74), drug abuse and alcohol consumption (Arnedo-Pena et al 2019:1-5).

According to a study conducted in Peninsular Malaysia, human factors had a significant effect on TB cases. Statistical correlation analysis indicated that TB cases in 2010 were significantly correlated with the number of population and mean monthly income ($r > 0.500$) rather than urban population ($r < 0.500$). This correlation shows the effect of local risk of the population and social economic status on the occurrence of tuberculosis (Rasam, Shariff, Dony & Misni 2018:190).

In another study conducted among Brazilian prisoners, male sex and school age between four and eleven years were protective factors for TB/HIV co-infection. There was significant risk of being infected with TB among age groups between 26-35, 36-55 and 56-84 years compared to ages between 18-25 years (Saita et al 2021:266).

As the study conducted in Valencia region of Spain indicated, univariate logistic regression of pulmonary TB associated factors compared with extra pulmonary TB. The main determinant factors of tuberculosis were found to be lower age and birthplace for pulmonary TB cases and having birthplace in extra pulmonary TB cases. The most elevated risks were found among pulmonary TB cases at Grade IV-V social class occupations (OR = 2.82; 95% CI = 1.03-7.70), socio-economic problems (OR = 5.86; 95% CI = 2.19-15.64), being socially marginalised (OR = 4.18; 95% CI = 1.55-11.25), unemployment (OR = 2.82; 95% CI = 1.03-7.70) and stay in prison (OR = 5.02; 95% CI = 1.14-22.18) (Arnedo-Pena et al 2019:1-9).

2.4.2.2. Studies conducted in Sub-Saharan African countries on socio-demographic factors for occurrence of TB

The study conducted in Botswana revealed that, among older adults with different age categories who were infected with tuberculosis and had low levels of education, HIV prevalence was very high (44% for age 50 - 54, 40.6% for age 55 - 59 and 68.4% for age 60 - 64 years). The rate of TB/HIV co-infection was 21.9%, which is high, and prevalence of TB among the adults was 8.6% (13%, males and 5.3%, females) while only 0.8% of them were currently on treatment (Ama, Ama & Okurut 2019:40-51).

Cormier et al (2019:76) reported that crowded housing conditions, malnutrition, being infected with HIV and substance use were too scant to permit firm conclusions as predictors of tuberculosis. Poor socio-economic status can be explained as lacking social and economic basic necessities. This is a multidimensional concept that includes a combination of factors, such as lack of education, low income, overcrowding, and unemployment. The structural determinants and the conditions in which people live are factors for an important part of health status differences and the increased risk of TB (Duarte et al 2018:115-119).

In the index study conducted in Tanzania, male individuals were found to have an increased risk of developing TB. Several studies conducted in South Africa and Mexico support this finding. Social behaviour and hormonal differences between male and female increase susceptibility to tuberculosis. Sex has been suggested as potential explanation of TB predominance among adult male patients. In contrast to this finding, fewer studies demonstrate the high prevalence of TB among female patients. On the other hand, gender difference in susceptibility to TB is clinically important since it has also been shown that male patients have higher risk of mortality. This was displayed in a study assessing mortality in Uganda where male patients were found to be severely ill with WHO AIDS-defining clinical stage III & IV (36%, 33% respectively; $p<0.0001$) (Gunda et al 2018:1-7).

2.4.2.3. Studies conducted in Ethiopia on socio-demographic factors for occurrence of TB

Shimeles et al (2019:9) revealed that illiterate patients were found to develop TB twice as often as individuals who were able to read and write the local language (adjusted odds ratio [AOR] = 2.15, with 95% confidence were found to develop TB twice compared to those with interval [CI]: 1.05, 4.40); patients with household income of less than 1000 birrs per who had higher income (AOR = 2.2; 95% CI: 1.28, 3.78).

In their study to determine factors for the occurrence of tuberculosis among individuals living with HIV in Addis Ababa, Alemu et al (2020:62) found that people living with HIV (PLHIV) who came from families with more than five members had 1.783 times higher risk of contracting TB than to those from families with three or fewer family members (adjusted HR (AHR) 1.783, 95% CI 1.113–2.855).

According to the study conducted in Ethiopia, being female, being married, being employed and family size larger than five persons were 10 times more likely to contract TB against those with the normal value (Alemu et al 2020:59-66).

According to the case control study conducted in Addis Ababa, Ethiopia, a total of 260 cases (45.8%) and 260 controls (46.2%) were in the age group 26–45. The multivariate logistic regression analysis showed that TB patients who lived in houses with no windows were almost twice as likely to develop the disease compared to those who had more than one window (AOR = 1.81; 95% CI:1.06, 3.07). A prior history of hospitalisation was discovered to be the root of more than three times the likelihood of developing the disease (AOR =3.39; 95% CI: 1.64–7.03). Household members who contracted TB predominantly increased the risk of developing TB by threefold (AOR = 3.00; 95% CI: 1.60, 5.62) (Shimeles et al 2019). Eating meals less than three times per day, drinking raw milk, living in poorly ventilated houses and inadequate sizes of the rooms were identified as contributing factors (Adane, Damena, Weldegebreal & Mohammed 2020). This study further revealed that low educational level groups were found to develop tuberculosis twice as often compared to those of them who had a basic literacy (AOR, 95% CI = 2.15, 1.05, 4.40). The study participants with household income of less than 1000 birrs per month were two times more likely to develop TB than those who had reported higher income (AOR = 2.2; 95% CI: 1.28, 3.78) (Shimeles et al 2019:1-6).

According to Shimeles et al (2019:1-6), people who live in houses with just one window or none at all are almost twice as likely to develop TB compared to people whose house has multiple windows (AOR = 1.81; 95% CI: 1.06, 3.07). A household member with TB increases the risk of developing TB by three-fold (AOR = 3.00; 95% CI: 1.60, 5.62). Similarly, areas with significant numbers of smokers are a significant four-fold risk factor for developing TB (AOR = 4.43; 95% CI: 2.10, 9.3). In addition to the above findings, this study revealed admission in hospital was more than three times as likely to raise risk (AOR = 3.39; 95% CI: 1.64, 7.03).

According to the study conducted to identify determinants of tuberculosis by Tilahun et al (2019:515), those individuals who have close contacts with TB patients have a 4-5 times greater risk of developing TB than individuals with no close contacts with TB patients [P = 0.003, AOR = 5.2 (95% CI 1.7–15.8) and P = 0.003, AOR = 4.5 (95% CI 1.7–11.9), respectively. Similarly, PLHIV and apparently healthy who had contact with a family member in the house having history of TB infection had about four times higher association with TB compared to those who did not have such history [P = 0.023, AOR = 3.8 (95% CI 1.2–12 and P = 0.025, AOR = 3.9 (95% CI 1.2–13), respectively (Asgedom, Teweldemedhin & Gebreyesus 2018:1-6).

2.4.2.4. Studies conducted in Hawassa on socio-demographic factors for occurrence of TB

According to an institutional base cohort study conducted in Hawassa town with 1604 TB patients, “the fit of the Weibull regression model” result revealed that sex and age were contributing factors for the occurrence and survival of TB patients (Chere, Tesfay & Enquoselassie 2015:1-17).

2.4.3. Environmental factors

2.4.3.1. Global studies on environmental factors for occurrence of TB

Lwin, Apidechkul, Saising, Upala, Tamornpark, Chomchoei, Yeemard, Suttana and Sunsern (2020:10) described the influence of environmental factors on the occurrence of tuberculosis. According to their findings, people who use wood and charcoal as their main sources of energy for cooking have a greater risk of developing tuberculosis infection than those who use electricity (AOR = 4.23; 95% CI= 1.25–9.64).

According to various studies conducted in Canada, it was found that there was high prevalence of TB among people who live in overcrowded environments. Overcrowding is defined by the number of persons per room (ppr) in a household. It was found to be greater in low level communities in the rest of the world (mean 0·7–1·1 ppr) than the Canadian average (0·4–0·5 ppr). In the same study, which explored the air quality of some regions of Europe and Canada in which a number of TB cases were identified, 65–93% of the surveyed areas were found to have poor air quality (Cormier et al 2019:68-80).

2.4.3.2. Studies conducted in Sub-Saharan African countries on environmental factors for occurrence of TB

According to different studies conducted in sub-Saharan African countries, it was found that one of the important diseases increasing the risk of pulmonary and extra-pulmonary TB is silicosis. Exposure to silica dust without silicosis also increases the risk of TB (Floyd et al 2018:299-314).

The study conducted by Senya, Anim, Domson and Adu (2018:1-4) showed combustion of wood releases large particulate matter such as carbon monoxide, nitrogen oxide, formaldehyde and polyaromatic hydrocarbons which can be deposited deep into the alveoli and can cause considerable damage to the respiratory system and predisposes for activation of latent tuberculosis.

2.4.4. Clinical factors

2.4.4.1. Global studies on clinical factors for occurrence of TB

Nugus and Irena (2020:1-4) showed that the odds of TB cases among HIV patients whose haemoglobin level was less than 10mg/dl were nearly (AOR 3.67; P value<0.001) times higher among cases than in controls. This implies that having a haemoglobin level less than 10 at baseline is statistically positively associated with occurrence of active TB after starting ART treatment in HIV patients.

As the study conducted in Brazil showed, reported cases in the hospital with smear positive sputum exam and culture were found to be risk factors for TB/HIV co-infection, compared to cases notified in the prison system with sputum culture negative, sputum smear negative and X-ray suggestive of tuberculosis. There was less notification of cases in primary health care units. Most co-infected cases (85.6%) and non-co infected (97.5%) manifested with pulmonary symptoms (Saita et al 2021:267).

Case-control studies conducted in Latin American countries have revealed that the odds ratio of being contracted with tuberculosis is 2.44 to 8.33 times higher in patients with diabetes mellitus than in those without (relative risk = 3.11; 95% CI: 2.27-4.26). Some studies have shown that patients with diabetes mellitus are more likely to develop multidrug-resistant tuberculosis (Silva et al 2018:145-152). Among other risk factors, treatment with corticosteroid drugs given for the treatment of chronic inflammatory diseases increases the risk of TB by 1.6 to 25.1 due to the inhibition of inflammatory factor activating macrophages (Floyd et al 2018:299-314).

2.4.4.2. Studies conducted in Sub-Saharan African countries on clinical factors for occurrence of TB

A cohort study conducted among adult HIV patients receiving ART in North Western Tanzania has revealed that HIV-infected patients have a higher risk of TB development compared to persons without HIV. The rate is much higher among patients with lower CD4+ T lymphocytes cell count and detectable viral load test. Other risk factors identified were diabetes mellitus, malnutrition and hepatitis C infection (Duarte et al 2018:115-119).

In a study assessing mortality in Uganda, male individuals were found to be more severely ill with most WHO clinical staging III and IV AIDS defining manifestations (36% and 33%; p<0.0001). Patients who had stage IV HIV disease were also found to have an increased risk of developing TB despite receiving ART. In Burkina Faso, patients who had lower CD4 count at baseline diagnosis were shown to have an increased risk of developing tuberculosis. A study conducted in Nigeria revealed similar findings that patients who had lower baseline CD4counts<200cells/µl and those with previous history of TB had augmented risk of developing TB in spite of receiving ART with 8% prevalence. Patients who started ART at the baseline CD4 counts <200cells/µl have frequently been reported to have an increased risk of AIDS related morbidity and mortality (Gunda et al 2018:1-4).

2.4.4.3. Studies conducted in Ethiopia on clinical factors for occurrence of TB

The occurrence of HIV with CD4 cells count<200 was about (AOR 2.023; 95% CI: 1.244, 3.290; P value 0.004) times higher among cases than in controls. This shows that lower CD4 less than 200 is statistically and positively associated with occurrence of active TB in HIV patients after ART initiation (Asgedom, Tesfaye et al 2018:1-3).

Nugus and Irena (2020:1-8) showed that odds of having previous TB history are 2.4 times (AOR 2.4; 95% CI: 1.492, 3.895; P value<0.001) higher among cases than in controls. This shows having previous TB history is positively associated with occurrence of TB among HIV patients after ART initiation.

The study conducted by Shimeles et al (2019:1-5) reveals the probability of being on adherence level of fair utilisation were (AOR: 19.002; CI: 5.590,64.593; P value<0.001) times higher among cases than in controls, showing that being on adherence level of fair or poor was significantly associated with development of active tuberculosis among HIV patients on ART. Moreover, the odds of having WHO clinical stage III/IV at start of ART were also (AOR: 2.579; CI: 1.591, 4.179; P value<0.001) times higher among cases than in controls. This shows that advanced WHO clinical stage is statistically and significantly

associated with occurrence of TB among HIV patients after ART initiation (Tilahun et al 2019:515).

According to Alemu et al (2020:62), patients with lower baseline CD4 count (cells/ ml) <200, baseline Hb <10 g/dl baseline BMI value <18.5 kg/m 2, not enrolled on highly active antiretroviral therapy (HAART), and who did not take INH prophylaxis therapy (IPT) were found to be the independent determinants of TB incidence among PLHIV with 112 times the risk of developing TB compared to those who have the normal value.

Temesgen et al (2019:4&5) describe the odds of developing TB among HIV-positive adults on ART who were classified as WHO clinical stage III and IV at baseline were 2.1 (95% CI: 1.2, 3.2) times higher compared to those classified as WHO Stages I and II. Similarly, the hazard of developing TB among HIV-positive adults classified as ambulatory and bedridden at baseline was 1.8 (95% CI: 1.1, 3.1) times higher compared to those who were classified as working functional status. This shows that being bedridden among HIV patients predisposes for tuberculosis infection.

The chance of developing TB among patients who had opportunistic infection (OI) at baseline was 2.8 times (95% CI: 1.7, 4.4) higher compared to those who were OIs free at baseline. This shows that those patients who have previous history of other opportunistic infections are at higher risk of developing tuberculosis too (Tilahun et al 2019:515).

The risk of developing TB among patients presenting with Hgb level less than 10g/dl during ART initiation was 3.5 (95%CI: 2.1, 5.8) times higher than those with Hgb levels greater than or equal to 10 g/dl. HIV-positive adults on ART who did not take IPT were 3.9 (95% CI: 1.9, 7.6) times more likely to develop TB compared to those who took IPT (Temesgen et al 2019:1-9).

Belew et al (2020:1-5) revealed that the WHO clinical stage I or II (AOR=0.34; 95%CI: 0.20, 0.56) and co-trimoxazole preventive therapy (AOR=0.36; 95%CI: 0.21, 0.62) have a protective effect against tuberculosis infection. This shows that as the level of HIV clinical staging is low there is less likelihood of contracting tuberculosis infection.

According to the study conducted in Addis Ababa city to determine factors responsible for occurrences of tuberculosis among HIV positive individuals who had a baseline CD4 count of <50 cells/ m l and those with a CD4 count of 50–200 cells/ml were 2.568 times (AHR 2.568, 95% CI 1.602–4.116) and 1.568 times (AHR 1.568, 95% CI 1.088–2.311),

respectively, as likely to have TB compared to PLHIV who had a baseline CD4 count of >200 cells/ ml. Similarly, PLHIV who had a baseline BMI < 18.5 kg/m 2 were at 1.907 times the risk of developing TB at any time when compared to PLHIV who had a baseline BMI > 18.5 kg/m^2 (AHR1.907, 95% CI 1.530–2.690) (Alemu et al 2020:62).

According to Shimeles et al (2019:9), BCG has a protective effect against TB and reduces the risk by one-third (AOR = 0.34; 95% CI: 0.22, 0.54). This shows that BCG vaccine boosts the immunological status of individuals against tubercle bacilli.

A study conducted in Ethiopia disclosed that development of active TB while receiving ART was significantly higher among those patients who were in the WHO clinical stage III and IV compared to those in the WHO clinical stage I and II (AOR 2.29; p 0.003). These findings help to develop strategies for early HIV diagnosis and management before it progresses to advanced stages (Melkamu, Gebeyehu, Afenigus, Hibstie, Temesgen, Petrucka & Alebel 2020:1-12).

Gunda et al (2018:1-4) report that in their study patients who did not start isoniazid preventive therapy (IPT) while on ART were more likely to develop TB compared to those who received the prophylaxis. Moreover, it was shown that the occurrence of TB while taking ART was higher among those who did not use IPT compared to those who used IPT (AHR 2.41; p<0.05).

A retrospective cohort study in northeast Ethiopia indicated that HIV infected individuals and those who had history of TB were 3.65 times at higher risk of developing TB than people living with HIV (PLHIV) who had no previous history of TB (adjusted HR (AHR) 3.65, 95% CI 1.97 to 6.73). PLHIV who have been in bedridden functional status at baseline were 5.45 times at more risk of developing TB compared with PLHIV not in bedridden functional status (AHR 5.45, 95% CI 1.16 to 25.49) (Ahmed, Mekonnen, Shiferaw, Belayneh & Yenit 2018:2372-2388).

Likewise, PLHIV with baseline BMI less than 18.5 kg/m were 2.53 times at increased risk of developing TB than those with BMI greater than 18.5 kg/m 2 (AHR 2.53, 95 % CI 1.27 to 5.05). Individuals who received IPT were 86% less likely to develop TB compared with those who did not receive IPT (AHR 0.14, 95% CI 0.05 to 0.39). It was also shown that PLHIV in WHO clinical stages III and IV had a higher risk of contracting tuberculosis compared with WHO stages I and II (AHR 2.84, 95% CI 1.11 to 7.27; AHR3.07, 95% CI 1.08 to 8.75, respectively) (Melkamu et al 2020:1-12).

The study by Ahmed et al (2018:2372-2388) also revealed that the incidence of TB in the first three years of follow-up was higher when compared with successive years. Moreover, PLHIV who were anaemic (Hgb <11 g/dL) were 2.31 times at higher risk of developing TB than those with Hgb level greater than 11 g/dL (AHR 2.31, 95% CI 1.35 to 3.93).

Children on WHO clinical stages III and IV were three times (AHR = 3.0, 95% CI 1.2–7.7) more likely to develop TB infection than those on WHO clinical stages I and II. Poor adherence to ART was four times (AHR = 4.0, 95% CI 1.5–10.8) more at risk of developing TB compared to good ART adherence. Late initiation of ART was at four times (AHR = 4.0, 95% CI 1.5–10.6) more increased risk of developing TB than starting early in children who received ART for less than or equal to six months. The presence of improved technologies helped for implementation of early TB diagnosis, treatment and prevention activities in developed countries and played a significant role in reducing TB incidence (Temesgen et al 2019:1-19).

In a current study conducted in Ethiopia, early initiation of ART was found to be one of the relevant strategies for the prevention of OIs, including tuberculosis. Those children-initiated on ART later were found to develop TB infection. Other studies in Tanzania and Kenya support this finding (Endalamaw, Engeda & Tezera 2018:1-17).

A study conducted in the northern part of Ethiopia identified two main associated factors for the occurrence of tuberculosis, namely low CD4 count (less than 200 cells/mm 3) and advanced WHO clinical stage (WHO stage III & IV). Patients with low CD4 count were 3.5 times more likely to have TB/HIV co-infection compared to high CD4 count (OR: 3.53, 95% CI: 1.55, 8.06). Patients with advanced WHO clinical stage were 6.81 times more likely to have TB/HIV co-infection compared to those with WHO stage one (OR: 6.81, 95% CI: 3.91, 11.88) (Tesfaye et al 2018:1-18).

2.4.4.4. Studies conducted in Hawassa town on clinical factors for occurrence of TB

According to the cohort study conducted in Hawassa university hospital, among 499 PLHIV, 36.1% were males and 63.7% were females; most of them were in the age range 16-45 years (87%). Ninety-one (18.2%) of the respondents were infected with tuberculosis; out of these, 58 (64%), 20 (22%), and 13 (14%) were smear negative, smear positive, and extra-pulmonary tuberculosis cases, respectively. Multivariate logistic regression analysis showed that being female (AOR=0.39; 95% CI: 0.20-0.77), in WHO clinical stage 3 (AOR=5.66; 95% CI: 1.79-17.94), and WHO clinical stage 4 (AOR=7.89;

95% CI: 2.01-30.96) and being ambulatory (AOR=2.22; 95% CI: 1.06-4.64) were associated with TB/HIV co-infection (Fekadu et al 2015:898-904).

According to an institutionally based cohort study conducted in Hawassa town from 1604 TB patients, “the fit of the Weibull regression model” result revealed that baseline weight and HIV status were factors for the occurrence and survival of TB patients (Chere et al 2015:1-17).

2.5. TUBERCULOSIS AND HIV COLLABORATIVE ACTIVITIES

TB and HIV are overlapping epidemics, and both have been declared global emergencies demanding global attention (Global Fund 2019). There is evidence that HIV infection weakens the immune system, thereby fuelling the TB epidemic among people living with HIV/AIDS (Adhikari, Bhattarai, Basnet, Joshi, Tinkari, Thapa & Joshi 2022:1-5).

On the other hand, TB is the main opportunistic infection and leading cause of deaths among PLHA. In many countries. TB cases have been increasing in line with rising HIV prevalence (Gezae et al 2019:1-9). In sub-Saharan Africa, for instance, a fourfold rise in TB cases related to the HIV epidemic has been reported. The situation is ever increasing in some African countries like Tanzania (National Tuberculosis & Leprosy Program of Tanzania 2021:1-3).

The WHO first released a provisional directive on TB/HIV cooperation in 2004. In 2012, it was updated to reflect evidence-based reviews. Since then, many collaborative activities have been scaled up, but progress by region and activity has been variable (WHO 2012:10-15). These policy guidelines on collaborative TB/HIV activities are a compilation of existing WHO recommendations on HIV-related TB. They follow the same framework as the 2004 interim policy document, structuring the activities under three distinct objectives: establishing and strengthening mechanisms for integrated delivery of TB and HIV services; reducing the burden of TB among PLHIV and initiating early antiretroviral therapy; and reducing the burden of HIV among people likely to have tuberculosis.

According to UNAIDS (2018:8-17), between 2005 and 2017, joint TB/HIV activities saved an estimated 6.6 million lives. However, much more effort is needed to establish and strengthen the mechanisms within health systems that enable TB and HIV services to be accessed in one place. Models of TB/HIV integration range from TB clinics referring patients to HIV clinics and vice versa, to full integration where both services are available

at a single facility, on the same day, by the same healthcare worker. Although significant progress has been made on this in the past decade, health services do not always work in integrated ways and may even fail to provide screening for common co-infections (Anku, Amo-Adjei, Doku & Kumi-Kyereme 2020:1-14).

Some countries in the European region have reported on successful collaboration and integration of TB and HIV services. However, it is not known what models and levels of integration are applied in the majority of the region's countries and territories, and how the prevention and care services for the two diseases should collaborate (De Vries et al 2021:1-9).

In 2015, the Wolfheze Workshops created a working group on TB/HIV collaborative activities. It was planned to document and promote the best models on integrated TB/HIV care and treatment. Emphasis was on considering the specific challenges and opportunities on promoting TB/HIV research priorities in the region (WHO 2021d:1-10).

According to the cross-sectional study conducted by Ganju, Mahapatra, Adhikary, Patel, Saggurti and Dallabetta (2018:1-10), India's National AIDS Control Programme and the revised National TB Control Programme have been instrumental in reducing the burden of HIV and TB. Since 2001, they have been implementing collaborative TB-HIV activities. The national HIV-TB response includes intensified TB case finding in HIV care settings, intensified and integrated TB/HIV packages for patients, and a focus on TB prevention for PLHIV. India's HIV/AIDS Alliance implements the largest national HIV/TB care and support programme in close coordination with the central TB division, India's National AIDS Control Organization and communities most affected by HIV and TB. As part of this, Vihaan Care and Support centres have been offering community-led, integrated TB and HIV services since 2017, leading to an expansion of services across the country (De Vries et al 2021:1-9).

Moreover, an Indian National Framework for Joint TB-HIV Collaborative Activities has been developed, under which the National and State TB/HIV coordinating mechanisms still function. Service level coordination mechanisms have also been established at the grassroots level. Components such as planned human resources, integration of surveillance, joint training, standard recording and reporting, joint supportive monitoring and evaluation, and conducting action research were strategically implemented. The overall coverage was achieved by 2012. The national level TB-HIV coordination committee and technical working group regularly monitor, evaluate and make

suggestions about existing policies and strategies related to TB/HIV collaborative activities (MoHI 2021:85-99).

There is an increasing recognition of the need to strengthen collaboration between national TB and HIV/AIDS programmes. The Tanzania Ministry of Health has developed National Policy Guidelines for Collaborative TB/HIV activities with the overall objective of providing a framework for ensuring transparent and consistent processes in developing comprehensive collaborative TB/HIV activities. This objective emphasises the need for joint decision-making processes that consider the comparative advantages of the National TB and Leprosy Program (NTLP), the National AIDS Control Program and other stakeholders (Hushie 2019:138-147).

According to a health institutional survey conducted In South Africa, the Department of Health has developed guidelines and policies supportive for the integration of TB/HIV services. These include testing and counselling for HIV in all people diagnosed with active TB, isoniazid prophylaxis therapy for PLHIV who screen negative for TB, co-trimoxazole prophylaxis therapy for people living with HIV/TB, strategies to support people to be retained in care and stay on treatment, and a fully integrated data management system. However, a 2017 analysis of primary healthcare in rural South Africa found that many of these approaches have not been adopted, resulting in poor integration (Maphumulo & Bhengu 2019:1-9).

However, a recent study described South Africa as having ‘turned a corner’ on integration since 2012. This follows the introduction of various national initiatives including the proactive diagnosis of TB among PLHIV through the use of GeneXpert technology. The country also provides integrated HIV/TB services for people in nearby facilities, the mining industry, and communities surrounding gold mines and informal settlements where transmission of both HIV and TB is high (UNAIDS 2018:6-65). The country is also collecting detailed, localised data on HIV/TB disease patterns, related social and economic factors, and the uptake on TB and HIV services. As priority setting, TB/HIV ‘hotspots’ can then be identified within key districts and integrated services targeted more effectively. As a result, TB treatment success rates among PLHIV are gradually improving (Gianella et al 2019:1-13).

2.5.1. TB/HIV collaborative activities in Ethiopia

Based on the WHO recommendation, integrated TB and HIV collaborative activities were launched in 2004 and updated in 2012. These collaborative activities aimed to reduce the

burden of HIV among TB patients and the burden of TB among PLHIV. Most developing countries like Ethiopia have been adopting this strategy, starting from the time of its inception (Gelaw, Williams, Assefa, Asressie & Soares Magalhães 2019:379-391).

Ethiopia is one of the countries with the highest number of people with TB/HIV co-infection in the world, with an estimated TB incidence rate of 164 per 100,000 TB, and 112/100,000 TB cases within those with HIV (MoHE 2018a). According to the Ethiopian HIV/AIDS Prevention and Control Office [EHAPCO] (2018:1-20) estimates, 613,000 adults (0.9% of the adult population) were HIV-positive. However, this figure is irregularly distributed throughout the country, with the lowest prevalence (0.1%) in Somali and highest in the Gambela Region (4.8%). Most of the PLHIV were from the Amhara region (30%), Oromia (26%) and in the capital city, Addis Ababa (18%). Research suggests that both TB and HIV incidence is high in areas where HIV is highly prevalent (Gelaw et al 2019:379-391).

Since then, the integrated TB and HIV service has expanded to the tertiary, secondary and primary health care levels in Ethiopia. However, knowledge regarding the burden of TB and HIV and knowing the dual burden and shared unexpected consequences of the two diseases, the programmes must not only collaborate to provide an integrated service for the co-infected patients, but it must also include the planning, monitoring and implementation of activities targeted for the TB/HIV co-infected patients (Arega, Minda, Mengistu, Endale & Agunie 2020:1-14). The collaborative service attempts to lessen the impact of HIV and TB diseases by strengthening the methods for cooperation; reducing the prevalence of TB in HIV-positive people; as well as lowering the prevalence of TB in HIV-positive patients (MoHE 2018a). Co-morbidity and its collaborative service implementations at regional/city level in the country is limited (Gelaw et al 2020:839-840).

2.5.2. TB/HIV collaborative activities in Hawassa

According to an institutionally based cross-sectional study conducted in Hawassa town to assess TB/HIV collaborative activities, different health institutions which provide the service were assessed and it was found that antiretroviral drugs have substantially benefited clients. The study further revealed inadequate patient monitoring, and lack of resources such as TB/HIV medications. Diagnostic tools and supplies were found to be the main reasons for compromised integration of the two programmes in the town (Lonsako 2017:1-3).

2.5.3. The analytical framework of TB/HIV collaborative activities

An analytical framework is a set of codes organised into categories that have been jointly developed by researchers involved in analysis that can be used to manage and organise the data (Arega et al 2020:1-14) The framework creates a new structure for the data (rather than the full original accounts given by participants) that is helpful to summarise/reduce the data in a way that can support answering the research questions (Goldstone 2019:37-51). Below is a diagram on TB/HIV collaborative activities which shows how programme integration positively influences the desired outcome, i.e., prevention of transmission of TB/HIV, to decrease mortality and morbidity among the targeted segments of the population.

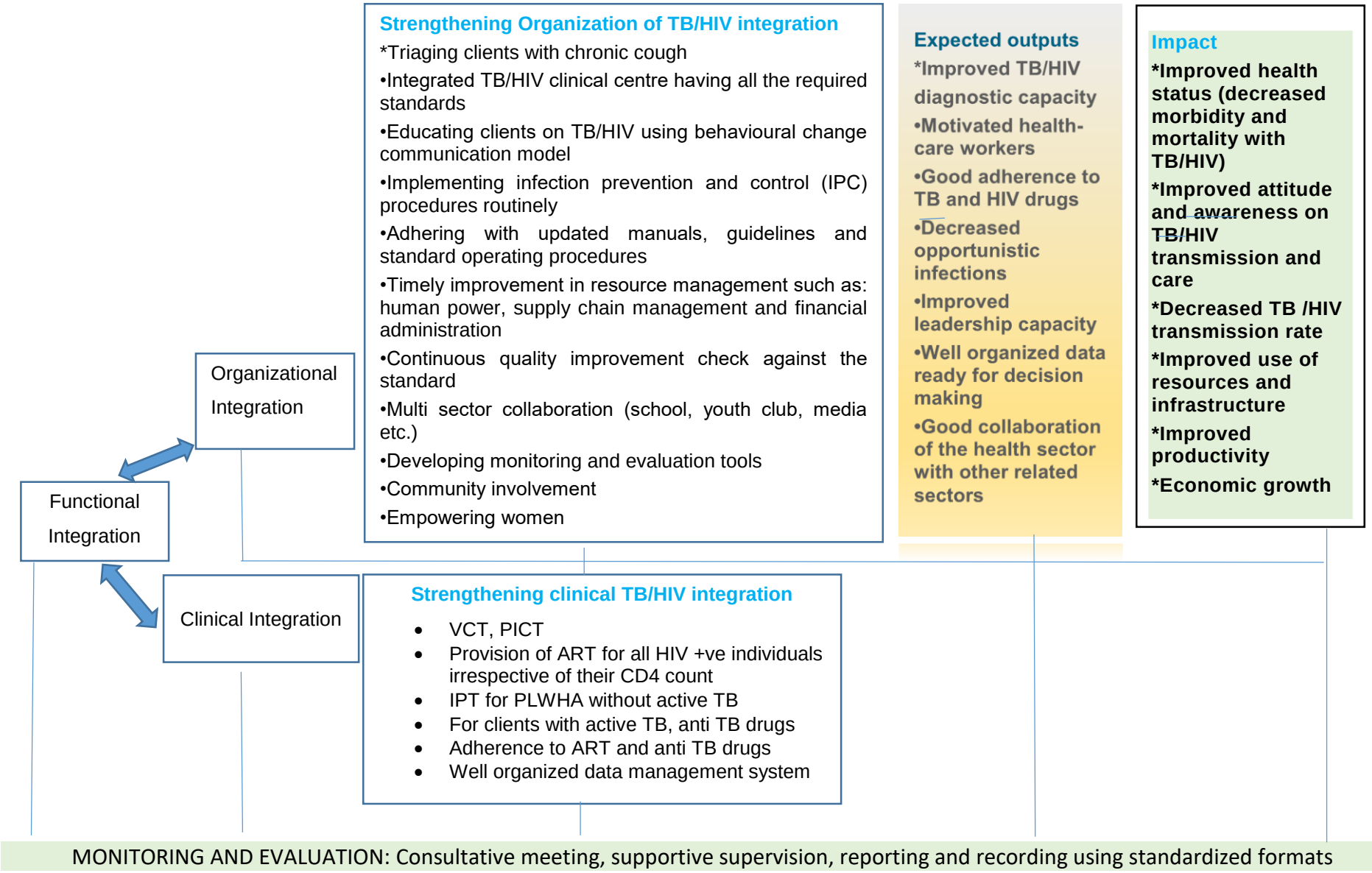


Figure 2.1: The analytical framework of TB/HIV collaborative activities. Adapted from SUTHI study theoretical framework

Source: Naidoo, Gengiah, Yende-Zuma, Padayatchi, Barker, Nunn, Subrayen et al 2017

Naidoo et al (2017:5) have developed a theoretical framework to illustrate clinical care and prevention of TB/HIV dual infection. According to Naidoo et al (2017:1-10), this TB/HIV care and support service integration model demonstrates the extent of integration from TB clinics to HIV care and support centres at which both services are accessible in one facility, on the same day and the service is given by the same health professionals. Implementing integration requires functional integration recommended at the policy and budget level; and clinical integration at which TB/HIV care and support take place at the same time. At the organisational integration facility level, resources and processes are integrated. Primary health care supervisors and regional health care providers are expected to follow service integration through continuous quality improvement measures.

Applied to prevention of TB/HIV dual infection among adolescents, the adapted analytical framework was designed to have basic constructs such as TB/HIV clinical care service integration, strengthening the organisation of TB/HIV integration, expected outputs, impact, monitoring and evaluation. The aim of this integration is to facilitate prevention and control of TB/HIV (WHO 2019a:2&3).

2.5.4. TB/HIV clinical care service integration

In TB/HIV clinical care integration, the entry point is voluntary, or HIV counselling and testing is initiated by health professionals. Based on HIV test result the client is counselled to start ART and IPT provided that he/she does not have active TB. Anti TB drugs are recommended for those patients whose sputum smear test result is positive for Mycobacterium TB or their chest radiological exam reveals TB signs (MoHE 2017:10-15). Once the patient has started taking TB/HIV drugs, strict measures are taken on regular and consistent intake of drugs (adherence). Well organised leadership measures play a pivotal role for integration of TB/HIV care and support activities and resources (MoHE 2018a:115).

2.5.5. Strengthening organisation of TB/HIV integration

In strengthening of organisations for TB/HIV integration, the entry point for this service delivery is triage (separating and treating those who are suspected of having TB). This is one of the measures to prevent the disease from spreading to healthy susceptible individuals at service delivery centres (Naidoo et al 2017:5). TB/HIV care and support centres are expected to have all the required standards for their infrastructure, operating procedures,

supply chain management and leadership. All TB/HIV care and support activities are integrated under the same roof (MoHE 2018a:116; Arega et al 2020:1-14). The overall activity of any given health facility is influenced by external factors such as the role of community engagement, multi-sectorial involvement, and women empowerment. Those factors have a profound positive effect on implementing the programme and achieving the desired organisational objectives (Igbokwe, Abugu & Aji 2020:367-373).

2.5.6. Expected outputs

Integration of activities with partner collaboration is believed to bring significant outputs in terms of improved TB/HIV diagnostic capacity, motivated healthcare workers and improved health status of TB/HIV service takers who are the main service provision targets (Naidoo et al 2017; Arega et al 2020:1-14).

2.5.7. Impact

The overall inputs and outputs in an integrated TB/HIV programme are expected to bring significant impact in terms of decreased morbidity and mortality due to TB/HIV, improved attitude and awareness on TB/HIV transmission, decreased TB /HIV transmission rate, improved use of resources and infrastructure, improved productivity, and economic growth of countries at large (Igbokwe et al 2020:67).

2.5.8. Monitoring and evaluation

Close follow-up of planned activities in the light of organisational objectives through consultative meetings, supportive supervision, reporting and recording using standardised formats is the major target of a monitoring and evaluation framework (Arega et al 2020:1-14). Monitoring and evaluation in the TB/HIV collaborative management context is a cross-cutting periodical activity which addresses all existing programmes working on prevention and control of TB/HIV (De Vries et al 2021:1-5). The output of monitoring and evaluation is used to identify gaps which deter the full achievement of objectives, and thereby make timely correction. Improvised and well-designed integration of TB/HIV care and support activities are a cornerstone in the prevention and control of TB/HIV (Naidoo et al 2017:1-5).

2.6. SUMMARY

The literature review has assessed various studies on determinants of tuberculosis among HIV patients. It has further assessed studies focused on prevention modalities used to

prevent TB and HIV transmissions. Moreover, the ever-encountered challenges during those measures have received due attention.

2.6.1. Context of TB prevention

The literature review shows a number of studies have been conducted with different methodologies on the prevention and control of tuberculosis. It starts from the historical background of TB prevention and examines the current intervention scenarios under the subheadings: prophylactic, socioeconomic, contact screening, partner's collaboration, governance, clinical case management, policy and strategy. It also assesses the success and challenges in the effort to prevent and control tuberculosis.

2.6.1.1. Continuum of tuberculosis care and prevention in the present era

The literature review assessed the findings of different studies on the successful prevention and control of tuberculosis. It further explored the experience of different countries and those efforts were described as: using pre-exposure prophylaxis, vaccination, TB contact tracing, targeted screening of cases, prompt clinical case management, improving socio-economic status and running TB/HIV programmes collaboratively. Moreover, the formulation of better policy and strategies was identified as an additional advancement in reducing mortality and morbidity from tuberculosis. Finally, it emphasised that those preventive measures should be led under good governance. In the implementation of the such preventive activities, failure to adhere to the standard treatment, emergence of drug resistant TB, lack of knowledge on the care and prevention, negative attitudes toward care and prevention of TB, lack of budget and poor socioeconomic status were identified as challenges in the prevention of tuberculosis.

2.6.1.2. Challenges in TB prevention

The literature review outlines a number of challenges in the prevention and control of tuberculosis, such as the difficulty of making a diagnosis, given the clinical overlap of TB symptoms with other common childhood diseases. The deficiencies in TB diagnostic apparatus currently available for the care of TB patients are evident for this challenge. The delay in detection of TB cases and the demands and costs of the current treatment approaches are becoming challenges. Prevention through vaccines or preventive treatment remains inefficient. It is not uncommon that case definitions between and within countries

are inconsistent, with deficient disease recording and reporting. In high TB burden countries, operational research conducted to cover such approaches is limited. Due to an increasing threat of antimicrobial resistance and growing number of global migrations, prevention of tuberculosis is becoming a threat. Forced mass displacement and systematic violations of humanitarian law have resulted in overcrowding and the destruction of key infrastructure, leading to an increased risk of both drug-sensitive and resistant TB besides restricting timely diagnosis, tracing contacts, on time treatment, and follow-up.

2.6.2. Context of HIV prevention

The literature review focuses on studies conducted on the prevention and control of HIV/AIDS. It starts from the background of HIV prevention and proceeds to the current intervention scenarios under the subheadings prophylactic, behavioural, socioeconomic, and biomedical, partners' collaboration, governance, clinical case management, policy and strategy. It also assesses the success and challenges in those efforts to prevent the disease.

2.6.3. Continuum of HIV care and prevention in the present era

The literature review appraised various studies on measures taken against HIV infection and transmission. According to the extensive evaluation made in the literature review, voluntary counselling and testing as entry point for care and prevention of HIV/AIDS were found to have a significant role in reducing transmission of HIV. Behavioural modification, fighting against gender violence, and administration of drugs as pre-exposure prophylaxis on those people who have high adherence to the medications were emphasised. Studies have shown that early initiation of ART in individuals is effective for reducing the risk of HIV transmission (CDC 2021b:1-10). In the care and prevention continuum of HIV, some studies recommend having a platform on partner collaboration, especially in joint monitoring/evaluation of programmes, availing the necessary logistics. It was also indicated that well formulated policies and strategies are key factors for programme sustainability and reducing the burden of diseases.

2.6.4. Challenges in HIV prevention

The literature review shows different challenges encountered since the early start of HIV prevention activities, such as the growing emergence of antiretroviral drug resistance and the need for sustainable financing of the global response (WHO 2021b:1-20). Although

women feel at risk of contracting HIV from their partners and many women know about condoms, they are unable to use them because of the partner's refusal (Seyler, Lacor & Allard 2018). Many people, even those who engage in high-risk behaviour, do not get tested because they do not believe they are at risk of HIV infection. The wide spread of antiretroviral drug resistance is another challenge that has provoked many countries to invest for randomised control trials.

2.6.5. Determinants of tuberculosis among HIV positive individuals

The literature review has focused on studies that have been conducted in relation to a range of factors that influence the health status of individuals or populations by determining the occurrence of tuberculosis. As to host factors, previous history of contact with TB patients, nutritional status and substance use were found to have association with tuberculosis. Among the socio-demographic factors, age, sex, educational status and income were found to be positively associated with the occurrence of tuberculosis. As to environmental factors, number of rooms in the house, number of windows, exposure to smoke and presence of persons infected with TB in a house were found to be determinants of TB among HIV individuals, Among the clinical factors, the WHO HIV clinical staging, CD4 count (cells/ ml) < 200, blood haemoglobin level, BMI, use of co-trimoxazole and INH prophylaxis, and early initiation of antiretroviral drugs have shown strong association for development of tuberculosis.

2.6.6. Tuberculosis and HIV collaborative activities

The literature review has shown the overall picture of models on TB/HIV collaborative activities and described collaboration as a range of activity from TB clinics referring patients to HIV clinics and vice versa, to full integration where both services are available at a single facility, on the same day, by the same healthcare worker. The literature has also shown the experience of different countries in effective collaborative activities aimed at reducing the burden of HIV among TB patients and the burden of TB among PLHIV. It further mentioned that developing countries like Ethiopia have adopted this strategy starting from the time of its inception and have recorded significant achievement in reducing the burden of the disease (Gelaw et al 2019:379-391).

2.6.7. The analytical framework of TB/HIV collaborative activities

The literature review has shown the benefit of TB/HIV collaborative activities summarised in an analytical framework applied to the prevention of TB/HIV dual infection among adolescents: The adapted analytical framework depicts the basic constructs such as TB/HIV clinical care service integration, strengthening organisation of TB/HIV integration, expected outputs, impact, monitoring and evaluation. The aim of this integration is to facilitate prevention and control of TB/HIV so as to reduce the burden of the dual pandemics (WHO 2019a:2&3).

In conclusion, the literature review has provided an epidemiological update on both TB/HIV, clarifying their distribution and determinants in terms of time, person and place. Moreover, it has described the relation of tuberculosis with HIV/AIDS. The findings of various studies on prevention and control of TB/HIV were explicitly discussed under appropriate sub-headings such as prophylactic treatment, governance, policy and strategy, socioeconomic factors, contact tracing, surveillance, and programme collaboration. The literature has further reviewed challenges encountered in the effort to control the two dual epidemics. Finally, the implementation of the collaborative management of TB/HIV was summarised in an analytical framework.

CHAPTER 3
RESEARCH METHODOLOGY

3.1. INTRODUCTION

This methodology chapter discusses the research design and methods which guided this study. The research environment, study design, research procedures, and ethical considerations are also described. Additionally, a detailed explanation of the sample size, participant and responder selection, and sampling strategies used to direct data collection are provided in the section on the study process. Also covered in this chapter are data collecting and analysis.

The methodology of a research study is a systematic way of analysing a problem. It is the science of studying how research is to be carried out. Essentially, the procedures by which researchers go about their work of describing, explaining and predicting phenomena are called a research methodology (Kumar 2018:9-20).

Pandey and Pandey (2021:18-20) add that a research methodology simply refers to the practical “how” of any given piece of research. More specifically, it is about how a researcher systematically designs a study to ensure valid and reliable results that address the research aims and objectives.

For example, how did the researcher go about deciding:

- What data to collect (and what data to ignore)?
- Who to collect it from?
- How to collect it?
- How to analyse it?

A research design, according to Polit and Beck (2012:118-136), is an overall plan for addressing a research question, including specifications for enhancing the study’s integrity. The research methods are techniques for acquiring data for a study (Bryman 2016:40).

3.2. STUDY SETTING

This study was conducted in Hawassa town, which is located 273 km south of Addis Ababa via cities along the way: Bishoftu, 130 km east of Sodo and 75 km north of Dilla. The town serves as the capital of the Sidama Region. It lies on the Trans-African Highway from Cairo to Cape Town and has a latitude and longitude of 7°3′N 38°28′E (Coordinates: 7°3′N 38°28′E) and an elevation of 1,708 metres (5,604 ft) above sea level. Its name is derived from a Sidamic word meaning "wide body of water". The town is divided into eight sub-cities and 32 Kebeles (Worldometer 2021). The town has two referral hospitals and each sub-city has a health centre. For this study data was collected from the two referral hospitals located in the town (Hawassa University Referral Hospital and Adare General Hospital) and two health centres (Millennium Health Center and Alamura Health Center) at which these institutions take the majority of patient flow among all institutions in the town. Moreover, these facilities have advanced diagnostic technology to diagnose and treat TB/HIV in Hawassa Town.

3.2.1. Ethiopia

Ethiopia is a landlocked country in East Africa. Its neighbours include Sudan in the northwest, Eritrea in the north, Djibouti in the northeast, Somalia in the east, Kenya in the south, and Eritrea in the north. Ethiopia has a total area of 1,100,000 square kilometres and a population of over 109 million. It is the world's fifteenth-most populous nation and the fourth-most populous in Africa. The capital and largest city, Addis Ababa, lies several kilometres west of the East African Rift Valley (Worldometer 2021).

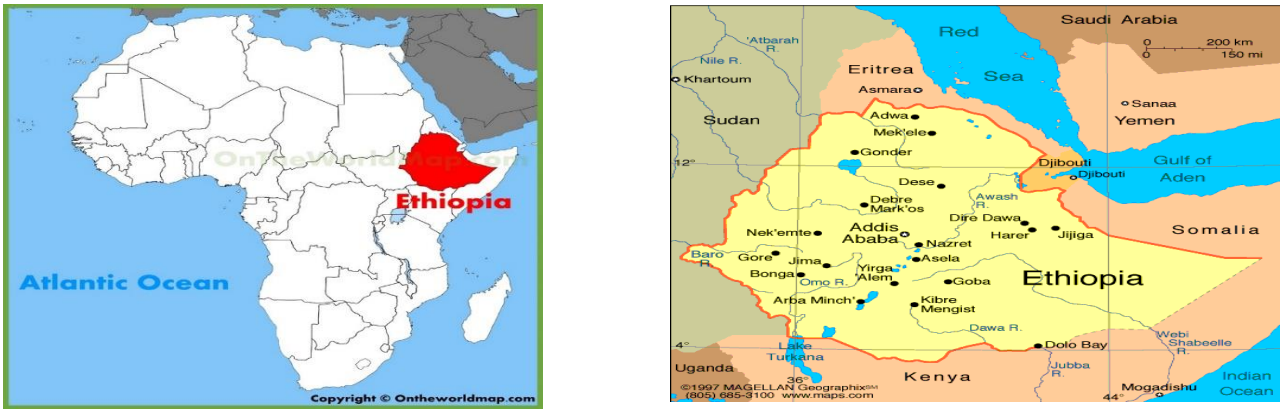


Figure 3.1: Ethiopia located on a map of Africa

Source: https://geology.com/world/ethiopia-satellite-image.shtml

The regions are each governed by a regional council whose members are directly elected to represent districts (*woreda*). Each council has a president, who is elected by the council. The regions also have an executive committee, whose members are selected by the president from among the councillors and approved by the council. Each region has a sector bureau, which implements the council mandate and reports to the executive committee. There are currently ten regional states and two chartered cities, the latter being the country's capital, Addis Ababa, and Dire Dawa, which was chartered in 2004. Being based on ethnicity and language, rather than physical geography or history, the regions vary enormously in area and population, the most notable example being the Harari Region, which has a smaller area and population than either of the chartered cities. When they were originally established in 1992, there was a larger number of regions, but five regions were merged to form the multi-ethnic SNNPR later in 1992, following the first elections of regional councils on 21 June 1992 (Independent Advisory Group on Country Information [IAGCI] 2020).

According to the 2019 revision of the World Population Prospects, the total population was 109,224,414 in 2018, compared to 18,434,000 in 1950. The proportion of children below the age of 15 in 2010 was 41.5%, between 15 and 65 years of age was 55.8%, while 3.3% was 65 years or older. The average age was 25.1 (Worldometer 2021).

3.2.2. Hawassa Town (the research area)

Hawassa was capital of the former Sidamo Province from about 1978 until the province was abolished with the adoption of the 1995 Constitution. It then became the capital of the SNNPR. When the Sidama Region was formed in June 2020, the town became part of that region. Hawassa currently serves as the capital of both the Sidama Region and the SNNPR. Hawassa will continue to serve as the seat of government of the SNNPR for two national electoral cycles, after which the regional government will move to a town within the region's boundaries (Central Statistical Agency of Ethiopia [CSA] 2020:219-249).

Based on the 2014 census conducted by the Central Statistical Agency (CSA) of Ethiopia, this zone has a total projected population of 258,808, of whom 133,123 are men and 125,685 women. While 157,879 or 61% are living in the town of Hawassa, the rest of the population of this zone is living in surrounding rural kebeles. A total of 61,279 households was counted in this zone, which results in an average of 4.22 persons to a household, and 57,469 housing

units. In 2016, a new industrial park was built in Hawassa to accommodate 60,000 jobs at a 1.3 km^2 (0.50 sq mi) site. The administrative land area of Hawassa is 15,720ha, with the municipal boundary (i.e., urban kebeles) covering 65 square km. Hawassa town is bounded by Lake Hawassa in the West, Oromia Region in the North, Wendogenet woreda in the East and Shebedino woreda in the south (CSA 2020:25-31).

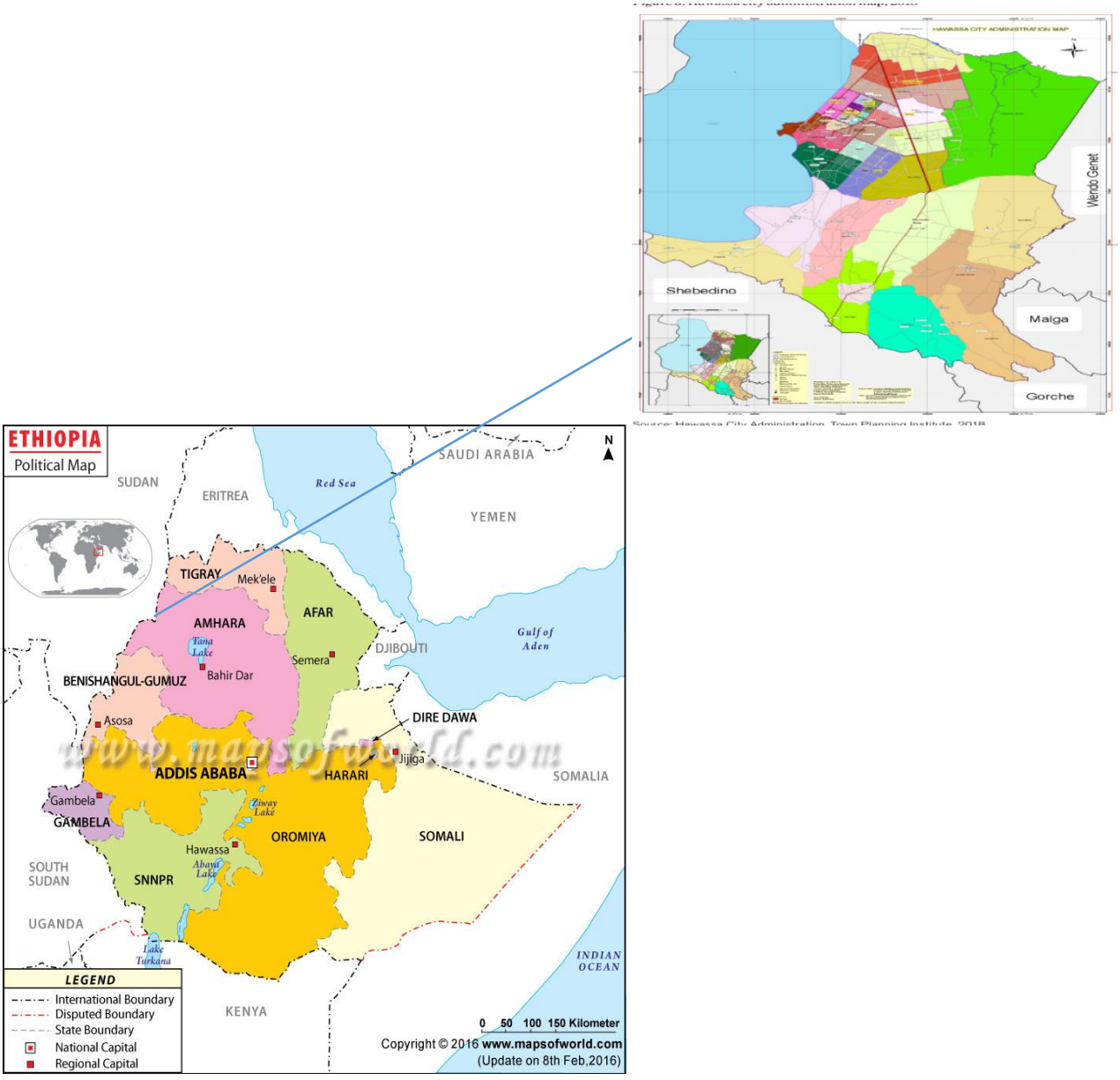


Figure 3.2: Map of Ethiopia showing location of Hawassa Town

Source: https://geology.com/world/ethiopia-satellite-image.shtml

3.2.2.1. Health facilities in Hawassa

The health policy of the country is mainly focused on a prevention strategy. Based on this strategy the health service coverage of the Hawassa Town administration has encouragingly increased during the last few years. In 2013 in the town administration, there have been many activities in the area of disease prevention and improving the health service of the community. Implementing family health care and controlling communicable diseases at each household level, improving the total number of health professionals, implementing the capacity building programme and constructing more health institutions in the town administration are among the major success. The health coverage of the town administration was 92% in 2013. There is one referral hospital, one district hospital, three private hospitals, seven health centres, 15 health posts, 51 private clinics, 46 drug stores, two diagnostic laboratories and 55 pharmacies in the town administration (Kinfu, Bombeck, Nigussie & Wegayehu 2019:77-78).

3.2.2.2. Health facilities and the situation of TB HIV in Hawassa

In Hawassa town all health facilities have TB and HIV diagnosis settings, but TB/HIV care and support centres are not available in all health institutions. Most of the patient load lies on the two hospitals (Hawassa University Referral Hospital and Adare General Hospital) in the town. Hawassa is one of the main target towns at which TB/HIV dual infection studies have been conducted and its prevalence was found to be 18%. According to the study conducted by Bekele, Kote, Yesuf and Girum (2017:272&273), the highest incidence rate of TB in Hawassa town was observed in the first year of ART enrolment. TB incidence may rise during the initial months on ART, which is largely due to ART-induced unmasking of subclinical active TB and delayed diagnosed unspecific symptomatic patients in resource-limited settings.

According to a five-year retrospective cohort study, Simieneh, Hailemariam and Amsalu (2017) conducted in Hawassa city, a high proportion of TB patients was diagnosed in September 2011 to August 2012, 606(30.9%) and in September 2012 to August 2013, 619(31.6%). Significantly declining trends of TB/HIV co-infection was found among co-infected unlike that of adolescents in which there has been marked increase (MoHE 2020).

3.3. RESEARCH DESIGN

This section describes the research methodology and the justification for applying it to this particular study. Research designs are types of inquiry within qualitative, quantitative and mixed methods approaches that provide specific direction for procedures in a research study. Others have called them strategies of inquiry (Creswell & Hirose 2019). Research design is defined as the plan or strategy which the researcher uses to implement his or her study based on the researcher's approach to the study (Grinnell 2018:13). Moreover, a research design is one of the main pre-conditions for successful data collection and analysis. It embraces the importance of integration of time, money and human power. It has a profound effect on the reliability of the expected result and its foundation (Oliver, Kothari & Mays 2019).

The research issue in this study was the rising proportion of newly diagnosed TB infections among adolescents who are HIV positive. According to World Health Organization (2021c:1-8), TB is one of the commonest infectious diseases and a leading cause of illness and death worldwide. According to estimates, globally in 2020, 1.3 million HIV-negative people died. while there was an additional increase in 214,000 deaths among PLHIV. In Ethiopia, HIV has been a challenge in the control and prevention of tuberculosis whereas the latter (tuberculosis) remains the main cause of death in PLHIV. In the recent year an estimated 16,000 people living with HIV (PLHIV) in Ethiopia have developed TB. Most of them were adolescents and youths (MoHE 2018d:18). To this end, the researcher was interested to study factors responsible for the ever-increasing number of newly TB infected adolescents living with HIV in Hawassa town. Since there have so far been no studies conducted on this particular issue in the town, research with appropriate study design was required to investigate the cause and generate information for timely decision and action, hence a mixed methods design was found to be appropriate for this study.

3.3.1. Research paradigms

This study adopts the pragmatism paradigm which is concerned with applications and solutions to problems. A paradigm is defined as the belief of individuals which they use as a philosophical assumption in order to explore a specific natural phenomenon for the sake of guiding a particular approach to an enquiry (Polit & Beck 2018:39-44). Creswell and Clark (2018:6) add that paradigms refer to the general philosophical view that a researcher has

about the world when dealing with the approach to the research study. Pragmatist researchers view the consequences of research, using multiple data collection methods to respond to the problem statement. Pragmatism is pluralistic and focuses on “what works” and “how it works” in the real world practice (Creswell and Clark 2018:69).

A pragmatic researcher emphasizes the problem and uses all available approaches to understand the problem; thus, supporting the mixed method approach (MMS) which is adopted in this study. The qualitative phase of the study pinpoints general abstract theory of a process, action, or interaction grounded in the views of participants (Creswell 2014:30-44). It helps the researcher to observe and understand individuals’ and institutions day to day routine experience such as events, actions and processes in the material world in which they occur (Creswell 2009:195). In this study it invokes the study participants to describe their experiences on TB/HIV prevention programme’s availability and accessibility. Whereas the quantitative phase of this study tries to identify determinants of tuberculosis among HIV positive individuals and the association of one study variable with the other. This is better explained in terms of rates, ratio and percentage (Mukherjee 2020:75-90). According to Creswell and Poth (2018:27), the pragmatic worldview offers the following philosophical foundation of research:

- Pragmatism is not committed to any one system of philosophy and reality; the researchers have freedom of choice.
- Pragmatists do not see the world as an absolute unity; they look to many approaches to collecting and analysing data rather than subscribing only to one way. Hence, pragmatism as paradigm opens doors to multiple methods, different worldviews as well as different forms of data collection and analysis.
- Pragmatists agree that research always occurs in social, historical, political and other contexts.

The findings from the two phases informed development of a strategy that would hopefully prevent tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia

3.3.1.1. Mixed methods

Creswell (2015:18) and Ivankova and Plano Clark (2018) highlight core characteristics of mixed methodology as involving collection and analysis of both qualitative and quantitative

methods in response to the research question and an integration or mixing of qualitative and quantitative data followed by interpretation of the findings. The researcher found it fitting and helpful to combine both the quantitative and qualitative data sets using a mixed methods study approach. For this investigation, there was a justification for combining quantitative and qualitative data so the methods would complement each other in soliciting information to understand the research problem. Their combined use offers a greater comprehension of research issues than using either of them alone (Wium & Louw 2018).

According to Polit and Beck (2018:309), a mixed methods design has three main advantages:

1. Complementarity. To avoid the limitation of a single approach, using quantitative and qualitative approaches could provide rich data.
2. Practicality. It is suited to most methodological tools and addresses pertinent research questions.
3. Enhanced validity. When a hypothesis or model is supported by multiple and complementary types of data, the researcher will be confident enough to reach exact conclusions.

Dawadi, Shrestha and Giri (2021:25-36) classify mixed methods as simultaneous and sequential planning. Both qualitative and quantitative data is gathered simultaneously in the concurrent design. In sequential designs the quantitative and qualitative data build on each other. Sequential designs might be exploratory, explanatory, or embedded consecutively. In this study, the researcher used an exploratory sequential mixed methods design to describe and explore factors contributing to the occurrence of the research problem.

3.3.2. Exploratory sequential mixed methods:

It is an approach of combining qualitative and quantitative data collection and analysis in a sequence (Creswell & Plano Clark 2018:291). The exploratory sequential mixed methods adopted in this study was characterised by data collection and analysis in two different phases in sequence. The research question was explored qualitatively first and from its analysis the researcher developed questions for the quantitative phase. Therefore, in this regard the qualitative results helped develop the quantitative method which was the second phase of the study. The mixing took place in the third and last phase (Dewasiri, Weerakoon

& Azeez 2018; Walker & Baxter 2019:1-2). When attempting to comprehend a complex phenomenon, researchers often use an exploratory study approach (Reynolds & Guest 2015:14).

In this study an exploratory sequential mixed methods design was employed to explore how and why adolescents living with HIV are instantly affected with pulmonary tuberculosis Issues related to TB/HIV. Dual infection among adolescents is a highly delicate and complex phenomenon that may be impacted by several social, cultural, economic, and political elements. A single research design method was not believed to be adequate to address those multiple factors.

3.3.2.1. Qualitative research methods

Qualitative research methods deal with collection and analysis of non-numerical data to understand views, concepts, opinions or experiences. They can be used to gather in-depth insights into a problem or generate new ideas for research (Merriam & Grenier 2019). Qualitative methods explore text and image data, have their own approach in data analysis, and draw on diverse designs. Information collected from different individuals, observing their behaviour and using the available information within their context is a peculiar feature of qualitative research (Creswell & Creswell 2018:300).

In this study the researcher used an exploratory sequential mixed methods design. He started with a qualitative method with the intention of examining and describing the experiences of the adolescents by conducting focus group discussions and key informant interviews on the availability and accessibility of the TB/HIV prevention programme. He further observed and understood institutions' day-to-day routine actions, events and processes in the environment in which they occur and explored and described challenges that are faced in the implementation of interventions. This helped to address the problem of TB/HIV dual infection in Hawassa, Southern Ethiopia.

In the qualitative phase of this study the researcher further assessed the prevention strategy of TB/HIV dual infection in Ethiopia especially in Hawassa town. Documents on the existing TB/HIV prevention and control strategy were reviewed, analysed and described using a checklist based on the national standard. This enabled the researcher to explore threats and

opportunities which could facilitate the design of a better strategy for implementation of TB/HIV prevention and control.

3.3.2.2. Quantitative research methods

Quantitative research is a method for generating numerical information about what we see, feel or hear. It is conducted to describe concepts, events, new situations or examine relationships among different types of variables (Bloomfield & Fisher 2019:27-30). It is the process of collecting and analysing quantitative data. It is used to find averages, make predictions, test associations among different variables, and generalise results to wider populations (Polit & Beck 2018:209). According to Bloomfield and Fisher (2019:27-30), a quantitative research method is a research approach that focuses on processes such as collection, organising, analysis and interpretation of data. It is one of the characteristic features of a deductive approach in which emphasis is placed on the testing of hypotheses. It is derived from the social and natural sciences. This research approach supports the empirical investigation of observable situations to test and understand possible associations. It is done through a spectrum of quantifying methods and disciplines, reflecting on its widespread utilisation as a research approach across differing academic fields.

According to LeTourneau University (2021), quantitative research deals in numbers, logic, and an objective stance. Quantitative research focuses on numeric and unchanging data and detailed, convergent reasoning rather than divergent reasoning. Its main characteristics are:

- The data is usually gathered using structured research instruments.
- The results are based on larger sample sizes that are representative of the population.
- The research study can usually be replicated or repeated, given its high reliability.
- The researcher has a clearly defined research question to which objective answers are sought.
- All aspects of the study are carefully designed before data is collected.
- Data is in the form of numbers and statistics, often arranged in tables, charts, figures, or other non-textual forms.
- The project can be used to generalise concepts more widely, predict future results, or investigate causal relationships.

- The researcher uses tools such as questionnaires or computer software to collect and analyse numerical data.

In this study the quantitative methods explored, identified and described the determinants of TB infections among the adolescents in Hawassa, Ethiopia in the second phase of this study. Data from both phases was then mixed in the final analysis to provide a more complete description on adolescents' experiences as well as the determinants of TB infection among them in Hawassa, Ethiopia. The findings inform development of the proposed strategy to prevent TB infections among HIV positive adolescents in Hawassa, Ethiopia.

3.3.3. Research design in quantitative study

There are many types of non-experimental studies, including descriptive research (Polit & Beck 2018:329). Kumari (2021:51-63) additionally identifies a descriptive investigation as pertinent information to conceptualise a research challenge. Polit and Beck (2018) explain that a descriptive study involves the researcher reporting, observing, and describing quantifiable features of the situation in a specific setting as a first step in developing theory. Furthermore, this sort of research design is mostly employed in social and health science research to characterise "the opinions, feelings, attitudes, and beliefs people have" about particular phenomena (Nayak, Singh, Padhye & Wang 2015:1-16).

In phase two of the study, a structured questionnaire was used to gather quantitative data for conducting face-to-face interviews and clinical record review to explore, identify and describe the determinants of TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia. The questionnaires were pre-tested on 10% of the sampled adolescents to reduce error and to check its consistency, reliability and to modify the questionnaire before the main study was conducted. Questionnaires were prepared prior to the actual data collection. The questionnaire provides the respondents with a brief explanation of the purpose of the research. The questionnaires were administered to those who have consented to taking part in the study. The quantitative phase addressed objectives in phase two.

3.3.4. Analytic epidemiological study

According to Nordholm-Carstensen, Wewer, Zhao, Weimers, Seidelin and Burisch (2021), analytic epidemiological study compares the exposure status of patients who have the

disease of interest with that of a comparison group. For successful comparison, individual factors such as demographic, constitutional, behavioural characteristics are considered. In this case it is said to be matching. These types of study aim to identify different populations in terms of presence or absence of exposures of interest. This helps to identify risk factors of disease. The main purpose of group comparison is to reach conclusions on the existence of associations between exposure and disease. Appropriateness of analytical study is determined by the formulated objectives. Analytical studies have two broad classifications such as observational and experimental studies. In experimental studies, the researcher studies the outcome of certain interventions. The investigator is not expected to intervene in an observational study. S/He simply observes and examines the relation between exposure and disease variable. Observational studies are of four types: cross-sectional studies, cohort studies, longitudinal studies and case-control studies (Merrill 2019:153).

3.3.4.1. Case control study

According to Zeni (2019:161), a case control is a study which compares individuals who have a disease or cases with individuals who do not have the outcome of interest. It assesses back to compare the frequency of the exposure to the expected risk factor to identify the possibility of association between the risk factor and the disease of interest. Case control studies are observational because no intervention is attempted, and no attempt is made to alter the course of the disease. The goal is to retrospectively determine the exposure to the risk factor of interest from each of the two groups of individuals: cases and controls. In this analytic study cases are identified as to whether they belong to the exposed or unexposed group. Patients in the control group are considered as exposed and unexposed categories. The purpose of identifying a control group is to determine the size of the exposed and unexposed segments of the source population.

In this study's quantitative segment, a case control study was employed. Cases were those adolescents diagnosed as having both tuberculosis and HIV, whereas controls were those adolescents living with HIV but diagnosed as having no tuberculosis. The purpose of this observational study was to identify determinant factors of tuberculosis among HIV positive adolescents. This may help to design an appropriate disease prevention strategy against tuberculosis.

3.3.5. The triangulation method

Triangulation is the employment of diverse data gathering methods within a single study to ensure that the results reveal what the researcher hopes they will reveal. It “refers to the use of multiple referents to draw conclusions about what constitutes truth and has been compared to convergent validation” (Polit & Beck 2018:793). “Triangulation is supposed to support findings by showing that at least three independent measures agree with it or, at least, do not contradict it” (Noble 2019:67-68). But it is not as simple as that. For one thing, if two measures agree and one does not, the researcher is stuck with a deeper question: “Which one is believed to have more relation with the finding?”

According to Flick (2018:527-544), to maximise the strengths of both quantitative and qualitative research approaches while minimising their drawbacks, triangulation design aims to collect various but complementary data on the same subject. Triangulation refers to the application and combination of several research methods in the study of the same phenomenon. By combining multiple observers, theories, methods, and empirical materials, researchers hope to overcome the weakness or intrinsic biases and the problems that come from single-method, single-observer, and single-theory studies (Polit & Beck 2018:419).

The researcher collected data using different methods to achieve triangulation: key informant interviews, focus group discussion and document review methods in the qualitative phase and face-to-face interviews using structured questionnaires in the quantitative phase of the study. In this study space and person triangulation was achieved by examining the determinants of tuberculosis among HIV positive adolescents at different levels of public health centres through interviews with both TB and HIV sufferers as well as members of their families, using the above qualitative and quantitative data collection methods. When those conditions occur in the same period and the findings are integrated at the interpretation phase data triangulation is evident.

3.3.5.1. Methodological triangulation

Utilising multiple data gathering techniques or research approaches to study the same topic is known as methodological triangulation. Structured questionnaires were employed to get quantitative data, and a semi-structured interviewing guide was used to gather qualitative data (Heesen, Bright & Zucker 2019:3067-3081).

3.3.5.2. Space triangulation

Space triangulation entails gathering information on the same subject from other sites to check for uniformity across sites (Polit & Beck 2018:419). Data was gathered from two purposefully selected hospitals and two health facilities.

3.3.5.3. Person triangulation

Person triangulation involves gathering information from various kinds or levels of people (Polit & Beck 2017:793). This aims to validate data by using several viewpoints on the subject. Data was gathered from TB/HIV patients receiving ART in clinics, their guardians, as well as public officials working on prevention and control of TB/HIV.

3.3.5.4. Data triangulation

Data triangulation is achieved using several sources of data to find holistic perspectives using a variety of data on a particular subject to assess the veracity of the conclusions. Analysis of the data gathered is possible using multiple methods of authentication (Polit & Beck 2018:419). Information was gathered from TB/HIV patients enrolled in ART clinics for chronic care and support, their family members and public officials representing different sector organisations collaborating in the existing health system. Data from different sources provide enriched information to the study for reaching valid conclusions (Creswell & Plano Clark 2018:245-246).

3.3.5.5. Investigator triangulation

This concerns a phenomenon where at least two researchers with specific roles and different educations investigate the same situation (Moon 2019:103-105). If there is only one investigator, potential bias is likely to occur. This study included one coordinator of overall data gathering and nine qualified research assistants. All of them had a health background to interview the adolescents during administered interview sessions of the quantitative phase of the study. The stages of the study that entailed analysis and interpretation were not shared with the research assistants. This measure is believed to minimise bias. To enhance the validity and reliability of the study, a statistician was hired by the researcher to analyse the quantitative data, and another skilled individual was hired for the analysis of the qualitative data. These measures were intended to guarantee the study's reliability and validity (Hayashi, Abib & Hoppen 2019:105).

3.4. RESEARCH METHODS

Research methods relate to techniques for acquiring data for a study (Bryman 2016:40). The terms "research methods" and "study structure procedures" are also used interchangeably. (Polit & Beck 2012:743). These techniques are used, as Polit and Beck suggest, to methodically gather and evaluate data pertinent to the study subject (2012:118-136). Consequently, the research methodologies are used to determine the quality of the findings. To gather and analyse data, choose a sample, and arrive at valid and reliable results, researchers must follow appropriate research methodologies (Bryman 2016:40). The study's research techniques included population definition and identification, sampling, sample size, data collection, and data analysis, as well as guaranteeing validity, reliability, and ethical issues for both qualitative and quantitative phases.

3.4.1. Study population

According to Majid (2018:1-7), the population of a study is an exhaustive grouping of all components or subjects the researcher is interested in for a specific investigation and from which conclusions are to be drawn. A person, group, organisation, nation, thing, or any other entity about which researchers desire to draw scientific judgements may serve as the unit of analysis. The general, target, and accessible groups are the three kinds of population used in research (Grove, Burns & Gray 2012:350).

A generic population is a collection of individuals who share the traits or features that make up the subject of a research study (Grove et al 2012:351). A target population, according to Polit and Beck (2012:744), is the entire population in which the researcher is interested. The researcher can extrapolate the research findings from this target demographic because they meet all the inclusion requirements. The term "accessible population" pertains to respondents who were selected from the study's target demographic and contacted by the researcher during data collection (Polit & Beck 2012:307). Below is a description of the population for both the qualitative and quantitative stages.

3.4.1.1. Study population for qualitative study

The overall population for the qualitative segment of this study were all adolescents, their guardians and all public officials living or working in Hawassa city. The target population were adolescents aged from 13 to 24 with TB and HIV or only HIV who were in chronic care

centres, guardians of those adolescents, and public officials who were focal persons for TB/HIV prevention/control programmes in their institutions which were located in Hawassa town. The accessible population comprised those adolescents aged from 13 to 24 with TB and HIV or only HIV who were in chronic care centres, and public officials who were focal persons for TB/HIV prevention/control programmes who were available during the period of data collection.

3.4.1.2. Study population for the quantitative phase

The entire population in the quantitative segment of the study were adolescents living or working in Hawassa city. The target population were adolescents aged from 13 to 24 with TB and HIV or only HIV who were in chronic care centres. The accessible population were those adolescents aged from 13 to 24 with TB and HIV or only HIV who were in chronic care centres and who were available during the period of data collection

3.4.2. Sampling techniques

Sampling is the process of deciding which research participants will have their data collected (Rahman, Tabash, Salamzadeh, Abduli & Rahaman 2022:42-51). To recruit participants for this study, the researcher used particular sampling strategies that were suited for the subject at hand (Rahman et al 2022:42-51). Generally, both probability sampling and non-probability sampling are types of sampling procedures (Rahman 2022:42-51).

With probability sampling, each component of the population has a known non-zero chance of being included in the sample (Berndt 2020:224-226). Probability sampling embraces random selection, allowing a researcher to make strong statistical inferences about the population, thus the ideal choice for a study that needs to be representative (Lohr 2021:1-20).

On the other hand, using the technique of "non-probability sampling", the researcher consciously chooses subjects based on convenience or other criteria, allowing the researcher to collect data for the study (Rahman et al 2022). Non-probability sampling involves non-random selection (Polit & Beck 2018).

Sampling is further defined as “selecting a given set of population to draw inferences and conclusions for one’s study” (Mukherjee 2020:93). Polit and Beck (2017:250) define sampling as a process of identifying elements to represent the population considered for actual inclusion in the study. Guided by Creswell (2015:76), sampling in mixed methodology is the procedure of selecting participants in both quantitative and qualitative research. The researcher views sampling as the process of obtaining a study sample.

3.4.2.1. Sampling techniques for the qualitative study

In the qualitative phase of this study a purposive sampling method was used. According to Gray et al (2016:418), purposive sampling is a method that is used to select the participants that are information-rich and will assist in achieving the purpose of the study. The researcher considered focal persons of TB/HIV in public institutions and adolescents with their guardians who were following chronic care in an ART clinic as information-rich persons and conducted key informant interviews and a focal group discussion respectively at a convenient time and place.

3.4.2.2. Sampling method for quantitative study

To select the study subjects for the quantitative phase, a sampling frame was compiled with the help of the antiretroviral treatment unit in Hawassa. Only adolescents who were on TB/HIV clinical follow-up in four purposely selected health institutions were considered. These four health institutions located in Hawassa town were select due to their high number of TB/HIV cases and for having better TB/HIV diagnostic centres at which false positive cases were expected to be non-considerable. Since the study was a case control study, the sampling technique was based on the disease (tuberculosis) outcome status of the study participants. Cases were those ART clinics’ adolescents diagnosed as having both tuberculosis and HIV. Controls were those adolescents who were living with HIV and diagnosed free of tuberculosis.

Rezigalla (2020:e6692) indicates that this type of sampling ensures the exposure of interest in cases as well as controls and helps to study the association between the exposure and outcome in these study participants. For each health centre a sample was calculated with 1:2 ratio for cases and controls respectively. Ninety-seven cases (those clients with both TB/HIV) and 194 controls (those clients with only HIV) were used in the sample distribution.

A 10% non-respondent rate was considered to make the total sample size 321. The distribution of the sample is indicated in the following table:

TABLE 3.1: DISTRIBUTION OF QUANTITATIVE STUDY SAMPLE IN DIFFERENT HEALTH FACILITIES OF HAWASSA TOWN

SN	Name of the health institution	Allocated sample size with (1:2) case control ratio		Total sample size allocated for the given institution
		Cases	Controls	
1	Hawassa University Referral Hospital	43	87	130
2	Adare General Hospital	30	59	89
3	Hawassa Millennium Health Centre	17	34	51
4	Alamura Health Centre	17	34	51
Total		**107**	**214**	**321**

3.4.3. Eligibility criteria

According to Polit and Beck (2018:547), eligibility criteria are the criteria indicating the peculiar characteristics of the target population according to which individuals get the chance to be selected for a study. It is stated in the form of inclusion and exclusion criteria:

3.4.3.1. Criteria for inclusion in the qualitative phase

- Public officials who were TB/HIV programme focal persons in the four selected public institutions of Hawassa town and willing to participate in the study.
- Adolescents and their guardians who were on TB/HIV chronic clinical care in Hawassa town and willing to participate in the study.

3.4.3.2. Exclusion criteria for the qualitative phase

- Public officials who were TB/HIV programme focal persons but not in the four public institutions of Hawassa town.
- Public officials who were not TB/HIV programme focal persons in the four public institutions of Hawassa town.
- Public officials who were TB/HIV programme focal persons in the four public institutions of Hawassa town and not willing to participate in the study.

- Adolescents and their guardians who were not on TB/HIV clinical care.
- Adolescents and their guardians who were on TB/HIV clinical care and not willing to participate in the study were excluded from the study.

3.4.3.3. Inclusion criteria for the quantitative phase

- Adolescents in the age range 13-24 and willing to participate in the study.
- Adolescents not included in the pilot study.
- Adolescents on TB/HIV chronic clinical care in the four selected health institutions.
- Adolescents who were physically fit to participate in the study.

3.4.3.4. Exclusion criteria for quantitative phase of this study

- Adolescents not willing to participate the study.
- Adolescents not from the four selected institutions.
- Adolescents who were critically sick and weak.
- Adolescents who were included in the pilot study.
- Adolescents in the age range younger or older than the required age range of 13-24 in the chronic TB /HIV clinical care.

3.4.4. Sample size

A sample size is defined as the number of individuals who participate in a study, and it is an important factor for statistical analysis and ensures validity of a quantitative research study. A sample is a subset of a population to be considered for inclusion in the study (Polit & Beck 2018:248). According to Holloway (2020:364-374), about six to eight participants may be used in a qualitative study consisting of a homogeneous group of individuals.

3.4.4.1. Sample size for the qualitative study

The number of public officials in this study could not be pre-determined, but the data collection continued until no new information was gathered; that is, until data saturation. It was envisaged that the focus group discussion (FGD) of the adolescents would be comprised of six groups of adolescents and six groups of their guardians, so each group was estimated to comprise at least six participants.

3.4.4.2. The sample size for the quantitative study

Sample size for the case control study in the ratio of 1:2 was calculated using Epi-Info version 7 software based on research findings on the major determinant factors of TB/HIV infection, i.e., advanced WHO clinical stages (III & IV), which was conducted in Nekemet town, Ethiopia (Hatoluf, Seyoum & Dessie 2013:4).

- Sample size formula for case control studies

$$n=\frac{(r+1)}{r} * \frac{P\,(1-P)\,(Z_{1-\beta} + Z_{1-\alpha/2})^2}{(P_1-P_2)^2}$$

n=Desired sample size

r = Control to cases ratio (2:1) =2

p = Proportion of population = $(P_1+P_2)/2=0.64+0.46/2 = 0.55$

$Z_{1-\beta}$ = It is the desired power (0.84 for 80%)

$Z_{1-\alpha/2}$ = Critical value and a standard value for the corresponding level of confidence (At 95% CI or 5% type I error it is 1.96)

P_1 = Proportion in cases (63.9%=0.64) } the proportions are found from similar studies

P_2 = Proportion in controls (45.8%=0.46)

$$n=\frac{(2+1)}{2} * \frac{0.55\,(1-0.55)\,(0.84 + 1.96)^2}{(0.64-0.46)^2}$$

(n) = 1.5 * 64.68

(n) = 97

- Since the case control ratio is (1:2)
- 97 for cases and 97 * 2=194 for controls
- 97+194=291 is a sample size
- Considering 10% dropout of study participants 291+29.1=321

Total sample size for qualitative phase (n) = 321.

3.4.5. Data collection procedure

Data collection refers to a structured plan that indicates the process of acquiring data to solve a research problem (Polit & Beck 2018:296). According to LoBiondo-Wood and Haber (2021:450), the quality of one's study can be determined by the accuracy of data measurement tools and methods.

The process for data collection commenced after the ethical clearance was obtained from UNISA's Health Studies Research Ethics Committee. The ethical clearance paved the way for requesting and obtaining permission from the newly established 10th region of Ethiopia, Sidama Regional State, in which Hawassa town is located. The data collection tools were developed in advance of data collecting, as described in the following paragraphs.

3.4.5.1. Creation and management of data collection tools

3.4.5.1.1. The interview guides

An interview guide is an instrument used by the interviewer and it contains questions that are asked orally in a face-to-face interview (Polit & Beck 2012:742). The structured guide for the focus group discussion with the adolescent clients contained open-ended questions classified as grand tour questions and six follow-up questions. Two different types of question were prepared for two different categories (adolescents with diagnosis of TB/HIV) and mothers or fathers of those adolescents. Separate guidelines for interviews with key informants were employed for the public officials working in TB/HIV prevention and control. The questions were intended to probe the current TB/HIV prevention and control activities/strategies in Hawassa town, the efforts of different institutions in the prevention and control of the disease, and challenges in implementing those activities. Moreover, possible recommendations from all discussants were sought. The interview guide had two distinct parts: Part I of the patients' interview questionnaire consisted of socio-demographic characteristics and Part II consisted of questions to assess TB/HIV control activities, possible challenges and recommendations.

The researcher used an audio recorder and took notes to ensure that all the data collected were accurate. Participants were assigned unique numbers for the purpose of anonymity; these numbers were used on the consent form as well. For the purpose of anonymity and confidentiality the audio recorder and notes were locked in a locker at the researcher's home,

and the consent forms were also locked away but separately from the audio and the notes. This data will be kept safe for five years after the thesis has been published.

To ensure the safety of the participants during the interviews, the researcher provided sanitisers and ensured implementation of the following measures stipulated by the WHO (2020a:3) to limit the spread of COVID-19.

- Hand wipes and sanitizer were provided and utilised to decontaminate the hands frequently throughout the process.
- Face masks were provided to be worn by both the participants and the researcher throughout the process.
- Social distancing of one meter was applied throughout the process.
- Hand sanitizer was used to sanitise the equipment such as the tape recorder, pen, and other equipment that may be necessary.

The qualitative phase aimed to achieve all objectives stated under phase 1 of the section under objectives. As to administration of the key informants' interviews and focused group discussions, face-to-face interviews were conducted using the interview guide with interactions between the study participants and the researcher. Polit and Beck (2018:394) emphasise that conducting interviews takes a variety of abilities. Interviewer expertise has a significant impact on the quality of interview data. The researcher made every effort to make the participants feel at ease so that they would feel comfortable sharing their ideas and beliefs. Focus group discussions were carried out at Hawassa University Referral Hospital. The researcher tried to keep to the participant's convenient time and to avoid bias (Polit & Beck 2018:394). As to the key informant interview, government officials who were TB/HIV prevention and control focal persons in their workplace were communicated with in their offices. Questions were communicated orally in Amharic as they were scheduled tentatively. The responses in the focus group discussion were recorded with an android version smartphone utilising the participants' own words. The researcher employed note taking and audio recording for all FGDs and key informants' interview (KII) sessions. The interviewers made an effort to allow for the comprehension level of each participant's responses, and sometimes it was necessary to ask the same questions again, to elicit further useful information. Prior to the interviews, the researcher and his assistants explained the purpose

and procedure and requested oral consent to use an audio tape-recorder. Participants in the study were advised that all information would be handled with extreme care for confidentiality. After receiving informed consent, the interviews began. The participants were assured they may quit the interview at any time, even if they had previously given their agreement. The data was transcribed following the qualitative component's interviews (Krosnick 2018:439-455).

3.4.5.1.2. Developing a checklist for assessment of policies and strategies in Ethiopia

Document review is a method of collecting data by reviewing available documents. The documents may be a programme or implementation strategy (such TB/HIV prevention and control strategies). Documents may be hard copy or electronic and may include reports, programme logs, performance ratings, funding proposals, meeting minutes, newsletters, and marketing materials. Document review is one of the most commonly used and powerful methods in health policy research (Dalglish, Khalid & McMahon 2020:1424-1431).

In the qualitative part of this study, various kinds of literature were assessed to identify gaps in TB/HIV prevention and control policies and strategies particularly in the southern part of the country. Policies and strategies targeting adolescents' health care were emphasised. The two strategic documents studied were: the National Strategic Plan Tuberculosis and Leprosy Prevention and Control 2006–2013 Ec (2013/14–2020/21) and the HIV/AIDS Strategic Plan 2015–2020 in an investment case approach. The policy and strategy assessment parameters were:

- Availability of elements of good practice as preventive measure against TB/HIV among adolescents in terms of protecting and promoting the health of adolescents and the community in general by building the capacity to deal with crises, linking with medium term and sub-national plans concerning adolescents' TB/HIV prevention, and linkage with programmes supporting adolescents' TB/HIV prevention.
- Better support for better policies, strategies and plans focusing on adolescents' TB/HIV prevention activities in terms of building on a sound situation analysis and inclusive priority setting, process management in respect of addressing TB infection among the HIV positive adolescents, ensuring coherence between the national health policy, strategy and plan, and the operational plans of disease specific programmes, and

building the institutional base based on performance monitoring and evaluation feedback.

The findings of the two strategy and policy documents: National Strategic Plan Tuberculosis and Leprosy Prevention and Control 2006–2013 EC (2013/14–2020/21) and HIV/AIDS strategic plan 2015–2020 were analysed as they focus on:

- The link and coherence between the regional and national strategic plan with the operational plan addressing a decentralisation approach.
- Inclusion of policy dialogue beyond the public and health sector since it emphasises the framework for planning policy and strategy (WHO 2016:1-20).
- Equitable distribution of resources for disease control programmes especially for TB/HIV, as it is one of the challenges in most developing countries (Moyo, Young, Gouws, Naidoo, Wamicwe, Mukui, Marsh et al 2018:e0201899).
- Community engagement including adolescents in disease prevention and control programmes. As it is informed by TB/HIV risk communication activity, partners collaboration with political advocacy and community engagement, coupled with vaccine trials has triggered the hope of finding the indefinable and miraculous advance to control TB/HIV (Sachdeva, Parmar, Rao, Chauhan, Shah, Pirabu, Balasubramanium et al 2020:1-8).
- Implementation of behavioural change communication models as they are a cornerstone in practising the preventive measures against infectious diseases (Nwagu, Abugu, Yohanna, Eze, Ononuju & Obayi 2020:1-10).
- Adherence to good governance and leadership in terms of resource mobilisation, drawing the attention of partners for technical and financial support, implementation of monitoring and evaluation techniques for better activity performance (Adoyo 2020:36-37).
- Strengthening research works focusing on health problems of adolescents. As the research focuses on adolescents, it is highly important to improve adolescent health care. This is because adolescents often are not adequately represented in research works assessing their health seeking behaviour (Bundy, De Silva, Horton, Patton, Schultz & Jamison 2017:1-6).

3.4.5.1.3. Developing questionnaires

For this research quantitative data collection tools were developed and used for each level of data collection activities. For the quantitative phase data collection, a questionnaire administered by an interviewer was created. For data analysis to be easy, the questionnaires had to be clear, non-confusing and to the point (Polit & Beck 2018:260). The questionnaires drew on the literature analysis relevant to determinant factors for TB/HIV co-infection, the study's goals and its theoretical foundation. The researcher also considered other pertinent resources that researchers have utilised in related studies and that make use of some of the study variables in this study. Most of the questionnaires used were closed ended in such a way that the respondents were limited to choosing equally exclusive response options. Closed ended options offer coding and statistical analysis of aggregated data. They further ensure obtaining the desired information, at which the reliability of the study will be secured (Saunders, Sim, Kingstone, Baker, Waterfield, Bartlam, Burroughs & Jinks 2018:28-53). Interviewers translated the surveys into Amharic, the country's official language, and some terminology and phrases were further explained to aid comprehension.

- *Structure of the questionnaire for the respondents*

The questionnaires for the respondents in the quantitative phase addressed both TB and HIV patients. The questions were structured to assess determinants of tuberculosis based on appropriate variables. The quantitative questionnaires were divided into two main sections and eight sub-sections (parts).

Section "A" Data collection with interview

Interviews are methods of data collection that take place between two or more people through a series of questions and answers for exchanging information using a guiding framework (Powell & Brubacher 2020:645-659). This section covers from Part I to Part III as follows:

Part I: was designed to assess socio-demographic factors associated with TB infection.

Part II: contained questions designed to assess environmental factors associated with TB infection such as condition of the house, waste disposal system, persons per room and house shared with animals.

Part III: Host factors associated with TB infection such as history of smoking, history of other respiratory diseases, taking ART, IPT, cotrimoxazole preventive therapy (CPT) and previous history of TB.

Section "B" Data collection from patient clinical records

Medical record review deals with the critical assessment of patient's healthcare data. It deals with searching, reviewing, inferring and analysing the facts in a medical record (Kim, Ryu, Cho, Heo, Kim, Lee, Jung et al 2019). Medical record analysis is the comprehensive assessment, review, evaluation, and interpretation of medical records. It is conducted by medical officers, clinical nurses, midwives, and other health professionals who have a comprehensive knowledge of medicine and experience in interpreting clinical data (Madden, Lydon, Curran, Murphy & O'Connor 2018:192-201). To identify determinants of tuberculosis among HIV positive adolescents from the clinical record review, the researcher assessed the medical records of interviewed clients to get further information which could not be accessed through interviews. This section covers from Part IV to Part VIII as follows:

Part IV: Clinical variables associated with TB infection such as the WHO clinical staging, haemoglobin level, CD4 count, viral load test and BMI.

Part V: Patients' clinical record review such as diagnosis, co-morbidity opportunistic infections treatment status, laboratory diagnosis findings, evidence of drug resistance.

Part VI: Treatment status such as start of anti TB/HIV, evidence of drug resistance and treatment outcome.

Part VII: Laboratory test findings such as sputum for acid-fast bacillus (AFB), tissue biopsy, urine for microscopy, stool test and Cerebrospinal fluid (CSF).

Part VIII: Additional clinical finding and diagnosis

- *Sampling frame*

All TB and HIV patients discovered at the individual health facilities at the time of data collection made up the sampling frame for the quantitative design, which continued until the sample size requirement was reached. In general, three clients (ranged 1 – 6) from two hospitals and two health centres were interviewed per day. The data collectors took a

minimum of one month and a maximum of four months to complete the required sample size for a specific healthcare facility.

- *Pilot testing of the questionnaire*

A pilot study is what Polit and Beck (2018:266) refer to as a scaled-down version or trial created to evaluate the procedures to be applied in a more substantial and extensive investigation. It is carried out to find any potential flaws in a data collection tool. Saunders et al (2018:28-53) see its objective as to update questionnaires so respondents will not encounter any issues in responding to each question and there will not be confusion in completing the data. The researcher assessed questions for validity and reliability of the data that was collected. Polit and Beck (2018:267) write that pre-testing a questionnaire:

1. Helps define the research question.
2. Tests the proposed study design and process. This could alert to issues which may negatively affect the project.
3. Educates oneself on different techniques related to the study.
4. Tests the safety of the medical treatment in preclinical trials on a small number of participants.
5. Determines the feasibility of the study, so one does not waste resources and time.
6. Provides preliminary data that one can use to improve his/her chances for funding and convince stakeholders that he/she has the necessary skills and expertise to carry out the research successfully.

Thirty-two (10%) patients with TB and HIV from Hawassa University Referral Hospital who were not among the selected study units participated in the pre-testing of the questionnaire by the researcher to identify any gaps in the measurement tool. The pre-test helped determine how long it would take to finish the questionnaire and helped to identify questions that were ambiguous and difficult to understand.

- *Training the research assistants*

For the quantitative and qualitative components of this study, the researcher hired and recruited eight research assistants. In order to gather information from ART patients, the research assistants conducted interviews, and administered quantitative questionnaires. Moreover, two health professionals were employed to control the research assistants. The

researcher required effective communication abilities and fluency in both written and spoken Amharic – the official language of Hawassa town – and English from the research assistants. Furthermore, they had to have a public health profession background, a first degree at graduate level, and previous experience in data collection. Data collectors' training was given to ensure standardisation of the data collection process. Depending on their prior experience, the training covered both the general procedures such as how to conduct an interview and those specific to this study, such as how to exercise administration of questions, as well as how to conduct research in accordance with ethical principles. A round of questions and answers with some demonstrations followed the interactive training, until the research assistants were comfortable with the procedure (Polit & Beck 2018:382-383). The two-day training involved the senior clinical nursing specialist with a master's degree to be overall supervisor during the training and at time of data collection. Eight data collectors received training, and following the evaluation, they were qualified to continue with the data collection. The coordinator of the overall data collection process met with each of them frequently throughout the data collection period to discuss immediate corrective action. All data collectors performed their activity according to expectations during the process. Before data entry, inconsistent and incomplete questionnaires were rejected without causing any issues.

- *Administration of the questionnaire*

Data collection involved the use of questionnaires. Interviewer-administered questionnaires were used by data gatherers to conduct interviews with the allocated sample until the predetermined sample size for that particular healthcare facility was reached. All research assistants were assigned purposefully in their places of work which were included in the selected study site. The data collection period was from 10 September 2021 – January 30, 2022.

Based on sampled cases that were proportional to the facility's overall TB/HIV patient load, the sample size for each facility was determined. Data collectors were given allowances for their level of effort based on the number of questionnaires they administered. They were also expected to be available by 9:00 at the designated health facility. Interviews were conducted before working hours, primarily when patients were in their waiting rooms, without interfering with the regular delivery of services. Each data collector was given permission to conduct a maximum of 15 interviews per day, expecting that each interview would last 30 minutes. This

ensured that the data gatherers would not rush, thus preserving the data's quality. Furthermore, research assistants had frequent meetings with the data collection coordinator to turn in the completed surveys and go through the day's events.

- *Recruiting respondents and participants for the study*

The potential respondents and participants in the selected study places were given information about the study and requested to sign consent forms upon voluntarily agreement to be interviewed or participate in discussion. The interview guides and questionnaires developed by the researcher through the use of relevant literature and validated by the supervisor were used to collect data in the two phases respectively. The qualitative phase covered objectives in phase one (1) and the quantitative phase covered objectives in phase two (2).

- *Obtaining consent for participation in the study*

A consent form is a written agreement document signed by a study participant and a researcher concerning the terms and conditions of voluntary participation in a study (Polit & Beck 2018:542). For this study consent was obtained from the respective study sites.

- *Obtaining consent for participation in the study, the qualitative phase*

Each focus group discussion and key informant interview followed an appropriate ethical procedure. The purpose of the research was described to potential respondents (TB/HIV focal persons in government institutions Hawassa city, adolescents in chronic care centres and their guardians) in a language they could understand, so that they had the knowledge necessary to participate in the conversation or interview.

- *Obtaining consent for participation in the study, the quantitative phase*

Each interview was underpinned by proper ethical considerations. The aim, dangers, and advantages of the study were explained to participants (Adolescents with TB or TB and HIV in chronic care centres in Hawassa city) in a language they could understand, so that they could decide whether to participate in the study. First-hand information enabled the participants to give informed permission. They were informed that they were under no obligation to participate, that they might decline and could leave at any time if they felt uncomfortable.

- *Recruitment of participants (qualitative phase)*

After providing the necessary information and requesting participants to sign consent forms upon voluntarily agreement to be interviewed or participate in discussion, the FGDs were conducted by the researcher with the adolescents and with their guardians who met the inclusion criteria. The key informants who were public officials representing Hawassa Town Health Office, Hawassa Town Education Office, Hawassa Town Media Centre and Hawassa Town Women Children and Youth Affairs were visited in their offices. The interviews with the key informants/public officials were followed by focus group discussions with the adolescents and their family members. The FGDs were used mainly to explore adolescents' views on the research question (Baku, Agbemafle, Kotoh & Adanu 2018:1-13).

- *Recruitment of respondents (quantitative phase)*

The potential respondents and participants in the selected study sites (Hawassa University Referral Hospital, Adare General Hospital, Alamura Health Centre and Hawassa Millennium Health Centre) were given information about the study and requested to sign consent forms upon voluntarily agreement to be interviewed or participate in discussion. The interview sessions were conducted after the development of questionnaires by the researcher through the use of relevant literature and validation by the supervisor.

Data was collected by using a structured questionnaire to explore, identify and describe the determinants of TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia. The questionnaires were pre-tested on 10% of the sampled adolescents to reduce error and to check its consistency, reliability and to modify the questionnaire before the main study. The questionnaire offers a brief explanation of the purpose of the research and was administered to participants who had consented to take part in the study. The quantitative phase covered the objectives in phase two.

3.4.6. Improving data quality and integrity

Quality refers to the scientific process consisting of all aspects of study design and the match between the methods and questions, selection of subjects, measurement of outcomes, and avoidance of different types of bias. The use of multiple approaches enhances the accuracy of findings as well as convinces readers about its accuracy (Creswell & Creswell 2018:313-326).

3.4.6.1. Improving qualitative data quality and integrity

Bhandari, Schutte, Jayasuriya, Vaidya, Subedi and Narasimhan (2021:e052986) define qualitative research broadly as follows: “Qualitative research involves collecting and analysing non-numerical data (e.g., text, video, or audio) to understand concepts, opinions, or experiences. It can be used to gather in-depth insights into a problem or generate new ideas for research.” The United Kingdom Economic and Social Research Council (ESRC 2021) states that qualitative methods are “scientific, but are focused more on the meaning of different aspects of peoples’ lives, and on their accounts of how they understand their own and others’ behaviour and beliefs”. In qualitative research, reliability and validity are not studied independently as they are in quantitative studies; rather, concepts that incorporate both are employed – such qualities as credibility, adaptability, and dependability (Polit & Beck 2018:416).

3.4.6.1.1. Trustworthiness

According to Athanasou, Di Fabio, Elias, Ferreira, Gitchel, Jansen, Mpofu (2012:140), Perakyla defines the collection, organisation, and classification of data as the basis for trustworthiness. On the other hand, Stahl and King (2020) citing Lincoln and Guba (1985) note that trustworthiness embraces credibility, dependability and conformity.

3.4.6.1.2. Credibility

Holloway (2005:290) explains that credibility measures how well the research findings accurately explain the phenomenon being studied. While Lee, Zhang and Abitbol (2019:413-429) mention that credibility is established by the researcher's interpretation of the data collected. In the current study, credibility of the findings in the qualitative phase was ensured through using purposive sampling to confirm that only those participants who had first-hand knowledge of the phenomena under investigation actually became the primary informants.

3.4.6.1.3. Transferability

It refers to the specific context in which the research occurs. Sufficient background and context details must be provided for readers to determine whether the conclusions can be transferred to other environments or situations (Krukowski, Leonard & White 2018:11). It is also referred to as the degree to which conclusions from a mixed methods study can be

applied to similar settings, contexts, and people (Headley & Plano Clark 2020:145-163). The transferability of this study will depend on future studies done in similar contexts.

3.4.6.1.4. Dependability

In quantitative research, dependability equates to reliability and reproducibility. In order for others to replicate the research in comparable or other situations, the researcher must be able to clearly and concisely describe the complete research process. Athanasou et al (2012:140) mention Goetz and Lecompte's (1984) assertion that dependability (or consistency) refers to the method's long-term stability and consistency.

In the current study, dependability was assured through addressing research questions that were wholly consistent with the specified research purpose. The use of audio recorded interview transcripts and functional audio recording devices should address distortions or inadequacy in portraying phenomena as expressed by the participants.

3.4.6.1.5. Conformability

Brink et al (2018:110) explain that conformability assures that the results, interpretations, and suggestions are consistent with the information gathered. The authors add that there should be agreement between the researcher's interpretation and the actual evidence. The researcher provided the findings in detail and connected these findings to the data analysis after comprehensively documenting the data collection and data analysis methods.

3.4.6.1.6. Authenticity

Authenticity refers to the extent to which researchers fairly and completely show a range of different realities and realistically convey participants' lives (Polit & Beck 2018:416). For this study, findings of the in-depth interviews were supported with quotations from the study participants to ensure authenticity.

3.4.6.2. Criteria for enhancing quality of quantitative data

3.4.6.2.1. Validity of the questionnaire

Validity refers to the extent to which the measurement tools measure what they are supposed to measure (Polit & Beck 2018:261). Cambridge Biomedical Research Centre (2021) defines validity as the degree to which a method appears to provide the desired information about

the variable it has been designed to measure. If a research tool accurately captures the variables it was designed to capture, it is considered to be valid. Polit and Beck (2018:261) have determined that there are four primary methods for evaluating the reliability of research instruments: face, construct, content, and criterion related validity. The researcher used construct and content validity in this study. The degree to which the measurement tool genuinely assesses the presence of those variables intended is referred to as construct validity by Yusoff (2019:49–54). By thoroughly researching the measurements in a large body of literature, the researcher was able to define the meanings of the construct and its constituent parts. The researcher is confident that the terminology categories applied to the participants in the specified natural situation were relevant. On the other hand, content validity examines how well a measurement tool responds to research questions (Binti 2021:5172-5178). Due diligence was taken in the sampling and design of the research questionnaires in this study to ensure content validity. This made sure the surveys were pertinent to the research area. Experts with knowledge of this research topic such as an associate professor at Hawassa University College of Medicine, a health science and assistant professor at Wollo University and the Ethiopian Public Health Institute were consulted to determine whether the instrument items appropriately covered the subject matter's recognised substance.

3.4.6.2.2. Reliability

Reliability, broadly speaking, is the extent to which scores are free from measurement error. The stability or test-retest reliability of the survey instrument was obtained through the pilot testing of the instrument with participants prior to the actual data collection period. Test-retest reliability shows whether the same results are obtained with repeated administering of the same survey or consistency with similar study participants (Polit & Beck 2018:259).

To further enhance rigour, triangulation of data sources was also employed, which in this study consisted of focus groups, key informant interviews and document review to increase the validity of conclusions and provide a more reliable and valid interpretation of the data. Triangulation in mixed methods research, which involves obtaining different but complementary data on the same issue, makes it possible for researchers to get a better understanding of the issue being investigated (Creswell 2014:220).

3.4.6.2.3. Rigour

The purpose of ensuring rigour in a quantitative research study is to strive towards producing unbiased results with ethical diligence and objectivity (LoBiondo-Wood & Haber 2014:14). The questionnaire was developed by the researcher and was finalised after an intense and rigorous literature review.

3.4.6.2.4. Trustworthiness

In this quantitative phase of research, reliability and validity of the instrument were very important for minimising errors that might arise from measurement problems in this study. The degree of confidence in data, interpretation, and methods used to ensure the quality of a study have paramount importance (Connelly 2016:435).

3.5. DATA ANALYSIS

According to Polit and Beck (2018:545), data analysis is the systematic organisation and synthesis of research data and for quantitative studies it is the testing of hypotheses using such data. In this study data analysis was conducted for the study's qualitative segment; followed by the quantitative phase sequentially, using appropriate methods of data analysis.

3.5.1. Data analysis for the qualitative phase

The analysis of qualitative data is an active and interactive process. Qualitative researchers typically scrutinise their data carefully and deliberately, often reading the data over and over in search of meaning and understanding. Insights and theories cannot emerge until researchers become completely familiar with their data (Polit & Beck 2017:748).

Colaizzi's (1978) method of data analysis is rigorous and robust, and therefore a qualitative method that ensures the credibility and reliability of its results. It allows researchers to reveal emergent themes and their interwoven relationships. Researchers using a descriptive phenomenological approach should consider using this method as a clear and logical process through which the fundamental structure of an experience can be explored (Wirihana, Welch, Williamson, Christensen, Bakon & Craft 2018:30-31).

For the qualitative phase of this study, the data gathered from the key informants from the four institutions described above and the FGDs in relation to the adolescents was analysed using Colaizzi's seven-step analysis framework as follows:

1. Reading each set of information repeatedly for a general sense of the content.
2. Extracting significant statements based on the transcripts related to the phenomenon being studied.
3. Formulating connotations from important assertions.
4. Classifying formed meanings into groups, themes, and clusters of themes.
5. Integrating themes a thorough breakdown of what was said by each participant.
6. Describing the phenomenon's composition followed by validating the findings with the research participants.
7. Summarising each interview session and asking the interviewees to confirm that the researcher had indeed captured the responses accurately to ensure validation. Creswell (2014:245) holds that themes enrich the qualitative results.

Furthermore, data extracted from the clinical records of the adolescents who were on clinical follow-up and taking monthly antiretroviral and anti-TB drugs and the current policies, strategies and guidelines related to addressing TB/HIV for the adolescents in Hawassa was analysed using a structured checklist after it was validated by the supervisor and the information considered to enrich data collected through the interviews.

3.5.2. Data analysis for the quantitative phase

For this study data was checked for consistency and accuracy at the time of data collection and entry. It was coded, cleaned and entered to Epi info version 7 software; then exported to the Statistical Package for the Social Sciences (SPSS) statistical programme version 26 for analysis. Descriptive statistics using frequencies and cross-tabulations were undertaken to establish linkages between dependent and independent variables.

Bivariate analysis was included to determine the association between the dependent and independent variables. To measure the strength of association, an odds ratio with a 95% confidence level was calculated. Multivariate logistic regression was used to control possible confounders and to identify the determinant factors associated with TB/HIV co-infection.

3.6. DATA PRESENTATION

After analysis of the data, where applicable, it was shown as frequency tables, graphs, and text. Consequently, to discuss the results, tables, charts, and figures were used. The benefit of graphs is that they may document a lot of information in a summary (De Smith 2018:69). The percentages were displayed to one decimal place. Using the sample characteristics of the respondents as a starting point, the statistical test results from the research were reviewed. Cross references were only made for response frequencies that displayed noticeable variances.

3.7. SCIENTIFIC INTEGRITY OF THE RESEARCH

The work of others was acknowledged by the researcher by referencing the original sources. The researcher employed acceptable techniques to gather, analyse, and summarise the study's findings while remaining objective. Hence, the researcher used the required methodology components when appropriate and in accordance with the research goals. The researcher's opinion was not considered in the interpretation of data; rather, methodological standards were used to avoid bias. The researcher tried to discuss all findings based on the available sources without distorting the truth. The researcher took great care not to violate ethical values by adding fabrication and falsification (Polit & Beck 2018:132). The researcher respected the confidentiality and privacy of individuals who participated in the study. This study was verified as posing little risk as it did not cause any offensive and harming processes. Therefore, participants in the study were not harmed in any way.

3.8. ETHICAL CONSIDERATIONS

According to Polit and Beck (2018:132), the Belmont Report articulated three broad principles on which standards of ethical conduct in research are based. These are the principles of beneficence, respect for human dignity, and justice. By shielding the subjects from discomfort and injury on any level—physical, psychological, emotional, spiritual, economic, social, or legal—the researcher ensured their wellbeing (Brink et al 2018:42). During data collection, the researcher was careful in how the questions were put and kept an eye out for any symptoms of distress in the participants. Participants who showed any signs of discomfort were allowed to verbalise their complaints and reminded that the interview could be discontinued if it was causing intolerable uneasiness.

Three beliefs form the basis of respect for people as an ethical principle: that people have the freedom to make their own decisions and are autonomous; that people with diminished autonomy need additional protection; and that people may not be considered autonomous in some rural African communities and religious groups (Rezaul Islam 2019:32). The researcher in this study honoured each individual's choice to engage in the study or not, as well as their choice to leave once it had started, if they so desired. The participants were made aware of their right to refuse to provide information and that they might inquire about the study at any time. The study participants' permission was not obtained by compulsion or fraud on the part of the researcher.

Justice as a principle includes the right to fair treatment and the right to privacy. The right to fair treatment entails selecting the participants based on the study requirements and not on participant vulnerability. By keeping the research as little intrusive as possible and keeping the data in complete confidence, the right to privacy is safeguarded (Polit & Beck 2018:113-114). According to Gray et al (2016:123), privacy is the right of individuals to control when, how, and under what conditions their personal information is disclosed or kept private. The participants were chosen if they regularly followed care and treatment in antiretroviral treatment centres or not. The sole justification for such a choice is that these individuals as adolescents or their guardians were capable of giving in-depth information which would answer the research questions. To ensure privacy, the researcher conducted the interviews in a private room and used code names instead of real names.

For the qualitative phase, the individual interviews were once off, meaning that there would not be follow-up interviews with the same interviewees; hence there was no need to use real names of participants. The voice recorder and completed interview instructions are locked away and only the researcher has access to them. Since this study was conducted for academic purposes, the researcher has shared the processed data with the appropriate University of South Africa staff members. The researcher and the volunteers each signed a confidentiality agreement. Each participant gave their informed consent after being made aware of the importance of upholding the aforementioned values.

According to Gray et al (2016:122&123), the assumption behind informed consent is that the subjects and participants have received information from the researcher and have

understood it. The authors add that four components of informed consent must be present for it to be valid: the participant must be told of all material study information, understand it, be competent to consent, and voluntarily consent to participate in the study. An acceptance form was completed for those younger than 18 years. Furthermore, the researcher received clearance prior to data collection from UNISA and also sought permission from the SNNPR's Regional Health Bureau to collect data in Hawassa city.

3.9. CONCLUSION

As an introduction to this chapter, the researcher has presented the background of the study area, Hawassa town. The study's methodology and research strategy were explained. A sequential mixed-methods design, combining both aspects of qualitative and quantitative approaches, was used. The research methods were explained. The research procedures, which clearly described the population, sampling, sampling techniques, eligibility standards, sample size, data collection techniques, development of data collection tools, data analysis, and data presentation, as well as significant methods for ensuring the validity and reliability of the study were comprehensively discussed. Methods of document analysis as a means to investigate gaps in implementation of TB/HIV prevention policies and strategies were discussed explicitly. Additionally, a brief discussion of results sharing, and scientific integrity was offered. Chapters 4 and 5 present the results and discussion of the qualitative and quantitative phases of the study respectively.

CHAPTER 4
ANALYSIS, PRESENTATION AND DESCRIPTION OF THE RESEARCH RESULTS

4.1. INTRODUCTION

This chapter (Chapter 4) presents the results and discusses the findings of the study. The first section reflects the sample demographics, followed by data management and analysis. The research findings are offered in the second section.

The findings are displayed in two major sections. The first is a sample demographic breakdown of the study participants and respondents. In the second, study findings from both qualitative and quantitative research approaches are presented. The manner the research findings are presented makes a connection between them and the accomplishment of the study's goals. The chapter begins by restating the purpose and goals of the investigation.

4.1.1. The research objectives

The research objectives were grouped into phase 1 and phase 2 as follows:

Phase 1: Qualitative

The objectives of the qualitative phase of the study were as follows:

1. To explore and describe experiences of the **adolescents** and their guardians on the TB/HIV prevention programme's availability and accessibility in Hawassa, Ethiopia.
2. To explore and describe experiences of the **officials** on the availability and accessibility of the TB/HIV prevention programme for the adolescents in Hawassa, Ethiopia.
3. To explore and describe challenges associated with implementation of interventions to address TB/HIV dual infection in Hawassa, Southern Ethiopia.

Phase 2: Quantitative

1. To explore and identify the determinants of TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia.

2. To describe the determinants of TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia.

Objectives 1-3 were addressed in the qualitative phase and objectives 4-5 were addressed on the quantitative phase in this chapter. The last objective, objective 6, will be addressed in the remaining chapters. It has already been mentioned in Chapter 3 that the sequential mixed-methods approach was employed in this study to achieve the study objectives. The analysis of the results will be presented using graphs, tables and text in two sections: descriptive and inferential statistics.

4.2. DATA MANAGEMENT AND ANALYSIS

4.2.1. Data management

Quantitative and qualitative data was collected to investigate the determinants of tuberculosis infection among HIV positive adolescents in Hawassa, Southern Ethiopia. The findings will assist in developing a strategy for prevention of tuberculosis infection among HIV positive adolescents in Hawassa.

Following the university's data management policy, the researcher will keep the collected data for five years after the publication of the findings. After five years, the retained data will be deleted, subject to the approval of the university, and as long as there is no demand for prolonged retention of the data.

4.2.2. Data analysis

Data was analysed using appropriate analysis methods, depending on the type, as described in detail below. Qualitative data analysis is described first, followed by quantitative data analysis.

4.2.2.1. Data analysis: qualitative phase

The qualitative data was analysed thematically with the help of Colaizzi's seven steps of data analysis. This entailed the reading and re-reading of the transcripts to ensure familiarisation with the data; identifying significant statements and phrases; formulating meanings from these statements; identifying themes and sub-themes; and describing the phenomenon under study in detail. The qualitative phase mainly focused on exploring and describing the

experience and challenges of adolescents, their guardians, and government officials about TB/HIV prevention programmes.

4.2.2.2. Data analysis: quantitative phase.

Data was checked for consistency and accuracy at the time of data collection and entry. It was coded, cleaned and entered to Epi info version 7 software; then exported to the SPSS statistical programme version 26 for analysis. Descriptive statistics using frequencies and cross tabulations were undertaken to establish linkages between dependent and independent variables.

The primary characteristics of the data set were summarised using descriptive statistics and were shown in a summary that describes the data sample and its measurements; whereas inferential statistics was used to make inferences about the populations based on samples taken from the study place.

4.3. RESEARCH FINDINGS

4.3.1. Sample demographics

This section elaborates on the characteristics of the research participants and respondents who participated in both the qualitative and quantitative phases. It also describes the characteristics of the health facilities under study.

4.3.1.1. Characteristics of participants and respondents

In this sub-section, the profile of the participants and that of the respondents are elaborated upon. The profile of the participants in the qualitative phase is presented first, followed by the profile of the respondents in the quantitative phase.

4.3.1.1.1. The profile of the participants: Qualitative phase

The qualitative phase recruited seventy-six (76) participants from whom data was collected. The constitution of the sample was as follows:

Six focus group discussions consisting of 34 adolescents; Six focus group discussions consisting of thirty-eight (38) guardians of the adolescents. Most of them (the guardians) were receiving anti-retro-viral treatment (ART) in the chronic care centres in two public hospitals and health centres located in Hawassa town.

Four key informants' interviewees (KII) were TB/HIV prevention and control programme focal persons and represented four government institutions. The detail of the adolescents and six focus group discussions of the 34 adolescents and 38 guardians of the adolescents will be presented first followed by KIIs with programme focal persons and representing four government institutions. Table 4.1a below depicts the biographical details of focus group discussion participants.

Of the four key informant interviewees (KII). two were males and two were females. It is worth noting that two of them worked as HIV main streaming focal persons in their organisations, while the other two worked as TB/HIV programme officers. The details of the adolescents will be presented first followed by the guardians and then the key informant interviewees (KII). The latter, the KII, were programme focal persons and representing four government institutions.

Table 4.1A reflects the biographical details of the adolescents while Table 4.1B depicts the biographical details of key informant interview participants.

TABLE 4.1A: BIOGRAPHICAL DETAILS OF FOCUS GROUPS OF ADOLESCENTS IN HAWASSA TOWN, SIDAMA REGION, SOUTHERN ETHIOPIA (N=34)

Participants	Age	No	Sex	No	Residence	No
Adolescents	13-15	8	Males	3	Urban	2
					Rural	1
			Females	5	Urban	3
					Rural	2
	16-18	5	Males	2	Urban	2
					Rural	0
			Females	3	Urban	2
					Rural	1
	19-21	10	Males	4	Urban	3
					Rural	1
			Females	6	Urban	4
					Rural	2
	22-24	11	Males	5	Urban	4
					Rural	1

Participants	Age	No	Sex	No	Residence	No
			Females	6	Urban	4
					Rural	2
Total		**34**				**34**

TABLE 4.1B: BIOGRAPHICAL DETAILS OF FOCUS GROUPS OF GUARDIANS IN HAWASSA TOWN, SIDAMA REGION, SOUTHERN ETHIOPIA (N=38)

Participants	Age	No	Sex	No	Residence	No
Guardians	35-44	12	Males	0	Urban	0
					Rural	0
			Females	12	Urban	8
					Rural	4
	>45	26	Males	0	Urban	0
					Rural	0
			Females	26	Urban	20
					Rural	6
Total		**38**				**38**
Grand Total		**72**				**72**

As to the focus group discussions, it has already been said that a total of 12 FGDs were constituted of six groups of adolescents and another six groups of guardians. The participants were recruited from the adolescents living with TB/HIV who were taking their monthly medication from ART clinics in Hawassa town and their guardians who were also living with TB/HIV.

Six people on average participated in each session, with a minimum of five and a maximum of seven. Fourteen (14) males and twenty (20) females made up the group of adolescents. The 34 adolescents who participated in the six focus groups had an average age of 20 years, with minimum and maximum ages of 17 and 23 respectively. For parents or guardians of the adolescents, 38 of them were females and their average age was 42 years. The minimum and maximum ages were 38 and 50 respectively.

TABLE 4.1C: BIOGRAPHICAL DETAILS OF KII PARTICIPANTS (PUBLIC OFFICIALS COORDINATING TB/HIV PROGRAM), HAWASSA TOWN, SIDAMA REGION, SOUTHERN ETHIOPIA (N=4)

Name of institution of participants	No	Age	Sex	Responsibility
Southern Nations Nationalities and Peoples' Region Women, Children and Youth Affairs	1	42	Male	TB/HIV care and support main streaming head
Southern Nations Nationalities and Peoples' Region State Education Bureau	1	36	female	TB/HIV care and support main streaming head
Sidama Regional State Health Bureau	1	34	Male	TB/HIV prevention program officer
South TV and Radio Agency	1	39	Female	TB/HIV prevention program officer
Total	**4**			

As to the key informant interview (KII), Tabble 4.1c, it has already been stated that the participants of KII were four government officials who were programme focal persons and representing four government institutions. Equal distribution of sex (50%) was used. The age range of the participants was from 34 to 42 years with mean age of 38 years. All of them were working directly on prevention and control of TB/HIV.

4.3.1.1.2. The profile of the respondents in the quantitative phase

This section presents the socio-demographic and socio-economic characteristics of adolescents living with TB/HIV. These include sex, age, educational status, marital status, employment status, monthly income, residence and religion. The total number of study respondents was 321, constituted of 107 cases and 214 controls. The response rate was 100%.

- **Sex and age distribution**

TABLE 4.2A: THE SOCIO-DEMOGRAPHIC FACTOR IN RESPECT OF THE SEX AND AGE DISTRIBUTION PROFILE OF THE ADOLESCENTS WHO RESPONDED IN THE QUANTITATIVE PHASE OF THE STUDY

Socio-demographic factor	Cases (N = 107)	Controls (N = 214)	
	n (%)	n (%)	Total (n=321)
Sex			
Male	54(50.47)	96(44.86)	150(46.73)
Female	53 (49.53)	118(55.14)	171(53.27)
Age			
13-15	27(25.23)	65(30.37)	92(28.66)
16-17	16(14.95)	43(20.09)	59(18.38)
18-24	64(59.81)	106(49.53)	170(52.96)

Most of the total of 321 respondents were women, making 171 (53.27) of the sample and 150 (46.73) were males. From the female component, 53 (49.53%) were cases while 118 (55.14) were controls.

The table further shows that the ages varied with 18-24; 64 (59.81%) of the cases and 106(49.53%) of controls occupying the largest group in the age categories, surprisingly followed by age group 13-15; 92(28.66%), 27(25.23%) of cases and 65(30.37%) controls. In age category 16-17; 59(18.38%), 16(14.95%) of the cases and 43(20.09%) of the controls were identified to have the least number of respondents. The mean(+SD) of respondents age was 17.92(+3.36) with minimum age of 13 and maximum of 24 years. Table 4.2a reflects the socio-demographic profile of the adolescents who responded in the quantitative phase of the study.

- **Educational status**

TABLE 4.2B: EDUCATIONAL PROFILE DISTRIBUTION OF THE ADOLESCENTS WHO RESPONDED IN THE QUANTITATIVE PHASE OF THE STUDY

Socio-demographic factor	Cases (N = 107)	Controls (N = 214)	
	n (%)	n (%)	Total (n=321)
Educational status			
No formal education	14(13.08)	24(11.21)	38(11.84)
Primary education	48(44.86)	109(50.93)	157(48.91)
Secondary education	38(35.51)	63(29.44)	101(31.46)
Tertiary education	7(6.54)	18(8.41)	25(7.79)

The educational status of most of the respondents – 157(48.91%); 48(44.86%) – of the cases and 109(50.93%) of the controls was primary education followed by 38(35.51); 63(29.44) of the cases and 101(31.46) of the controls in secondary education and the least, 7(6.54) tertiary education; 18(8.41) of cases and 25 (7.79) controls.

- **Marital status**

TABLE 4.2C: MARITAL STATUS PROFILE OF THE ADOLESCENTS WHO RESPONDED IN THE QUANTITATIVE PHASE OF THE STUDY

Socio-demographic factor	Cases (N = 107)	Controls (N = 214)	
	n (%)	n (%)	Total (n=321)
Marital status			
Single	97(90.65)	195(91.12)	292(90.65)
Ever married	10(9.35)	19(8.88)	29(9.03)

As to the marital status, 292(90.65%); 97(90.65% of the) cases and 195(91.12%) of the controls were single, whereas 29(9.03%); 10(9.35%) of the cases and 19(8.88%) of the controls were ever married. This shows that most of the respondents were married and free of tuberculosis.

- **Employment status**

TABLE 4.2D: EMPLOYMENT STATUS PROFILE OF THE ADOLESCENTS WHO RESPONDED IN THE QUANTITATIVE PHASE OF THE STUDY

Socio-demographic factor	Cases (N = 107)	Controls (N = 214)	
	n (%)	n (%)	Total (n=321)
Employment status			
Employed	98(91.59)	193(90.19)	291(90.65)
Unemployed	9(8.41)	21(9.81)	30(9.35)

Most of the participants 291(90.65%); 98(91.59%) of the cases and 193(90.19%) of the controls were employed. The rest 30(9.35%); 9(8.41%) of the cases and 21(9.81%) of the controls were not employed. The magnitude of TB infection was found to be higher among the employed than non-employed.

- **Monthly income**

TABLE 4.2E: MONTHLY INCOME STATUS OF THE ADOLESCENTS WHO RESPONDED IN THE QUANTITATIVE PHASE OF THE STUDY

Socio-demographic factor	Cases (N = 107)	Controls (N = 214)	
	n (%)	n (%)	Total (n=321)
Monthly income			
<1000	92(85.98)	192(89.72)	284(88.47)
$\geq$1000	15(14.02)	22(10.28)	37(11.52)

As to the income status of the respondents; the monthly income 284(88.4%); 92(85.98%) of the cases and 192(89.72%) of the controls was assessed and found to be below 1000 Ethiopian birr whereas the monthly income of the rest; 37(11.52%); 15 (14.02%) of the cases and 22(10.28%) of the controls was above 1000 ETB.

- **Residence**

TABLE 4.2F: RESIDENCE STATUS OF THE ADOLESCENTS WHO RESPONDED IN THE QUANTITATIVE PHASE OF THE STUDY

Socio-demographic factor	Cases (N = 107) N (%)	Controls (N = 214) N (%)	Total (n=321)
Residence			
Urban	101(94.39)	205(95.79)	306(95.33)
Rural	6(5.61)	9(4.21)	15(4.67)

From a total of respondents, 306 (95.33%); 101(94.39%) of the cases and 205 (95.79%) of the controls respectively were from Hawassa town and the remaining 15(4.67%); 6(5.61%) of the cases and 9(4.21%) of the controls were from nearby rural areas of Hawassa town. Those who came from urban areas were found to have more TB infection than those from the rural areas.

- **Religion**

TABLE 4.2G: RELIGION STATUS OF THE ADOLESCENTS WHO RESPONDED IN THE QUANTITATIVE PHASE OF THE STUDY

Socio-demographic factor	Cases (N = 107) N (%)	Controls (N = 214) N (%)	Total (n=321)
Religion			
Orthodox Christians	54(50.47)	107(50)	161(50.16)
Protestant	43(40.19)	88(41.12)	131(40.81)
Muslim	8(7.48)	15(7.01)	23(7.17)
Catholic	2(1.87)	4(1.87)	6(1.9)

Table 4.2G shows that orthodox religion followers accounted for 161(50.16%) whereby 54(50.47%) were the cases and 107(50%) were the controls followed by 131(40.81%) protestants from which 43(40.19%) were cases and 88(41.13%) controls. The least were Muslims with only 8(7.48%) and Catholics 6(1.87%).

4.3.2. Qualitative phase: Availability, accessibility and the challenges associated with implementation of TB/HIV prevention of interventions to address TB/HIV dual infection in Hawassa, Southern Ethiopia

Section 4.4.1 above presented the demographic details from the study participants and respondents. Section 4.3.2 presents the results from both the qualitative phase and the quantitative phase.

Section 4.4.2: The qualitative phase of the study covered the following aspects of the findings:

- The experiences of the adolescents on the TB/HIV prevention programme's availability and accessibility in Hawassa, Ethiopia in 4.4.2.1
- The experiences of the guardians on the TB/HIV prevention programme's availability and accessibility in Hawassa, Ethiopia in 4.4.2.2
- The experiences of public officials who were key informants on the availability and accessibility of TB/HIV prevention programmes for the adolescents in Hawassa, Ethiopia in 4.4.2.3
- Challenges associated with implementation of interventions to address TB/HIV dual infection in Hawassa, Southern Ethiopia in 4.4.2.4

Section 4.4: The quantitative phase covered the findings in respects of the following aspects:

- Clinical factors associated with HIV-positive adolescents in public health facilities, Hawassa Town, Southern Ethiopia
- Host factors
- Environmental factors

The above section responds to objectives 4 and 5.

4.3.2.1. The experiences of the adolescents on the TB/HIV prevention programme's availability and accessibility in Hawassa, Ethiopia

After brief introductions on the purpose of the interview among participants and the researcher, the discussions took place in the Hawassa University College of Medicine and Referral Hospital compound. To preserve their confidentiality, interviewees consented to participate in the interviews and to be recorded. An android version smart phone was used

to record discussion points. All possible precautions for prevention of COVID-19 were considered at the time of data collection. After the analysis, themes and sub-themes were identified.

4.3.2.1.1. Themes and sub-themes

The transcriptions of the interviews with the participants in the FGD as well as key informants' interviews formed the basis of the results. Therefore, themes and sub-themes were identified from the FGDs and the interviews. The findings established the determinants and also informed the proposed prevention strategy of tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia.

Nine themes and 20 sub-themes were identified from the focus group discussions with the adolescents and their guardians. A further four main themes and eight sub-themes emerged from the key informants' interviews. The themes and sub-themes from the FGDs will be presented first followed by those from the key informants' interviews. These are presented below by each category, namely, five themes emerging from the FGDs with the adolescents followed by four themes emerging from the FGDs with the guardians. Lastly four themes from the key informants' interviews will be presented.

- **Themes and sub-themes emerging from FGDs with adolescents**

A total of five themes emerged from the FGDs with the adolescents on TB/HIV transmission and prevention as follows:

- Media factors
- School factors
- Health sector factors
- Community factors
- Adherence to applicable rules and regulations

TABLE.4.3: THEMES AND SUB-THEMES FROM FGD WITH ADOLESCENTS

SN	Themes	Sub-themes
1.	Media factors for TB/HIV transmission/preventions	• Role of the government • Role of people in utilisation of media inputs for TB/HIV prevention
2.	School factors for TB/HIV transmission/preventions	• Role of school administration • Role of students and their parents
3.	Health sector factors for TB/HIV transmission/preventions	• Role of the government • Role of health professionals
4.	Adherence to applicable rules and regulations	• Role of government in legal enforcement • Role of adolescents
5.	Community factors for TB/HIV transmission/preventions	• Role of religious leaders • Customs and traditions • Knowledge, attitude and behavioural influences • Discrimination
Total	**5**	**12**

Media factors on TB/HIV transmission

In this theme the theoretical role of the media for preventing and controlling TB/HIV was mentioned. Most participants criticised the weakness of the majority of mass media in the country for their reluctance and inadequate efforts in disseminating relevant information on prevention and control of TB/HIV. The sub-themes are discussed below.

The role of the government on TB/HIV preventions

In this sub-theme it was mentioned that nowadays public (government) media in the country are not working actively in disseminating information toward prevention and control of TB/HIV. The adolescents in the FGD were open to express their views in that regard.

A female adolescent aged 18 years lamented:

> *"At the start of HIV pandemic and TB/HIV related outcomes, mass media people were running here and there to disseminate information on prevention and control of those diseases. But nowadays most of the media in the country forgot their responsibility" (ELSI).*

A 21 -year-old male added:

> *"Public media is not active in disseminating information to public. Media people appear rarely and maybe once a year at national TB and HIV days" (WOINU).*

A 23-year-old female discussant expressed her feeling as follows:

> *"I am fully confident that if media people become active enough in disseminating TB/HIV related information to the public, so many people will be motivated to disclose themselves. They would be engaged in the information dissemination activities to educate the public as before" (TSIO).*

A 17-year-old high school student stated:

> *"It is a tragic news hearing that, since there is no adequate dissemination of information through mass media, a significant number of people are not taking their ART medications regularly. Some of them have totally discontinued their treatment" (MESTU).*

The role of the media in the prevention of TB/HIV has been documented in a number of studies (Nowshin, Alima, Chowdhury & Ahmed 2020:1-2). It is said that for ensuring treatment adherence among patients infected with TB/HIV, the role of social media in patient follow-up is critically important (Phyo 2020:210). Social media-based tools overcome barriers in disseminating sex education (Iribarren, Ghazzawi, Sheinfil, Frasca, Brown, Lopez-Rios, Rael et al 2018:352).

Role of people in utilisation of media inputs for TB/HIV prevention

In this sub-theme it was mentioned that due to a lack of trust in public media people were not interested in following and utilising TB/HIV information. The brief explanation of the study participants will be summarised as follows:

A 23-year-old male adolescent said:

> *"Mass medias in the country are only important to know the exact time for those who have no wristwatch" (ASME).*

One of the female discussants elaborated:

> *"Fraud news from international news agencies doesn't motivate people to listen and readily utilize any types of information" (TEZI).*

According to the information generated from various studies, public trust in the media has a strong influence on its utilisation (Huber, Barnidge, Gil de Zúñiga & Liu 2019:753). Public trust in health information is essential to implement preventative activities to reduce the transmission of most communicable diseases (Liu, Shan, Delaloye, Piguet & Glassey 2020:2). The issue of media trust and its impact on people's media use has to be considered as a major tool to measure its effectiveness (Strömbäck, Tsfati, Boomgaarden, Damstra, Lindgren, Vliegenthart, Lindholm et al 2020:153).

School factors in TB/HIV transmission

In this theme participants of the study expressed their feeling that the school community are not discharging their responsibility in protecting adolescents against the silent transmission of TB/HIV. They disclosed important information which shows the depth of the problem. The sub-themes are discussed below.

Role of school administration

In this sub-theme the school administration is blamed for being negligent in activating the previous risk communication activities on prevention of TB/HIV.

One of the adolescents who was from a rural corner of Hawassa town highlighted his idea as follows:

> ***"****To date providing health information is not common in schools. Clubs previously working on HIV/AIDS are not currently active because some schoolteachers are discouraging students' requests to activate (establish) clubs working on TB/HIV. They have wrong assumption that everybody has adequate information on TB/HIV and that is why sickness and death due to TB/HIV is becoming insignificant" (TEZI).*

An 18-year-old female discussant narrated one specific occasion as follows:

> *"While I was elementary school student and attending class, the teacher has been discussing on sexually transmitted diseases. He didn't raise the issue of HIV/AIDS. I became surprised and asked him about HIV/AIDS. He became angry and replied that nowadays HIV/AIDS is not a problem, and he didn't want to take time on that" (HARI).*

Role of students and their parents

In this sub-theme it was discussed that school children and young adults were not giving attention to taking care of themselves against transmission of infectious diseases including TB/HIV. The previous prevention measures were not in effect these days.

A 22-year-old female discussant expressed her feeling that:

> *"Parents of school children have obligation to make continuous follow-up of their children. Whenever they get information on the serum status of their children, they don't mostly give information to school management. This is becoming the main reason to adolescents not to take the necessary care to themselves including taking medication timely while they are in school compound freely and regularly" (SIA).*

Furthermore, a female adolescent in the FGD shared her opinion:

> *"Whenever young people living with HIV join higher education, a significant number of them don't want to disclose that they are living with HIV. As a consequence, they usually encounter difficulties in taking their medication timely. They are prone to develop serious illnesses and transmit the disease to others too" (METI).*

The other female participant of the group expressed her concern as follows:

> *"Some school children and young people get large amount of money from their family regularly. Most of the time this may lead them to drug addiction and have relation with commercial sex workers" (TGTG).*

Under normal circumstances, schools are in a special position to help improve the health status of adolescents everywhere and this may ensure progress in the implementation of better school health policies and practices (Brener, Smith-Grant, McManus, Shanklin & Underwood 2019:5-10). TB/HIV prevention modalities in schools still require meticulously evaluated, innovative combination prevention packages for adolescents. Prevention and control activity approaches are expected to consider the context of young people's lives and the multiple levels of influence on their lives including partners and communities (Jeihooni, Arameshfard, Hatami, Mansourian, Kashfi, Rastegarimehr, Safari & Amirkhani 2018:7285-7296). It is not uncommon that HIV prevention interventions in school environments must consider an integrated approach to achieve the desired outcome. To date, there have been

limited, meticulously evaluated combination prevention interventions to prevent TB/HIV for adolescents (Hosek & Pettifor 2019:120-128).

Health sector factors for TB/HIV transmission

In this theme it was commented that the health sector was currently not playing an active role in prevention and control of TB/HIV among adolescents. Only two sub-themes emerged as follows:

The role of government.

In this sub-theme the government was criticised for decreasing its support to health facilities controlling the spread of TB/HIV among young people and adolescents. A number of institutions that were formerly providing TB/HIV prevention and control activities were no longer routinely providing the service.

A 19-year-old male adolescent participant of this study stated that:

> *"Voluntary counselling and blood testing for HIV is the entry point for care and support of people living with TB/HIV. Nowadays it is totally neglected" (ZEWD).*

A teenaged female participant of the study reflected her idea as follows:

> *"There is no adequate teaching and learning processes on TB/HIV prevention and control activities. Even the formerly established youth clubs and special groups were deactivated. Donors are not giving money as before. No one is interested to take the initiative and start the programme because individuals think of the money, they put in their pocket than the service given to the citizens" (TRIS).*

The role of health professionals.

In this sub-theme it was indicated that some health professionals were strongly criticised for improper handling of patients while providing chronic care and support to TB/HIV patients because their attention to TB/HIV clients was inadequate.

One of the discussants of the group reported as follows:

> *"I was visiting a health centre for my regular follow-up; at that time, I was critically sick with skin problem. I was also weak and unable to walk. Suddenly I fall down on the ground. On seeing*

my condition, health professionals working around were not interested to take care of me. It was because of my skin lesion" (BETI).

A 19-year-old freshman university student expressed his opinion like this:

"Nowadays house to house visit […] providing VCT [voluntary counselling and testing] service is not active. People in need of those services are neglected and suffering from various types of complications" (WONDI).

A lady from a rural corner of Hawassa town indicated her concern as follows:

"There are a number of people in the community who are practicing risk sexual behaviour. This may enhance the transmission of TB/HIV to many others. Health professionals are not doing their best adequately to educate, provide VCT service and bring them to care and support" (SOLEM).

According to a study conducted in the United States, though HIV diagnoses prevention and control among adolescents and young adults increased by 6%, there has been inadequate effort by the health sector in reducing the disease transmission among key populations, such as adolescents and young adults (Guilamo-Ramos et al 2019a:276). Availability of fertile ground in socioeconomic settings helps to establish a range of HIV activities in which healthcare workers can effectively provide people-centred quality care, including implementation of disease prevention programmes through distributing the necessary preventive resources (WHO 2020a:8).

Adherence to applicable rules and regulations

In this theme it was stressed that due to concealed misbehaviour, adolescents violating applicable rules and regulations need attention. The discussants of the session expressed their opinions and suggested possible solutions accordingly. The sub-themes on this issue are discussed below.

The role of government in legal enforcement

Government has formal authority in executing applicable rules and regulations to protect the safety and security of its citizens. It was commented that what was happening in Hawassa town was very far from what it should be.

One of the female adolescents in the second FGD group shared her experience:

> *"Some young people and adolescents are practising substance use such as drinking alcohol, chewing chat, smoking cigarette, etc. Night clubs are usually crowded with those young people. To keep the safety and wellbeing of citizens, concerned government authorities have the obligation to take urgent measures" (MERI).*

The role of adolescents, young people and others

In this sub-theme it was emphasised that nowadays the former good customs of society such as individual and community discussions on improving the misbehaviour of young people was not happening. Some people of advanced age and knowledge were not interested in shaping the behaviour of adolescents with addiction and multi-sexual contact.

One of the discussants in the third FGD group said:

> *"Young people or other members of the community with good behavior are expected to give advice to their friends, relatives and any nearby individuals who are practicing substance use. If those individuals are not accepting advice, reporting the condition to legal authorities may save them from serious harm and complications. However, this has not been widely practised" (TEME).*

According to a study conducted in middle income countries, effective legal enforcement interventions were found to be a significant factor in controlling health risk factors including substance abuse. It was achieved due to good governance and leadership at all levels in society (Nomani, Rauf, Ahmed, Faiyaz, Khan & Tahreem 2020:539). The WHO and other concerned bodies should mobilise the legal workforce, strengthen legal capacity and support effective use of law at regional, national and global levels. Those legal and regulatory actions must move to the centre of national disease prevention and control action plans. This requires high-level leadership commitment from global and national leaders in ratifying evidence-based legislation and building legal measures (Magnusson, McGrady, Gostin, Patterson & Abou Taleb 2019:108). During any pandemics, law enforcement agencies are responsible for working with government and public health officials to prevent the spread, serve the local community, and maintain public order. Every country needs to have a public health act, which allows the health care service officials to execute all disease prevention measures to protect the health of all people during a pandemic. Local and national law

enforcement is often dedicated with explaining and enforcing these measures in the population (Jennings & Perez 2020:695).

Community factors for TB/HIV transmission

In this theme different factors such as custom and tradition in the community, the role of religious leaders, knowledge and attitudes of the community members towards people living with the problem were mentioned. Those entities were considered as principal factors in the prevention or dissemination of TB/HIV. This will be elaborated on as a sub-theme below.

The role of religious leaders

In this sub-theme it was discussed that community and religious leaders were a good influence in modifying the behaviour of the community. However, as was mentioned by the respondents of this study, some of them were not a positive influence toward prevention and control of TB/HIV.

One of the teenaged female discussants expressed this as follows:

> *"Religious institutions have been engaged in the prevention of TB/HIV activities such as pre-marital blood test, dissemination of health information to their followers, etc. But nowadays some religious scholars are insisting people not to take their medication regularly due to the assumption that their spiritual treatment is enough" (NUNU).*

A 28-year-old male narrated the following story:

> *"There was a young boy living with HIV. He had been following religious lectures in one of the centres in Hawassa town. There was good relationship between the priest serving the centre and the person mentioned above. After a series of spiritual lectures, the young boy had revealed his secret to the priest that he was living with HIV and taking ART regularly. He further told him that he has no sign and symptom of the disease other than having mild stress. After listening all those stories, the priest suggested to give him spiritual treatment. After repeated spiritual treatment, the priest had declared that the boy is free of HIV and taking ART is no more important. Health professionals who have the information on the decision of the priest and its outcome, are trying their best to bring the case to Hawassa municipality court after the death of the young boy due to serious opportunistic infections" (MESTI).*

A 23-year-old female client narrated a story from her memory:

> *"There was a teenaged high school student; she was engaged for a young man living in America. Her family advised her to visit one of the religious institutions to get premarital counselling. She and her fiancée who came from America have got a chance to get the service by one of the religious scholars working in Addis Ababa. He advised them that the main precondition for formal marriage ceremony is to take premarital blood test for HIV. At that time her fiancée was not happy believing that both of them were free of HIV but, the girl was eager to know his serum status; she vigorously enforced him to take the test. Unfortunately, he was HIV negative unlike that of her. The marriage was not successful. This type of care was a fashion at the beginning of HIV pandemic, but nowadays it is narrated as ancient tale" (MERI).*

Customs and traditions

In this sub-theme it was disclosed that some customs and traditions were responsible for the transmission of TB/HIV. Those customs and traditions are widely distributed in the community and becoming challenges against disease prevention and control activities.

A 19-year-old male adolescent mentioned:

> *"The wide spread of harmful traditional practices are confusing the community not to seek modern medical cares. This is becoming the major reason for people living with TB/HIV for their poor drug adherence" (TESHAE).*

A young lady expressed her feelings as follows:

> *"Formerly there was good social interactions for disseminating information to the public in the form of community conversation using various occasions such as "edir, ekub, etc." [Informal groups established traditionally for fund raising and mutual support]. But nowadays those traditions are not in place" (ASTU).*

Knowledge, attitudes and behavioural influences

In this sub-theme it was mentioned that the attitude of some community members toward prevention of TB/HIV has played a significant role for the current dissemination of TB/HIV. Lack of knowledge and positive attitudes toward a programme has been a great challenge to run the disease prevention programme.

A 21-year-old female adolescent said:

> *"Because of fear of stigma and discrimination, so many people are not willing to take voluntary counselling and blood testing; rather, they prefer to hide themselves" (LINDA).*

"A young boy aged 20 supported Linda's idea as follows:

> *"Whenever we are motivating people to get voluntary counselling and blood testing in the community, they became offended and regret not to take those measures" (ALMI).*

Discrimination

In this sub-theme it was commented that the act of discrimination on PLHIV is progressively becoming a challenge not to take all the necessary chronic care and support services freely. Those discrimination acts are becoming common everywhere in the region and special attention has not been given as required.

An 18-year-old university student highlighted:

> *"So many people are not willing for voluntary counselling and blood testing. Most of them are hiding themselves because of fear of social exclusion" (BLIE).*

These findings are in line with the findings of a study conducted in various parts of the world. In Indonesia it was revealed that community barriers significantly affected HIV prevention modalities and needed a broad community-approached strategy including raising awareness in the community and enhanced discussions about TB/HIV issues to curb its transmission in the community (Chikwari, Dringus & Ferrand 2018:261). Discrimination, stigma and fear associated with an HIV-positive result are reasons for people in the community not to know their HIV serum status and take immediate measures. Some people, especially men, do not have the knowledge or a positive attitude toward the service (Ngwenya, Gumede, Shahmanesh, McGrath, Grant & Seeley 2018:76). According to the study conducted by Kennesaw State University, the identified barriers in poor medication adherence include financial instability, social stigma, educational deficits, legal status, and transitional care (Ramos, Nelson, Jones, Ni, Turpin & Portillo 2021:253). In some eastern and southern parts of African countries, it was found that in fragmented TB/HIV health care systems not addressing stigma and discrimination especially for the mobile population was

still a challenge. The timing, sequence and spatial scale of migrants' sexual networks could diminish intervention effectiveness (Camlin, Cassels & Seeley 2018:1-4).

4.3.2.2. The experiences of the guardians regarding the TB/HIV prevention programme's availability and accessibility in Hawassa, Ethiopia

From this focus group discussion with guardians, the themes and sub-themes were identified to inform the determinants and the prevention strategy of tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia. A total of four themes and eight sub-themes emerged. The themes and sub-themes will be presented below.

4.3.2.2.1. Themes and sub-themes emerging from in-depth interviews with the guardians

Four themes and eight sub-themes emerged from the FGDs with guardians of adolescent as depicted in Table 4.4 below. They are:

- Leadership issues
- Patients issues
- Community matters
- Health sector matters

TABLE.4.4: THEMES AND SUB-THEMES FROM FGD WITH GUARDIANS

SN	Main themes	Sub-themes
1	Leadership problem as a challenge not to address effective prevention intervention	• Leadership within the community • Leadership among government institutions and stakeholders
2	Patients' problems as a challenge not to address effective prevention intervention	• Patient attitude • Patient knowledge
3	Community problems as a challenge not to address effective prevention intervention	• Lack of knowledge in the community • Attitude problems in the community
4	Health sector problems as a challenge not to address effective prevention intervention	• Budget related • Lack of attention
Total	**4**	**8**

Leadership problems as a challenge not to address effective prevention intervention

In this theme it was commented that informal leadership roles which were dedicated to preventing HIV and other public health problems in the community have declined to the level where there is no significant activity. The observation of the study participants toward gradual deterioration of informal leadership roles will be discussed in the following sub-themes.

Leadership within the community

In this sub-theme it was pointed out that most informal leadership roles in Ethiopia are believed to maintain the good norms of the community. In this sub-theme it was mentioned that gradual cultural changes are causing a negative influence on their adherence.

A 45-year-old mother stated:

> *"Formerly community leaders such as clan representatives, community mutual support representatives, religious leaders etc., were used to give advice to adolescent and youth to avoid misconducts and other risky behaviours which are responsible to cause health problems, but nowadays they are not motivated to do so" (GUARD…a).*

Leadership among government and stakeholders

In this sub-theme government bodies and their stakeholders were blamed for being reluctant to strengthening the positive culture of the community which supports disease prevention and health care service seeking behaviours.

A 50-year-old lady expressed her feelings thus:

> *"We Ethiopians are well known with our good social life such as respecting each other, supporting everybody who is in need of our support, working together for mutual development, working together to eliminate or prevent anything which harms the community, but nowadays all those good and exemplary traditions are not well encouraged and supported by the government and its developmental partners" (GUAR_a).*

A 45-year-old mother disclosed her feeling that:

> *"The attention of government toward leading the prevention and control of TB/HIV is decreasing gradually" (GUAR_b).*

A 50-year-old lady living in the rural corner of Hawassa town said:

> *"According to my observation, donations to run TB/HIV programme are not properly administered. The fund is unnecessarily used for activities not targeting people living with HIV" (GUAR_c).*

A 42-year-old mother shared her experience as follows:

> *"I was at home with my two children. Suddenly the door was knocked. While I was opening the door two young men and a woman have greeted and requested me to perform voluntary counselling and blood testing for HIV. After a brief counselling, blood samples were taken from me and my two children. Unfortunately, all of us were found to be HIV positive. Until I get this opportunity to know my serum status, no one in my village has told me how the disease can be transmitted and prevented. This is a gap from government leaders in the health sectors. There should be clear direction on addressing health related information to grassroots level equitably. After getting this advice, recently I gave a birth of a male neonate with HIV negative serum status. The elder children started ART immediately and at this time they are following their elementary class education" (GUAR_d).*

As a study in countries in Sub-Saharan Africa indicated, good governance and leadership in intensifying efforts on reducing TB/HIV prevalence – and at the same time ensuring its effectiveness – is crucial for the success of the programme (Odugbesan & Rjoub 2019:1348). According to a study conducted in Pakistan, good governance and leadership can greatly improve quality health service delivery, especially in disease prevention programmes; however, nowadays few of these approaches are capable of evolving into embedded partnerships that can bring about positive changes in government's working practices in a sustainable manner (Bano 2019:1283). The study conducted by Agbodzakey (2021:1052) in South Florida, United States, disclosed the unique role of good leadership and collaborative governance in conditions which need a collaborative process and substantial outputs and outcomes for the benefits of individuals and society at large. It revealed how the HIV/AIDS pandemic unexpectedly promoted alternative leadership styles which were facilitative in nature and facilitated collective multi-stakeholder engagements for viable and sustainable solutions while embracing the associated challenges.

Patients' problems as a challenge not to address effective prevention interventions

In this theme, it emerged that patients themselves should take the major blame for the decline in the attention and care provided the individuals with TB/HIV. This will be briefly discussed in the following sub-themes:

Patient attitude

In this sub-theme some patients' negative attitude was taken as a significant factor for deterioration of their health status despite the availability of the necessary care and support.

A 48-year-old mother reported as follows:

> *"A significant number of […young people with HIV do not firmly believe in] the effectiveness of anti-retro viral drugs. That is why some of them have discontinued their treatment. They are busy with washing themselves with holy water and seeking additional spiritual treatment from priests" (GUAR…e).*

Patient knowledge

In this sub-theme some patients' poor knowledge was taken as a significant factor for deterioration of their health status despite the availability of the necessary care and support.

A 58-year-old mother reported her two observations that:

> *"Quite a lot of young people and adolescents living with HIV especially in rural area do not know how TB/HIV are transmitted from person to person. Sometimes they use sharp and pointed materials commonly with healthy people" (GUAR…f).*

> *"There are a number of people living with HIV/AIDS but due to lack of information on benefit of HIV treatment, some of them are not on ART. This may enhance the dissemination of infection in the community" (GUAR_f).*

A 36-year-old mother narrated an amazing story:

> *"In a family living in Hawassa town, there was a female house worker working for long time. She was HIV positive before joining this family but did not disclose her case to anyone living in the house. Gradually this lady has started sexual relation with the house guard. Once up on a time the first son of the family has seduced her for sexual relation and surprisingly, she was willing without any resistance. Consecutively the same request came from the father of the son.*

Her response was the same with that of the young person. Since all relations were secret, the marital relation of the father and mother of the young boy is still [in] progress" (GUAR…h).

According to the study conducted by Power (2018:180) in Cameroon, because of social impediments and lack of knowledge, the deliberate spread of HIV is among the important factors in the transmission of the disease. As a study conducted among university students in Nigeria revealed, some (1%) respondents reported that they would infect others, in a deliberate attempt to spread HIV infection, not wishing not to be affected or die alone (Mbacham, Atogho-Tiedeu, Ogundahunsi, Mosoko, Dionne, Fombad, Sikod, Anyangwa & Smits 2021:10). According to the study by Stadler (2021:97) conducted in South Africa, it was revealed that some individuals who were young and attractive had been purposefully infecting people with HIV. It was a shifting comprehension of AIDS from an external to an internal threat which domesticates and constructs the cultural framings of moral personhood.

Community problems as a challenge not to address effective prevention intervention

In this theme it was mentioned that some prevention measures against TB/HIV in the community were not accepted as useful. The participants in the study shared their experience of the issue in the following sub-themes.

Lack of knowledge in the community

In this sub-theme it was stressed that lack of knowledge in the community contributed to the occurrence of a high infectious disease burden due to its negative consequence for individuals' health care seeking behaviour.

A 32-year-old lady expressed her observation that

"Some community members believe that some food items and traditional medicines are effective for radical cure of HIV/AIDS and other infectious diseases" (GUAR…i).

Attitudes in the community

In this sub-theme it was indicated that certain negative attitudes toward people living with HIV /AIDS were making the care and support service difficult.

A 42-year-old mother living with HIV expressed her feeling that

> *"Nowadays for we people living with HIV/AIDS, social life is becoming very hard. Some people show us the act of discrimination. They don't want to eat, drink and use toilet together with us. We are feeling stigmatised" (GUAR_j).*

A 32-year-old lady disclosed her observation thus:

> *"Until recently it was believed among the community members that using some of the preventive measures against HIV such as use of condom has no value, rather it disseminates disrespectfulness and loss of loyalty to formal marriage partners" (GUAR…k).*

A 48-year-old woman who living with HIV narrated as follows:

> *"I am living with my husband and children in one big compound's rental house. In this compound a number of people are living together with us as neighbours. Once up on a day, one of my female neighbours has been distributing food to all households in the compound but she purposely overlooked me. Moreover, when my family members use toilet, she frequently uses ash to dust the floor assuming that HIV transmits through common use of latrine. Her frequent act of discrimination and misbehaviour has fully prepared me to commit strong revenge and I am waiting for appropriate time to…" (GUAR_l).*

As the study conducted in Zimbabwe by Moorhouse, Schaefer, Thomas, Nyamukapa, Skovdal, Hallett & Gregson (2019:1-3) demonstrated, some social factors that emerge from the community may negatively influence TB/HIV preventive activities. Hence, conversation which was developed to address community-level factors underlying gaps in motivation, access and effective use was found to be effective in prevention of TB/HIV in the wider community.

Social stigma on HIV/AIDS may interrelate with other forms of stigma such as gender, sex and sexuality. Stigma can create barriers to accessing necessary psychological, social and structural support, which can aggravate the existing experiences of stigma (Jackson-Best & Edwards 2018:1-19).

As a study conducted in South Africa indicated, social stigma which resulted from violence and discrimination in the community was responsible for the unwillingness of disclosure of

sexual orientation in the community. Timely measures have to be taken for adolescents and young people to come out freely to use programmes targeted at the prevention and control of TB/HIV (Abaver & Cishe 2018:60-70).

Health sector problems as a challenge not to address effective prevention

In this theme it was discussed that some health care institutions were not fully discharging their responsibility to prevent TB/HIV at grassroots level. In this main theme participants of the study briefly reflected their witness as follows:

Budget related factors

In this theme it was mentioned that lack of budget for TB/HIV care and support led to a gradual decline of the programme, and as a consequence people living with this problem were suffering a great deal.

A 32-year-old mother from the rural part of Sidama Zone around Hawassa town reported that:

> *"Nowadays health care service provider institutions are becoming first aid treatment centres. They are not giving basic diagnostic and treatment services for major health problems like TB/HIV. Health professionals in those institutions usually claims budget problem" (GUAR…m).*

Lack of attention

In this sub-theme it emerged that in some areas of Sideman region, in spite of the availability of resources, appropriate attention for clinical care and support was not provided by authorities concerned.

According to a 48-year-old mother,

> *"At the very beginning of HIV pandemic in the country, Ministry of Heath of Ethiopia and regional heath bureaus had been playing the major role in care, support and prevention of the disease, but now lack of attention toward the problem is causing increased number of cases and deaths" (GUAR…n).*

One of the discussants of the group explained her idea as follows:

> *"At the start of TB/HIV prevention and control activities in the country, there were people living with HIV who educate the community on prevention of TB/HIV. Those efforts have been*

supported by the health sector. But to date, the health cadres are not attentive enough to work on its sustainability. The newly coming generation is not getting life experience from people living with the problem at community level" (GUAR_o).

Another respondent of the group presented her witness that

"At the start of HIV pandemic, health education which has been given on prevention and control of TB/HIV at health facilities level has helped so many people to acquire the necessary knowledge and develop health care seeking behaviour. This has reduced the spread of the disease unlike that of today, it is considered as old fashion" (GUARD_p).

One of the caregivers of adolescents mentioned that

"Some health institutions providing [assistance and care for TB/HIV patients are] not strict enough in controlling their clients' adherence to ART" (GUARD_q).

Delivery of quality health services should address all the components of health systems, including optimised patient management, funding, resources for health services personnel, information systems as well as procuring high-quality drugs, laboratory supplies and commodities (WHO 2019e:5).

According to the study conducted in Nigeria, a significant number of respondents were satisfied with the quality of services provided by peer-led organisations in contrast with health care facilities in respect to service providers listening to respondents' problems and other health cares ($p = 0.007$), the same thing was true for privacy and confidentiality ($p = 0.04$) and considering the right of clients ($p = 0.04$) (Ochonye, Folayan, Fatusi, Emmanuel, Adepoju, Ajidagba, Jaiyebo, Umoh & Yusuf 20191-11).

The greatest number of new infections in the Eastern and Southern African region occur among adolescents and young people but in this region, attention and access to TB/HIV and sexual/reproductive health services is limited and this is intensified by social stigma and widespread violation of human rights (Govender et al 2018:53).

4.3.2.3. The experiences of public officials who were key informant interviewees regarding the availability and accessibility of TB/HIV prevention programmes for the adolescents in Hawassa, Ethiopia

In this study a key informant interview guide was used to conduct face-to-face interviews with public officials coordinating TB/HIV prevention and control programmes. The discussion guide was designed to explore information about the current TB/HIV prevention and control activities/strategies in Hawassa town, the efforts of different institutions in the prevention and control of the disease, and challenges not to implement those activities. Moreover, possible recommendations on the prevention and control of the dual infections were exhaustively communicated.

A total of four themes and eight sub-themes emerged from KII as depicted in Table 4.5 below:

- Leadership
- Budget
- Health information
- Health sector related factors

TABLE. 4.5: THEMES AND SUB-THEMES FROM KII WITH PUBLIC OFFICIALS

SN	Main themes	Sub-themes
1	Poor leadership experience as a challenge not to run TB/HIV prevention activities	• Political influence • Competing priority
2	Budget related issues experienced as a challenge not to undertake TB/HIV prevention activities	• Budget scarcity • Poor budget management
3	Problem in health information dissemination	• Giving less value to information, education and communication • Lack of programmatic integration and quality of information
4	Health sector related problems not to run effective TB/HIV prevention programmes	• Inadequate commitment • Failure to use available opportunities (Missed opportunity)
Total	**4**	**8**

4.3.2.3.1. Themes

At the time of data analysis for the KII four main themes were derived from the findings. From the four themes eight sub-themes emerged.

Poor leadership experience as a challenge not to run TB/HIV prevention activities

In this theme exercising poor leadership in health care service delivery institutions was mentioned to be a factor for the deterioration of TB/HIV prevention and control activities in the country. Under this theme participants of the study shared their experience as follows.

Political influence

In this sub-theme it was mentioned that the former political party (EPRDF) had a significant contribution for gradual deterioration of the health system of the country with its unnecessary interference.

Two tuberculosis prevention and control programme focal persons (36 and 38 years old) disclosed the following information respectively:

> *"Appointment of leaders on district health management position is based on their political commitment [rather] than their professional merit. Health care services including disease prevention activities are not properly managed. A huge gap in leadership capacity is becoming one of the important factors not to achieve the desired outcome" (GOVE.O-1).*

> *"Formerly there was one to five integrations of people in the community to give brief update on TB/HIV information. This has been facilitated by the local government authorities. Currently, this type of approach is assumed to be improper means to execute political mission.*

Competing priority

In this sub-theme it was discussed that to date there had been competing priorities in the country to which the government and developmental partners were giving much of their attention rather than to routine health care activities.

A 42-year-old HIV mainstreaming focal person expressed his feelings as follows:

> *"Since the last three years our country has been challenged with COVID-19, civil war, economic crisis and drought. All those factors have drawn the attention of the government from routine disease prevention and control activities to those competing priorities" (GOVE.O-2).*

According to one of the programme coordinators,

> *"The attention of government toward prevention and control of TB/HIV is decreasing gradually" (GOVE.O-3).*

One of the key informant interviewees reported that

> *"Currently the national prevalence of HIV has lowered at 0.9%. This was taken as irreversible success. The government and other development partners proudly feel that they have already accomplished their mission and diverted their attention to other competing priorities" (GOVE.O-2).*

The other key informant interviewee provided important information:

> *"Currently in various parts of the country including Hawassa town, there has been fast establishment of industrial parks. So many people including foreigners are recruited in those areas as new job opportunity. Beside the rapid industrialisation and urbanisation, those areas are flooded with commercial sex workers. The government is not giving attention to strengthen TB/HIV prevention and control activities such as condom distribution, health education, community conversation, voluntary counseling, and blood testing because of giving attention for the current competing priorities" (GOVE.O-4).*

A female programme coordinator continued:

> *"Formerly there were projects which had been supporting commercial sex workers to be engaged in safe income generating activities. But these days those activities are not in place. Commercial sex workers are widely distributed in urban areas and boosting the spread of TB/HIV" (GOVE.O-1).*

She continued, providing pertinent information:

> *"Currently partners working on TB/HIV prevention and control are not active and attentive in carrying out humanitarian activities as before. Vertical programmes dealing with prevention and control of TB/HIV are not getting the necessary support as before" (GOVE.O-1).*

One of the male programme coordinators discussed his observation as follows:

> *"In some health service delivery facilities, there is no proper coordination among various work units including TB/HIV collaborative activity" (GOVE.O-4).*

He added:

> *"At the time of the former Minister of Health, Dr. Tewdrose Adhanome (now he is the WHO director general), there was renowned health extension programme with 18 health service packages including prevention and control of TB/HIV. Currently professionals working in this programme are totally burnout and not interested to go forth. There is no attention for supportive supervision and capacity building activities nor regular monitoring and evaluation" (GOVE.O-4).*

The Adaptive Leadership Framework for Chronic Illness emphasises that health care services' difficulties, including the common problem in the developing world such as lack of attention to service takers by considering other competing priorities, can find solutions through defining the technical work of health care providers and taking joint action with stakeholders. It further delegates appropriate responsibility to patients and their caregivers (Bailey, Caiola, Adimora, Ramirez, Holt, Johnson, Koch et al 2022:259-269).

The role of leadership among all partners working on HIV/AIDS has come to be recognised as a highly important effort as the HIV pandemic moves into its fourth decade. Globally, there is a remarkable need for well-trained leaders in healthcare, research, policy, programme management, and advocacy, especially in countries and settings with high HIV prevalence and limited human power. Formal and informal leadership contributions in shared understanding are expected to be institutional design, commitment to process, having effective communication, trust building, empowerment, allocation of reasonable priorities and system context with the service takers' benefits to reduce the challenges (Agbodzakey 2021:1051-1064).

Besides widespread inclusion of TB/HIV prevention and control directives in guidelines and programmatic documents, effective preventive strategies are required for uninterrupted service delivery facilitated by good leadership and coordination between HIV and TB programmes (Surie, Interrante, Pathmanathan, Patel, Anyalechi, Cavanaugh & Kirking 2019:1308-1313).

Budget issues as a challenge not to undertake TB/HIV prevention activities

In this theme it was mentioned that beside its scarcity, budget allocation and utilisation have a number of implementation problems. The government and its stakeholders were blamed as the root cause of the problem.

Budget scarcity

In this sub-theme it was stated that nowadays due to a number of reasons the health sector was encountering a shortage of budget to run basic health care services including disease prevention and control activities.

A 38-year-old male HIV mainstreaming focal person said:

> *"Ethiopian government is encountering budget deficit due to the civil war and economic sanctions from the Western world. This made negative influence on a number of health sector programmes including running of TB/HIV prevention and control programme. It has not [been] getting adequate budget as before (GOVE.O-1).*

He further stated his opinion that*:*

> *"Due to shortage of reagents/testing kits, blood testing for HIV is not performed routinely. It is performed selectively for selected cases" (GOVE.O-1).*

Finally, he concluded:

> *"Due to shortage of budget, professionals are not adequately recruited on the newly designed HIV main streaming structure. This structure is getting implemented in all governmental organisations. The recruited professionals are not motivated due to their low salary and as a consequence, there is high attrition rate. Hence, there are so many vacant places in the new structure" (GOVE.O-1).*

Poor budget management

In this sub-theme it was emphasised that beside the scarcity of budget, poor budget utilisation was fuelling the problem.

A 38-year-old female TB/HIV programme focal person provided a brief elaboration on budget issues as follows:

> *"The central government of the country has good partnership with neighbouring countries and the international community. A number of donations were given to infectious disease prevention and control programmes. However, problems in proper utilisation of budget have been documented as a main factor for scarcity of budget" (GOVE.O-2).*

She added that

> *"Formerly budget from different partners has been allocated for capacity building activities and financial support to people living with HIV. Due to donor's fatigue, currently those activities are not on progress, programme sustainability was not properly addressed. Moreover, concerned government bodies are reluctant to secure budget from regular government budget" (GOVE.O-2).*

She concluded:

> *"Since 2-3 decades back, there was high commitment by all citizens working in governmental organisations to contribute 0.5% of their monthly salary. This fund has been allotted to support people living with HIV. The fund was not subjected to audit and diverted to activities other than HIV/AIDS care and support. Since this information is well known by people living with HIV, they are not motivated to disclose their zero status and educate their workmates" (GOVE.O-4).*

The findings of this study are in line with the study conducted in Tanzania in which failure to allocate reasonable budget and its poor utilisation were found to be one of the constraints in the prevention and control of disease prevention programmes such as TB/HIV (Stopard, McGillen, Hauck & Hallett 2019:1241).

A number of studies have demonstrated that reductions in magnitude of mortality can be achieved by efficient HIV prevention programmes that can be funded with an available budget. Failure to consider budget allocation constraints may significantly affect the technical efficiency and therefore limit the effectiveness of the programme (Coşgun & Büyüktahtakın 2018:431).

Ensuring proper placement of funding arrangements to support TB/HIV long-term prevention strategies will make the input most impactful. Maximising reasonable budget utilisation

brings considerable returns through reductions in new infections, better health of the population and reduction of unnecessary burden on health care facilities in the future (Anderson, Ghys, Ombam & Hallett 2018:1-4).

Problem in health information dissemination

In this theme it was discussed that even if everybody knew the importance of dissemination of health information for prevention of TB/HIV, proper attention was not being given for its quality and sustainability issues.

Giving less value for information, education and communication

As a disease prevention and control measures, many activities in the country have been planned and implemented, but it was mentioned that information, education and communication efforts were not valued properly.

One of the male key informant interviewees shared pertinent information as follows:

> *"Providing health information has vital importance in disease prevention activities. However, its implementation is encountering multiphase challenges" (GOVE.O-1).*

> *"Formerly social Medias and government news agencies were busy in disseminating TB/HIV related information to the public. But nowadays, those Medias are busy with political news and advertisement, giving less value to public health issues" (GOVE.O-2).*

> *"TB/HIV transmission hot spot areas were not given priority for dissemination of health information through community involvement" (GOVE.O-2).*

HIV main streaming focal person in one of the government institutions in Hawassa town supported the information given by the previous interviewee:

> *"To date the importance of community involvement in TB/HIV information dissemination initiative is not getting attention by the government and developmental partners" (GOVE.O-3).*

Lack of programmatic integration and quality of information

In this sub-theme it was discussed that the current TB and HIV programmes are running smoothly but due to less emphasis given to programme integration, some basic preventive activities were not given adequate attention.

A 45-year-old programme coordinator said:

> *"There is no adequate teaching materials for TB/HIV risk communication activities. The available resources are not properly used by professionals due to poor programmes integration" (GOVE.O-3).*

According to the statement of one of the public officials:

> *"Usually government and private media agencies are not working in integrated manner. One criticises the other, sometimes they disseminate contrary information on a similar issue including health information. This may confuse the audience not to take urgent preventive measures. Moreover, the government has no good capacity to control fraud news and misinformation" (GOVE.O-4).*

According to studies conducted in different parts of the world, integration of health programmes is a crucial factor to ensure understanding and acceptance of infectious disease prevention precautions and it also has an essential role in TB/HIV integrated programme monitoring with due accountability (Somse & Eba 2020:371). This has to be further strengthened by the establishment of formal mechanisms for consistent flow of health information with the desired standard and quality across partners and in the community through reviewing existing national TB/HIV policy guidelines (Mukasa, Kimaro, Kiwanuka & Igira 2017:1-11). Utilisation of those materials would result in the potential to expand future HIV prevention intervention success through dissemination of culturally appropriate health information to all people at different levels and times (Villegas, Cianelli, De-Tantillo, Warheit, Montano, Ferrer & Patel 2018:197-203). Such key implementation outcomes may further enhance programme effectiveness through well designed and integrated communication strategic approaches such as fidelity, penetration, and appropriateness. This could promote the rigour of future HIV care and prevention (Shangani, Bhaskar, Richmond, Operario & Van den Berg 2021:177-191).

Health sector related problems thwarting effective TB/HIV prevention

In this theme it was mentioned that the health sector itself was to blame for the spread of TB/HIV for reasons mentioned in the following sub-themes:

Inadequate commitment

In these sub-themes it was mentioned that individuals' commitment plays a vital role for the success of a programme. The ever-increasing lack of commitment in different health care service structures gradually compromises the service quality and increases the magnitude of the problem.

One of the public officials reported that

> *"Due to various reasons the health sector is not fully discharging its responsibility on prevention and control of TB/HIV. Health care service providing institutions are making significant contribution for the current distribution of the disease (GOVE.O-)*

One of the interviewees expressed his feeling as follows:

> *"Ministry of Health, regional health bureaus and zonal health departments didn't make adequate commitment to maintain the sustainability of TB/HIV preventive activities. They are not allocating resources adequately. Their collaboration with partners is getting declined. Formerly established efforts for integrated preventive activities are stepping down. Moreover, those governmental organisations and partners … used to give capacity building training to health professional who run the programme in due course but nowadays those efforts are not in good strength" (GOVE.O-4).*

A 32-year-old interviewee reported that

> *"To date the health system of the country is tight with crisis management. When emerging and reemerging infectious diseases like COVID-19 occur, all disease prevention efforts are directed to the current problem, making less commitment for the existing programmatic activities" (GOVE.O-3).*

Failure to use available opportunities (Missed opportunity)

According to a 38-year-old female disease prevention programme focal person stated:

> *"A number of health care services are given in the country. However, provision of integrated TB/HIV prevention and control services are not among the priority health care service issues. In some health care facilities with good resources. It is observed that the required patient care and support services are not given satisfactorily. This is considered as a missed opportunity in programme implementation process" (GOVE.O-2).*

This result is consistent with a study carried out in Sao Paulo, Brazil, where, due to the complexity of TB/HIV dual infection, utilising the available opportunities in health services and social context was not emphasised. Despite the high coverage of health professionals in some cities, this did not affect the magnitude of the problem. This finding was attributed to fragmented care and attention to acute conditions rather than integration/prioritisation of prevention and health promotion measures (Campoy, Arroyo, Ramos, Berra, Crispim, Yamamura, Pinto, Monroe et al 2020:1187). Research generated evidence has shown that HIV prevention interventions at all heath care service settings must employ an integrated method to ensure maximum effectiveness. Currently there is a range of effective behavioural, biomedical and structural approaches that can be integrated into various prevention modalities to address the sexuality and reproductive health needs of adolescents, including oral pre-exposure prophylaxis, male circumcision, voluntary counselling and blood testing (Hosek & Pettifor 2019:120-128). Moreover, collaboration of the health sector with implementing partners, civil society organisations, private sector providers and expertise to enhance service delivery for demand creation would help to ensure all levels are integrated in youth-friendly services. These factors allow the establishment of meaningful functions at all levels, including global, national, sub-national and grassroots, including the community (Fleischman, Kachale, Mhuriro, Mugambi, Ncube, Ndwiga, Nyirenda et al 2022:1-3).

4.3.2.4. Challenges associated with implementation of interventions to address TB/HIV dual infection in Hawassa, Southern Ethiopia

- Nowadays adequate attention is not given to behavioural change communication on TB/HIV prevention and control by concerned bodies all over the country
- The media has gradually decreased its responsibility in disseminating current health information and its collaboration with other sectors.
- Reluctance of the government in controlling substance abuse is encouraging adolescents towards drug addiction and drinking alcohol.
- Community leaders, religious leaders and other influential people in the community are not getting the necessary support from the government and developmental partners to be engaged in the prevention and control of TB/HIV in the community.
- A critical shortage of budget to run capacity building programmes, purchase medical equipment and supplies for the care and prevention of TB/HIV and for recruiting well

trained health professionals is the prominent challenge in combating the spread of the disease all over the country.

- Lack of good governance and leadership is the root cause that TB/HIV prevention programmes are not achieving the desired outcome.
- Strategic objectives for TB/HIV prevention and control lack appropriate implementation guidelines.

4.4. MEASURES RECOMMENDED TO PREVENT AND CONTROL THE SPREAD OF TB/HIV INFECTION AMONG ADOLESCENTS IN HAWASSA TOWN

- Attention has to be given to strengthening behavioural change communication activities and care/support to people living with TB/HIV at all levels, including the private sector. For its implementation, the Ministry of Health, the Ministry of Education, partners working on health development, and the media are expected to work hand in hand.
- The media has to support the prevention and control of TB/HIV.
- Strong measures have to be taken in controlling night clubs, illegal narcotic drug sales/traffic with legislative rules and regulations.
- To combat the spread of TB/HIV in the community, the local governmental administrative bodies, the private sector, developmental partners, the community, and religious leaders are expected to engage in the integrated TB/HIV prevention and control programme.
- Engagement of community leaders, religious leaders and social workers in the new global initiative known as “U = U (undetectable = untransmissible)” is vital for ending the HIV/AIDS pandemic.
- A reasonable amount of budget needs to be allocated for care and support of patients in chronic care centres, health professionals’ capacity building and activating the former community and school-based TB/HIV preventive activities.
- Exercising good governance and resilient leadership through capacity building and supportive supervision is of paramount importance in controlling TB/HIV and other health problems of the community.
- Regular policy dialogue, equitable distribution of resources, and significant community engagement need attention in the implementation of the disease prevention programmes.

- Strategic objectives for TB/HIV prevention and control need an appropriate implementation strategy.

4.5. PRESENTATION, ANALYSIS AND DISCUSSION OF QUANTITATIVE DATA

4.5.1. Introduction

The previous chapter addressed and described the determinants of TB. The quantitative phase aimed at determining factors responsible for causing tuberculosis among HIV positive adolescents. This phase addressed objectives 3 and 4 of the study. Tables and figures were used to present, simplify and elaborate on the findings. The findings are described, interpreted and discussed based on the output of the data analysis. Moreover, this section presents a conclusion of the results and discussion that comprehensively offer a picture of all determinants of TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia to inform the design of an integrated TB/HIV prevention strategy.

4.5.2. Study population, data collection and analysis

The study population enrolled were adolescents aged 13 to 24 years for both cases and controls. Cases were those clients who were following their treatment in chronic care centres and diagnosed with both pulmonary TB and HIV. Controls were those clients who were following their treatment in chronic care centres and diagnosed only with HIV. Data collection for the quantitative phase took place from 11 September 2021 to 28 February 2022 with the use of a questionnaire. The quantitative data was sourced in two phases. Face-to-face interviews were conducted with adolescents living with TB/HIV in chronic care centres followed by reviewing their clinical records for previous medical history and diagnoses which could be considered as additional factors for the occurrence of tuberculosis. Data analysis was performed in two broad divisions: descriptive statistical analysis in which the frequency and distribution of relevant variables were indicated/discussed, and inferential statistical analysis in which associations of different variables with TB infection were identified.

Associated factors analysed and discussed from this quantitative phase were:

- Clinical factors (from patients' interviews and clinical records review).
- Host factors.
- Environmental factors.

The results are presented in tables, graphs and narratives as follows.

4.5.2.1. Results and discussions from descriptive statistical analysis

4.5.2.1.1. Clinical factors

This section presents the distribution of clinical factors responsible for causing tuberculosis infection among the respondents of the study. Clinical risk factors can be described as physiological attributes which at certain levels may be associated with an increased risk of certain diseases or death (Jiang, Hou, Su, Zhang, Yang, Liu, Wang et al 2020:722-728). For this study they were identified as follows:

- Face-to-face interviews: WHO clinical staging, haemoglobin level, CD4 count, BMI and viral load test.
- Clinical record review: comorbidity and opportunistic infection: under comorbidity the distribution of diabetes mellitus, cancer, malnutrition and no comorbidity will be discussed, whereas under opportunistic infection the distribution of pneumonia, pneumocystis carinii pneumonia (PCP) and other opportunistic infections will be described.

- **WHO clinical staging**

WHO HIV clinical staging is a method used to measure the severity and development of different clinical manifestations in a person who has contracted HIV (Kopcha, Andreychyn, Iosyk, Kopcha, Radetska & Hanberger 2019:101-105). The four WHO HIV clinical diagnosis stages were assessed among those respondents who had both TB/HIV (cases) and only HIV (controls) as indicated in Table 4.6 below.

TABLE 4.6: DISTRIBUTION OF WHO CLINICAL STAGING AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	n(%)	n(%)	Total (n=321)
WHO Clinical staging			
Stage I	1(0.93)	108(50.47)	109(33.96)
Stage II	2(1.87)	60(28.04)	62(19.31)
Stage III	85(79.44)	37(17.29)	122(38.01)
Stage IV	19(17.76)	9(4.21)	28(8.72)

As indicated in Table 4.6, of the 321 respondents of the study, WHO clinical stages were assessed and the results reveal that most of the clients, 122(38.01%) – 85(79.4%) of the cases and 37(17.29%) of the controls – were in stage III. This implies that if any person living with HIV has TB as additional diagnosis, he/she automatically fulfils the minimum criteria to fall in stage III (Ministry of Health of Ethiopia [MoHE] 2018c:20-23). This could be the probable reason that the number became high. The lowest number of distribution, 28(8.72%) – 19(17.76%) of the cases and 9(4.21%) of the controls – were identified on stage IV. This is because most of the clients came from Hawassa town, which is an urban area, and they were exposed to health information for which they sought medical attention before the advance (stage IV) of the infection. The other probable reason could be that after reaching stage IV, some of the cases may have died due to advanced complications.

- **Haemoglobin (Hb) level**

Anaemia or low haemoglobin level increases an individual's susceptibility to infectious diseases including tuberculosis by reducing the immunity level (Gil-Santana, Cruz, Arriaga, Miranda, Fukutani et al 2019:1-8). Haemoglobin level categorised into two categories were assessed among the respondents of the study as indicated in Table 4.7.

TABLE 4.7: DISTRIBUTION OF HAEMOGLOBIN LEVEL AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	n(%)	n(%)	Total (n=321)
Haemoglobin level			
<13	71(66.36)	157(73.36)	228(71.03)
≥13	36(33.64)	57(26.64)	93(28.97)

Table 4.7 shows that haemoglobin level distribution of the 321 participants of the study was assessed. The result indicates that the haemoglobin level of most the clients, 228(71.03%) – 71(66.36%) of the cases and 157(73.36%) of the controls – fell below 13 mg/dl. This shows that most of them were on chronic disease. Unless individuals have active bleeding or

nutritional deficiency, low haemoglobin level is mostly the manifestation of chronic diseases such as tuberculosis (Gelaw, Getaneh & Melku 2021:1-15).

- **CD4 count**

Previous studies clearly demonstrated that HIV causes immunosuppression directly by depletion of host $CD4^+$ T lymphocytes. As a result of lymphocytopenia and down regulation of these immune cells, vulnerability to TB infection is increased in HIV positive patients (Geremew, Melku, Endalamaw, Woldu, Fasil, Negash, Baynes et al 2020:1-10). CD4 count categorised into three categories was assessed among the respondents of the study as indicated in Table 4.8.

TABLE 4.8: DISTRIBUTION OF CD4 COUNT AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	n(%)	n(%)	Total (n=321)
CD4 count (cells/mm^3)			
<200	27(25.23)	31(14.49)	58(18.07)
200–499	45(42.06)	71(33.18)	116(36.14)
≥500	35(32.71)	112(52.34)	147(45.79)

CD4 count distribution of the 321 respondents of the study was assessed, as indicated in Table 4.8, and the result reveals that the CD4 count of most of them, 116(36.14%) – 45(42.06%) of the cases and 71(33.18%) of the controls – fell in the range 200–499 cells/mm3. This shows that most of them were liable to develop various opportunistic infections including tuberculosis. The CD4 count of a considerable number of the respondents, 58(18.07%) – 27(25.23%) of the cases and 31(14.49%) of the controls – was lower than 200cells/mm^3 . This still shows there is high probability of acquiring various types of infections (Tesfaye et al 2018:1-4).

- **Body mass index (BMI)**

BMI is a person's weight in kilograms (or pounds) divided by the square of height in meters (or feet). A high BMI can indicate high body fatness. BMI screens for weight categories that

may lead to health problems (CDC 2021c:1-5). BMI categorised into three categories was assessed among the respondents of the study as indicated in Table 4.9.

TABLE 4.9: DISTRIBUTION OF BODY MASS INDEX (BMI) MEASUREMENT AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	n(%)	n(%)	Total (n=321)
BMI (kg/m²)			
10-18	74(69.16)	102(47.66)	176(54.83)
19-25	31(28.97)	105(49.07)	136(42.37)
26-30	2(1.87)	7(3.27)	9(2.8)

Of the 321 participants of the study indicated in Table 4.9, BMI measurement distribution was assessed and the result reveals that the BMI measurement of most of the clients, 176(54.83%) – 74(69.16%) of the cases and 102(47.66%) of the controls – fell in the range 10-18 (kg/m2). This shows that most of them were in a state of overt malnutrition and liable to develop various opportunistic infections, including tuberculosis (Walson & Berkley 2018:231). This number could be still higher if baseline BMI measurement were to be taken for all cases in the chronic care centre.

- **Viral load test result**

Viral load gives an idea of how much of the HIV virus is in the body. The test measures the number of HIV copies in a millilitre of blood (Ali & Yirtaw 2019:1-6). Viral load tests categorised into two categories were assessed among the respondents of the study as indicated in Table 4.10.

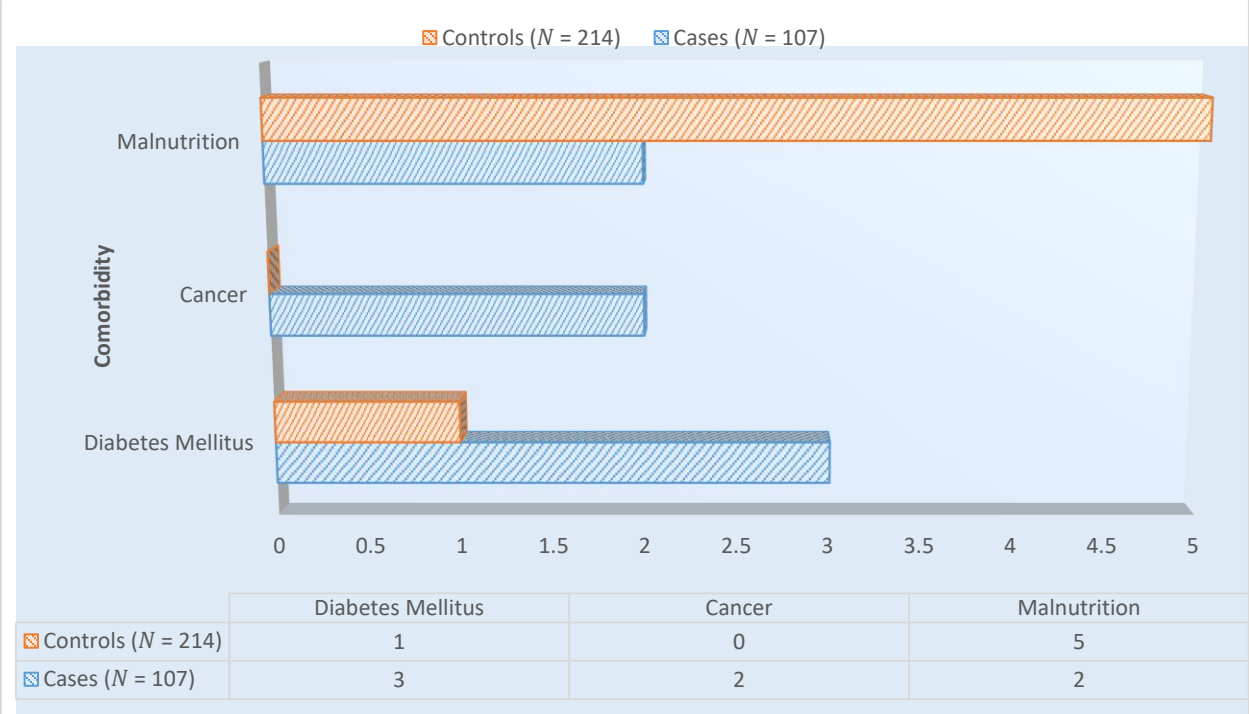
TABLE 4.10: DISTRIBUTION OF VIRAL LOAD TEST RESULT AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	n(%)	n(%)	Total (n=321)
Viral load test copies/mL			
<1000	97(90.65)	207(96.73)	304(94.70)
≥1000	10(9.35)	7(3.27)	17(5.30)

Among the 321 participants of the study indicated in Table 4.10, viral load test result distribution was assessed and the result indicates that the viral load test result of most of the clients, 304(94.70%) – 97(90.65%) of the cases and 207(96.73%) of the controls – fell to less than 1000 copies/mL. The probable reason for this result could be that some clients shift their treatment place from health centres and private health institutions to referral chronic care centres without having the baseline viral load test. The other probable reason could be that ART adherence has a dramatic effect in reducing viral load among clients in chronic care centres (Li, Segal, Bosch, Lalama, Roberts-Toler, Delagreverie, Getz et al 2020:1636-1642).

- **Comorbidity**

A comorbidity is any coexisting health condition. Comorbidities are often chronic conditions, and which can affect physical health (Di Gennaro, Vittozzi, Gualano, Musso, Mosti, Mencarini, Pareo et al 2020:489). From clinical record review findings, distribution of comorbidities was assessed among the respondents of the study as indicated in Figure 4.1.



	Diabetes Mellitus	Cancer	Malnutrition
Controls (N = 214)	1	0	5
Cases (N = 107)	3	2	2

Figure 4.1: Distribution of comorbidity among HIV-positive adolescents in public health facilities, Hawassa Town, Southern Ethiopia

As indicated in Figure 4.1, comorbidity distribution among the 321 respondents of the study was assessed and the result shows that of the total number of patients, 7(2.18%) –; 2(1.86%) of the cases and 5(2.34%) of the controls – had been experiencing malnutrition; 4(1.25%); 3(2.8) of the cases and 1(0.47) of the controls had diabetes mellitus, followed by 2(1.86%) of the cases and 0(0%) of the controls with cancer as a comorbidity. The rest, 308 (95.6%) were without comorbidity. Sometimes comorbidities at lower-level health institutions are not well identified and recorded where there are no adequate senior health professionals and advanced diagnostic tools, and this may decrease the number of diagnoses (Harries & Kumar 2018:78-79).

- **Opportunistic infection**

Opportunistic infections (OIs) are illnesses that occur in people with HIV when their immunity is low (Duff 2019:816-822). From clinical record review findings, distribution of opportunistic infection was assessed among the respondents of the study as indicated in Table 4.11.

TABLE 4.11: DISTRIBUTION OF OPPORTUNISTIC INFECTIONS AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	N (%)	N (%)	Total (n=321)
Opportunistic infections			
pneumonia	39(36.45)	58(27.10)	97(30.22)
PCP	10(9.35)	4(1.87)	14(4.36)
Others	15(14.02)	19(8.88)	34(10.59)
No infection	43(40.19)	133(62.15)	176(54.83)

Of the 321 respondents of the study indicated in Table 4.11, opportunistic infections distribution was assessed and the result shows that, of the total, 97(30.22%) – 39(36.45%) of the cases and 58(27.10%) of the controls – had been experiencing pneumonia, followed by 14(4.36%) – 10(9.35%) of the cases and 4(1.87%) of the controls – have pneumocystis carinii pneumonia (PCP). The rest, 176(54.83%), were without opportunistic infection. Sometimes opportunistic infections at lower-level health institutions are not well identified and recorded where there are no specialised health professionals, and this may decrease the number of diagnoses (Harries & Kumar 2018:78-79).

4.5.2.1.2. Host factors

This section discusses the distribution of host factors among the respondents of the study. Host factors are factors or behaviours responsible for influencing the health status of individuals and they appear in the day-to-day or previous experience of individuals (Dutt 2021:11-28). These were smoking, bronchial asthma, taking ART, taking IPT, taking CPT, previous history of pneumonia, previous history of tuberculosis, and being bedridden (Alemu et al 2020:59-66).

- **Cigarette smoking**

In previous studies it was identified that exposure to indoor air pollution and second-hand tobacco smoke increases the risk of contracting tuberculosis (Obore, Kawuki, Guan, Papabathini & Wang 2020:24-35). Cigarette smoking as a host factor was assessed among the respondents of this study as depicted in Table 4.12.

TABLE 4.12: DISTRIBUTION OF CIGARETTE SMOKING AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	n (%)	n (%)	Total (n=321)
Smoking			
Yes	9(8.41)	2(0.93)	11(3.42)
No	98(91.59)	212(99.07)	310(96.53)

From the 321 respondents of the study indicated in Table 4.12, their history of smoking as a host factor was assessed and the result reveals that 11(3.42%), – 9(8.41%) of the cases and 2(0.93%) of the controls – reported that they had a history of smoking at least once in their lifetime. The rest 300(93.45%) did not have a history of smoking. This number is much lower than studies conducted in other parts of Ethiopia where among the study's adolescent participants, smoking was prevalent in 270 (477, 4.7%) (Alemu et al 2020). This could be due to the socio-cultural difference between the two regions.

- **Bronchial asthma**

Bronchial asthma is one of the chronic obstructive pulmonary diseases and can predispose individuals to endobronchial TB (Nguyen-Ho, Nguyen-Tiet & Chang 2021:1-3). Bronchial

asthma as a host factor was assessed among the respondents of this study as depicted in Table 4.13.

TABLE 4.13: DISTRIBUTION OF BRONCHIAL ASTHMA AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	n(%)	n(%)	Total (n=321)
Asthma			
Yes	4(3.74)	5(2.34)	9(2.80)
No	103(96.26)	209(97.66)	312(97.2)

Of the 321 respondents of the study indicated in Table 4.13, the history of bronchial asthma as host factor was assessed and the result indicates that 9(2.80%) – 4(3.74%) of the cases and 5(2.34%) of the controls – reported that they had a history of bronchial asthma as past medical history and one attack at least in their lifetime. The rest, 312(97.2%), did not have a history of asthma. This number is much lower than studies conducted in other parts of the world. This could be due to memory lapse of the respondents, difference in individuals' response to disease conditions, and difference in geographical conditions at which those internal and external factors could predispose to allergic conditions including bronchial asthma (Katelaris & Beggs 2018:129-134).

- **Taking antiretroviral therapy (ART)**

Antiretroviral drugs are drugs which are administered to PLHIV to inhibit the multiplication of the virus in their body (Menéndez-Arias & Delgado 2021:16-29). Taking antiretroviral therapy regularly as a host factor was assessed among the respondents of the study as depicted in Table 4.14.

TABLE 4.14: DISTRIBUTION OF TAKING ART AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	n(%)	n(%)	Total (n=321)
Taking ART			
Yes	106(99.10)	209(97.66)	315(98.10)
No	1(0.90)	5(2.34)	6(1.90)

Of the 321 respondents of the study indicated in Table 4.14, taking ART regularly as host factor was assessed and the result shows that 315(98.10%) – 106(99.10%) of the cases and 209(97.66%) of the controls – confirmed that they took their medication regularly. The rest, 6(1.90%), did not take their medication regularly. Since the study was institutionally based, which was conducted in chronic care centres, clients were expected to be strictly followed by health professionals and lost to follow-up cases are minimal. According to a study conducted in South Western Ethiopia, the adherence of patients to ART was relatively low compared to other studies conducted in different regions of the country (Angelo & Alemayehu 2021:299).

- **Taking isoniazid prophylaxis therapy (IPT)**

Isoniazid prophylaxis therapy is one of the drug management approaches used to inhibit the development of latent tuberculosis to its active form using a drug known as INH (Ross, Badje, Rangaka, Walker, Shapiro, Thomas, Anglaret et al 2021:8-15). Taking isoniazid prophylaxis therapy regularly as a host factor was assessed among the respondents of the study as depicted in Table 4.15.

TABLE 4.15: DISTRIBUTION OF TAKING ISONIAZID PROPHYLAXIS THERAPY (IPT) AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	n(%)	n(%)	Total (n=321)
Taking IPT			
Yes	64(59.81)	202(94.39)	266(82.87)
No	43(40.19)	12(5.61)	55(17.13)

Taking IPT as host factor was assessed in the 321 respondents of the study indicated in Table 4.15, and the result shows that 266(82.87%) – 64(59.81%) of the cases and 202(94.39%) of the controls – sustained taking IPT regularly. The rest, 55(17.13%) of them, did not take IPT regularly. Forty-three (40.19%) clients with tuberculosis were still taking IPT regularly. This is not in line with the national anti TB drug treatment protocol because confirmed TB cases are recommended to take a full course of anti TB drugs for six to eight

months (Ministry of Health of Ethiopia [MoHE] 2018b:51-55) but they were taking only Isoniazid (INH). This figure shows there is medical error either due to lack of knowledge or negligence.

- **Taking cotrimoxazole preventive therapy (CPT*)***

Cotrimoxazole preventive therapy (CPT) reduces morbidity and mortality in people with untreated HIV infection and in those on ART (Kyosiimire-Lugemwa, Anywaine, Abaasa, Levin, Gombe, Musinguzi, Kaleebu et al 2020:381-390). Taking CPT regularly as a host factor was assessed among the respondents of the study as depicted in Table 4.16.

TABLE 4.16: DISTRIBUTION OF TAKING COTRIMOXAZOLE PREVENTIVE THERAPY (CPT) AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	N (%)	N (%)	Total (n=321)
Taking CPT			
Yes	97(90.65)	159(74.3)	256(79.75)
No	10(9.35)	55 (25.7)	65(20.24)

Taking CPT as host factor was assessed among the 321 respondents of the study as indicated in Table 4.16, and the result reveals that 256(79.75%) – 97(90.65%) of the cases and 159(74.3%) of the controls – had been taking CPT prophylaxis. The rest, 65(20.24%), were not taking CPT. This shows that most of the clients had been using the prophylaxis and it was given without considering their CD4 count. Only WHO clinical staging III and IV patients, and patients whose CD4 count is less than 350 cells/mm^3 who are eligible to take CPT (Anywaine, Levin, Kasirye, Lutaakome, Abaasa, Nunn, Grosskurth et al 2018:1-5). Not following the treatment guideline properly may cause failure in achieving the desired treatment outcome.

- **Presence of TB in the family**

Respondents of the study were interviewed to give information on the presence of any of their family members with pulmonary tuberculosis. This was asked to confirm whether there

was a history of significant contact with a chronic cougher or TB patient as a host factor for transmission of tuberculosis. The distribution of the response is depicted in Table 4.17 below.

TABLE 4.17: DISTRIBUTION OF PRESENCE OF TB IN THE FAMILY AS HOST FACTOR FOR OCCURRENCE OF TB AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	N (%)	N (%)	Total (n=321)
Presence of TB in the family Yes No	 17(15.89) 90(84.11)	 9(4.21) 205(95.79)	 26(8.1) 295(91.9)

Presence of TB in the family as host factor was assessed for the 321 respondents of the study as indicated in Table 4.17, and the result reveals that 26(8.1%) – 17(15.89%) of the cases and 9(4.21%) of the controls – had a history of the presence of TB in the family. The rest 295(91.9%) did not have history of TB in the family. This shows that most of the clients did not have significant contact with a chronic cougher outside their house or in the family. This could be because the respondents of the study may not have adequate knowledge or information about the health status of their family members. According to a systematic review and meta-analysis conducted in different parts of the world, a history of TB among family members was found to be associated with TB disease in two studies. The type of residence of the index case was reported as a significant factor. It was found that respondents living in slum areas were more affected with the infection than those who live in relatively better areas (Melsew, Doan, Gambhir, Cheng, McBryde & Trauer 2018:345-353).

- **History of pneumonia**

Pneumonia and TB can be combined or exist one after another, and this would cause certain difficulties in identifying of the two diseases (Wei, Zhao, Qian, Yang, Wei & Tang 2020:278-284). In this study previous history on pneumonia as a host factor was assessed among the respondents of the study as depicted in Table 4.18.

TABLE 4.18: DISTRIBUTION OF HISTORY OF PNEUMONIA AS HOST FACTOR FOR OCCURRENCE OF TB AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SIDAMA REGION

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	n(%)	n(%)	Total (n=321)
History of Pneumonia			
Yes	73(68.22)	81(37.85)	154(47.98)
No	34(31.78)	133(62.15)	167(52.02)

Of the 321 respondents of the study indicated in Table 4.18, history of pneumonia as host factor was assessed and the result reveals that 154(47.98%) – 73(68.22%) of the cases and 81(37.85%) of the controls – had a history of pneumonia. The rest, 167(52.02%), did not have a history of pneumonia. This shows that most of the clients did not have a history of pneumonia. The probable reason for not having a significant number of people with previous history of pneumonia is that unless the disease is identified by health professionals and recorded on patients' treatment chart, the diagnosis could be missed and treated as upper respiratory tract infection. The other reason could be that the respondents of the study may not have had adequate knowledge on their previous health status due to memory lapse. A study conducted in Malawi revealed low adherence to diagnostic and treatment guidelines may lead to missed diagnosis of cases which again leads to missed treatment and death of patients. The accurate diagnoses are missed and under-reported (Uwemedimo, Lewis, Essien, Chan, Nsona, Kruk & Leslie 2018:1-3).

- **Previous history of tuberculosis**

According to various studies conducted in different parts of the world, previous history of tuberculosis was mentioned as one of the determinant factors for the occurrence of tuberculosis (Elduma, Mansournia, Foroushani, Mansournia, Hamdan, Elegail, Elsony & Holakouie-Naieni 2019:41-42) In this descriptive phase of the quantitative study, the distribution of previous history of tuberculosis as a host factor was assessed among respondents of the study as depicted in Table 4.19.

TABLE 4.19: DISTRIBUTION OF PREVIOUS HISTORY OF TUBERCULOSIS AS HOST FACTOR FOR OCCURRENCE OF TB AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	n(%)	n(%)	Total (n=321)
Previous History of TB			
Yes	100(93.46)	2(0.93)	102(31.78)
No	7(6.54)	212(99.07)	219(68.22)

The previous history of tuberculosis as host factor was assessed of the 321 respondents of the study indicated in Table 4.19 and the result reveals that 102(31.78%) – 100(93.46%) of the cases and 2(0.93%) of the controls – had previous history of tuberculosis. The rest, 219(68.22%), did not have a previous history of TB. This shows that most of the clients did not have a history of tuberculosis. The probable reasons for not having significant number of people with previous history of tuberculosis are similar to the reasons stated earlier in this study for previous history of pneumonia.

- **Being bedridden**

Being ambulatory and bedridden was mentioned in recent studies as presenting a higher risk for development of tuberculosis in PLHIV and they were viewed as progression markers of the disease (Elduma et al 2019:41-42). In this study, the distribution of being bedridden as a host factor was assessed among the respondents of the study as depicted in Table 4.20.

TABLE 4.20: DISTRIBUTION OF BEING BEDRIDDEN AS HOST FACTOR FOR OCCURRENCE OF TB AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factor	Cases (N = 107)	Controls (N = 214)	
	n(%)	n(%)	Total (n=321)
Being Bedridden			
Yes	22(20.56)	17(7.94)	39(12.15)
No	85(79.44)	197(92.06)	282(87.85)

From the total 321 respondents of the study indicated in Table 4.20, being bedridden as host factor was assessed and the result reveals that 39(12.15%) – 22(20.56%) of the cases and 17(7.94%) of the controls – had a previous history of being bedridden. The rest, 282(87.85%), did not have a previous history of being bedridden. This shows that most of the clients did not have a history of being bedridden. The probable reason for not having a significant number of people with a previous history of being bedridden could be that unless the condition of being bedridden is identified by health professionals during admission time or at the first contact of the client with health professionals and recorded on the patients' treatment chart, the finding could be missed and hence lacks less consideration to use as supportive evidence for diagnosis of WHO's clinical staging. Another reason could be that the respondents of the study may not have adequate knowledge on their previous health status, or they may have a memory lapse or lack of attention (Uwemedimo et al 2018:1-3).

4.5.2.1.3. Environmental factors

This section discusses the environmental factors assessed among the respondents of the study. Environmental factors are ecological conditions relating to the biotic and abiotic surrounding of an organism or population which are responsible for influencing the health status of individuals (Rasam et al 2018:187-192). Poor environmental sanitation can become a way for disease transmission. The occurrence of environmentally based diseases is caused by the interaction between humans and the environment, especially for people who spend a lot of time at home. If the sanitation of the house environment is not well maintained, it has the potential to cause an illness (Aditama, Sitepu & Saputra 2019:227-231). In this study the distribution of environmental factors was assessed for tuberculosis infection. These were walls of the residential house, availability of a separate kitchen, availability of a waste disposal site, the floor of residential house, persons per room (PPR), number of windows in a house, and houses shared with domestic animals.

- **Wall of the residential house**

Distribution of the walls of the residential house as environmental factor was assessed among the respondents of the study as depicted in Table 4.21.

TABLE 4.21: DISTRIBUTION OF WALLS OF THE HOUSE AS ENVIRONMENTAL FACTOR FOR OCCURRENCE OF TB AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Environmental factor	Cases (N = 107)	Controls (N=214)	
	n (%)	n (%)	Total (N = 321)
Wall of residential house			
Mud/mud brick	44(41.12)	71(33.18)	115(35.83)
Cement	63(58.88)	143(66.82)	206(64.17)

Of all 321 respondents of the study indicated in Table 4.21, the walls of the house as an environmental factor were assessed and the result reveals that in 206(64.17%) – 63(58.88%) of the cases and 143(66.82%) of the controls – houses the walls were made of cement. The rest 115(35.83 %) were made of mud or mud brick. This shows that most of the client's houses were made of cement. The probable reason could be the fact that most of the study participants came from Hawassa town, which is a modern town and the capital city of the Southern part of Ethiopia, where they may have better living standards than those people who live in rural areas of Sidama Region. Housing conditions could be the indirect indicator for socio-economic status of individuals. Poor socio-economic status is well known in causing infectious diseases including tuberculosis (Jiamsakul, Lee, Nguyen, Merati, Cuong, Ditangco, Yunihastuti et al 2018:179-186).

- **Availability of a separate kitchen**

Availability of a separate kitchen as environmental factor was assessed among the respondents of the study as depicted in Table 4.22.

TABLE 4.22: DISTRIBUTION OF AVAILABILITY OF SEPARATE KITCHEN AS ENVIRONMENTAL FACTOR FOR OCCURRENCE OF TB AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Environmental factor	Cases (N = 107)	Controls (N = 214)	
	N (%)	N (%)	Total (n=321)
Separate kitchen			
Yes	66(61.68)	109(50.93)	175(54.52)
No	41(38.32)	105(49.07)	146(45.48)

A separate kitchen as environmental factor was assessed for the 321 respondents of the study indicated in Table 4.22, and the result shows that 175(54.52%) – 66(61.68%) of the cases and 109(50.93%) of the controls – reported that they had a separate kitchen in their house. The rest 146(45.48%) did not have separate kitchens. This shows that most of the clients had separate kitchens in their house. Having a separate kitchen helps to avoid frequent exposure to smoke and other irritant gases to the respiratory tract, especially to the alveoli of the lungs which precipitate the conversation of latent to active TB (Bai, Aerts, Verma, Ordway & Chan 2018:22).

- **Availability of a waste disposal site**

Availability of a waste disposal site as environmental factor was assessed among the respondents of the study as depicted in Table 4.23.

TABLE 4.23: DISTRIBUTION OF AVAILABILITY OF WASTE DISPOSAL SITE AS ENVIRONMENTAL FACTOR FOR OCCURRENCE OF TB AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Environmental factor	Cases (N = 107)	Controls (N = 214)	
	N (%)	N (%)	Total (n=321)
Waste disposal site			
In the compound	17(15.89)	18(8.41)	35(10.9)
Outside	90(84.11)	196(91.59)	286(89.1)

Among the 321 respondents of the study indicated in Table 4.23, a waste disposal site as environmental factor was assessed and the result shows that 35(10.9%) – 17(15.89%) of the cases and 18(8.41%) of the controls – reported that they usually disposed waste everywhere in their compound. The rest, 286(89.1%) of them, disposed waste outside of their compound. This shows that most of the clients did have the trend of disposing waste outside of the compound. The use of more communal trash bins, and the collection of waste from individual houses could help prevent exposing the public to communicable diseases (Rodseth, Notten & Von Blottnitz 2020:1-6).

- **Floor of residential house**

The type of floor in residential houses as environmental factor was assessed among the respondents of the study as depicted in Table 4.24.

TABLE 4.24: DISTRIBUTION OF FLOOR OF HOUSE AS ENVIRONMENTAL FACTOR FOR OCCURRENCE OF TB AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Environmental factor	Cases (N = 107)	Controls (N = 214)	
	N (%)	N (%)	Total (n=321)
Floor of house			
Earth	26(24.3)	38(17.76)	64(19.94)
Cement	81(75.70)	176(82.24)	257(80.06)

Of 321 respondents of the study indicated in Table 4.24, the floors of their houses as and environmental factor were assessed and the result shows that 64(19.94%) – 26(24.3%) of the cases and 38(17.76%) of the controls – responded that the floors of their houses were made of mud. The rest 257(80.06%) of them were living in houses made of cement. As one of the modern towns in Ethiopia; Hawassa town, a town with many recreational places, industrial parks and well-planned residential areas, is expected to have houses mostly made of cement. Floors and walls of houses made of cement will not be a good hiding place for disease harbouring organisms or reservoirs of infectious agents (Kilabuk, Momoli, Mallick, Van-Dyk, Pease, Zwerling, Potvin et al 2019:401-406).

- **Persons per room (PPR)**

Presence of persons per room (PPR) as environmental factor for transmission of TB was assessed among the respondents of the study as depicted in Table 4.25.

TABLE 4.25: DISTRIBUTION OF PERSONS PER ROOM AS ENVIRONMENTAL FACTOR FOR OCCURRENCE OF TB AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Environmental factor	Cases (N = 107)	Controls (N = 214)	
	N (%)	N (%)	Total (n=321)
Persons per room (PPR)			
1	48(44.86)	106(49.53)	154(47.97)
≥2	59(55.14)	108(50.47)	167(52.02)

Persons per room were assessed for the 321 respondents in the study indicated in Table 4.25, and the result shows that in 154(47.97%) – 48(44.86%) of the cases and 106(49.53 %) of the controls – only one person per room was living in their houses. For the rest, 167(52.02%), more than one person per a room was living in their houses. This shows that almost half of the respondents shared a single room with at least two persons. It is a good indicator that more than 50% of the respondents were living in an overcrowded house, which tends to facilitate the spread of respiratory tract infections including tuberculosis (Semilan, Abugad, Mashat & Abdelwahab 2021:1-8).

- **Presence of a ceiling in the house**

The presence of a ceiling in the house as environmental factor was assessed among the respondents of the study as depicted in Table 4.26.

TABLE 4.26: DISTRIBUTION OF PRESENCE OFA CEILING AS FACTOR FOR OCCURRENCE OF TB AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Environmental factor	Cases (N = 107)	Controls (N = 214)	
	N (%)	N (%)	Total (n=321)
Ceiling			
Yes	74(69.16)	139(64.95)	213(66.36)
No	33(30.84)	75(35.05)	108(33.64)

The presence of a ceiling in the house was assessed of the 321 respondents of the study indicated in Table 4.26. The result shows that 213(66.36%) – 74(69.16%) of the cases and 139(64.95%) of the controls – lived in houses with ceilings. For the rest, 108(33.64%), their houses only had corrugated iron without a ceiling. This shows that most of the respondents were living in better housing conditions. Bad housing conditions have an immense effect in transmission of airborne and vector borne diseases (Kilabuk et al 2019:401-406). This does not mean that people living in good housing conditions are well protected from all types of diseases. Other determinant factors should be assessed as well (Semilan et al 2021:1-8).

- **Number of windows in a house**

The number of windows in a house as environmental factor was assessed among the respondents of the study as depicted in Table 4.27.

TABLE 4.27: DISTRIBUTION OF NUMBER OF WINDOWS IN A HOUSE AS FACTOR FOR OCCURRENCE OF TB AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Environmental factor	Cases (N = 107)	Controls (N = 214)	
	N (%)	N (%)	Total (n=321)
Number of windows			
1	38(35.51)	94(43.93)	132(41.12)
>2	69(64.49)	110(51.4)	189(58.88)

The number of windows per house of the 321 respondents of the study indicated in Table 4.27 were assessed and the result shows that 132(41.12%) – 38(35.51%) of the cases and 132(41.12%) of the controls – live in houses with only one window. The rest, 189(58.88%), were living in houses with more than one window. This shows that most of the respondents were living in a good standard house with good ventilation. Poorly ventilated housing conditions can cause risk conditions for the transmission of airborne infections. In contrast to this, good ventilation is one of the preventive measures against respiratory infectious diseases such as tuberculosis (Pratiwi, Pramono & Junaedi 2020:61-70).

- **Houses shared with domestic animals**

Houses shared with domestic animals as environmental factor was assessed among the respondents of the study as depicted in Table 4.28.

TABLE 4.28: DISTRIBUTION OF HOUSES SHARED WITH DOMESTIC ANIMALS AS FACTOR FOR OCCURRENCE OF TB AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Environmental factor	Cases (N = 107)	Controls (N = 214)	
	N (%)	N (%)	Total (n=321)
House Shared with domestic animals			
Yes	21(19.63)	22(10.28)	43(13.39)
No	86(80.37)	192(89.72)	278(86.60)

Of the total of 321 respondents of the study indicated in Table 4.28, houses shared with domestic animals were assessed and the result shows that 43(13.39%) – 21(19.63%) of the cases and 43(13.39%) of the controls – lived in houses shared with animals. The rest, 278 (86.60%), were living in houses not shared with animals. This shows that most of the respondents were not sharing a house with domestic animals. Most of the respondents, 306(95.33%), were from urban areas where it is not common seeing people sharing a house with domestic animals. This shows that there is less probability of transmission of infections from animals to human beings of zoonotic diseases such as bovine tuberculosis (Cowie, Hutchings, Barasona, Gortázar, Vicente & White 2016:51-64).

4.5.2.2. Results and discussions from inferential statistical analysis

4.5.2.2.1. Introduction

This section presents the association of different factors with tuberculosis infection among adolescents who were receiving chronic care service in four public health facilities in Hawassa town. Socio-demographic, clinical, host and environmental factors were analysed for the existence of association with tuberculosis infection. For each factor the odds ratio (OR) and p-value were determined at 95% confidence interval (CI). Factors identified as having association with TB infections are presented next.

4.5.2.2.2. Socio-demographic elements linked to TB infection

The relationship between socio-demographic elements such as sex, age, educational status, marital status, employment status, monthly income, residence and religion with TB infection was assessed among the respondents of the study as depicted in Table 4.29 below.

TABLE 4.29 SOCIO-DEMOGRAPHIC FACTORS ASSOCIATED WITH TB INFECTION AMONG HIV-POSITIVE ADOLESCENTS IN HAWASSA TOWN, SOUTHERN ETHIOPIA

Host factor	**Cases (N = 107)**	**Controls (N = 214)**	**Crude Odds ratio**	**p-value**
Sex				
Male	54(50.47)	96(44.86)	1.00	
Female	53 (49.53)	118(55.14)	1.25(0.79, 1.99)	0.34

Host factor	Cases (*N* = 107)	Controls (*N* = 214)	Crude Odds ratio	p-value
Age				
13-15	27(25.23)	65(30.37)	1.49(0.86-2.57)	0 .15
16-17	16(14.95)	43(20.09)	1.66(0.87-3.19)	0.12
18-24	64(59.81)	106(49.53)	1.00	
Educational status				
No formal education	14(13.08)	24(11.21)	1.00	
Primary education	48(44.86)	109(50.93)	1.19(0.59, 2.41)	0 .62
Secondary & Tertiary	45(42.06)	81(37.85)	1.31(0.79, 2.14)	0 .29
Marital status				
Single	97(90.65)	195(91.12)	1.00	0.19
Ever married	10(9.35)	19(8.88)	1.59(0.79, 3.19)	
Employment status				
Employed	98(91.59)	193(90.19)	1.18(0.52, 2.81)	0 .68
Unemployed	9(8.41)	21(9.81)	1.00	
Monthly income				
<1000	92(85.99)	192(89.72)	1.00	0.19
≥1000	15(14.02)	22(10.2)	1.59(0.79, 3.19)	
Residence				
Urban	101(94.39)	205(95.79)	1.00	0.60
Rural	6(5.61)	9(4.21)	0.73(0.26, 2.13)	
Religion				
Orthodox Christians	54(50.47)	107(50)	1.00	
Muslim	8(7.48)	15(7.01)	0.95(0.375, 2.40)	0.91
Protestant & Catholic	45(42.06)	92(42.99)	1.00(0.62, 1.62)	0.99

******_Associated factors (P-value <0.05)_

As indicated in Table 4.29, to identify the determinants of tuberculosis among HIV positive adolescents in Hawassa town, socio-demographic factors were analysed for possible association with tuberculosis infection. Significant association was not found in sex, age, educational status, marital status, employment status, monthly income, residence and religion. This could be due to the fact that most of the respondents (> 90%) came from Hawassa town with similar backgrounds (living standards). A significant number of them were from Hawassa University.

4.5.2.2.3. Clinical factors associated with TB infection

Clinical factors associated with TB infection was assessed among the respondents of the study as depicted in Figure 4.2 below.

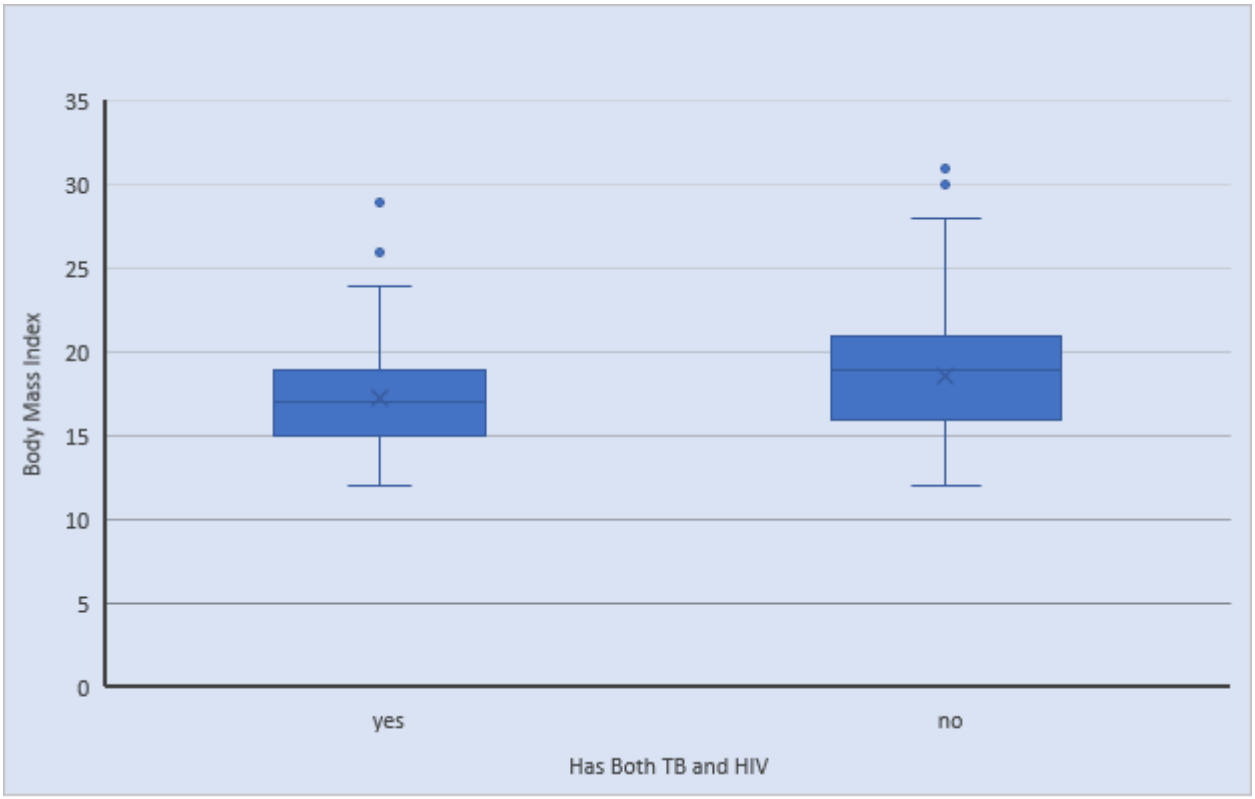


Figure 4.2: Box plot chart showing the distribution and association of body mass index (BMI) findings with tuberculosis infection among HIV-positive adolescents in public health facilities, Hawassa Town, Southern Ethiopia

As the figure shows, there is a reciprocal relationship between BMI and TB infection. As the level of BMI increased, the risk of being infected with TB has decreased.

- **WHO clinical stages and CD4 count**

WHO clinical staging and CD4 count associated with TB infection were assessed among the respondents of the study as depicted in Table 4.30 below.

TABLE 4.30: CLINICAL FACTORS ASSOCIATED WITH TUBERCULOSIS INFECTION AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical factors	Cases (*N* = 107)	Controls (*N* = 214)		p-value
	N(%)	N(%)	Crude Odds ratio (COR)	
WHO Clinical staging				
Stage III and IV	105(98.13)	46(21.5)	187(52.80, 172.87)	0.00 **
Stages I and II	2(1.9)	168(78.5)	1.00	
CD4 count cells/mm^3				
<200	27(25.23)	31(14.49)	2.69(1.42, 5.09)	.002**
200–499	45(42.06)	71(33.18)	1.95(1.15, 3.32)	.013
≥500	35(32.71)	112(52.34)	1.00	

***Associated factors (P-value <0.05)*

- **WHO clinical stages**

Clients in WHO clinical stage III and IV had a 187-fold increased risk of developing tuberculosis compared to those in stages I and II OR =187, 95% CI (52.80, 172.87); PV<0.001. The same findings were reported from studies conducted in Tanzania and a different part of Ethiopia (Gunda et al 2018:1-6; Tilahun et al 2019:515; Melkamu et al 2020:1-12). This could be due to the fact that as the HIV clinical staging increases, the immunological status of patients concurrently decreases, exposing them to various types of opportunistic infections including tuberculosis (see Table 4.30).

- **CD4 cell count**

CD4 cell count below 200 cells/mm^3 was found to be associated with TB infection, OR=2.69, 95% CI (1.42, 5.09), PV=0.002 compared to clients who had CD4 between 200-499cells/mm^3 were 1.95 times more likely to develop the infection. This finding is in line with studies conducted in northwest Tanzania, Uganda and a different part of Ethiopia (Duarte et al 2018; Gunda et al 2018:1-6; Asgedom et al 2018:1-5; Alemu et al 2020:59-66). This is explained as follows: as HIV infection advances in the body, it destroys CD4 T-lymphocytes which are responsible for cell mediated immunity. As the cell mediated immunity decreases, individuals will be liable to develop infection, including tuberculosis (see Table 4.30).

- **Opportunistic infections**

Opportunistic infections with TB infection were assessed with clinical record review among the respondents of the study as depicted in Table 4.31.

TABLE 4.31: OPPORTUNISTIC INFECTIONS ASSOCIATED WITH TUBERCULOSIS INFECTION AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Clinical record review findings	Cases (N = 107)	Controls (N = 214)	Crude Odds ratio (COR)	p-value
Opportunistic infections				
pneumonia	39(36.45)	58(27.10)	2.37(1.11, 5.06)	0.03**
PCP	10(9.35)	4(1.87)	1.17(0.53, 2.59)	0.70
Others	15(14.02)	19(8.88)	0.32(0.08, 1.21)	0.09
No infection	43(40.19)	133(62.15)	1.00	

** *Associated factors (P-value <0.05)*

** *Others include candidiasis, viral skin infection, fungal skin infection and bacterial skin infection*

Having lower respiratory tract infection such as pneumonia was associated with tuberculosis infection, OR=2.37, 95% CI (1.11, 5.06). Compared to those without the problem, clients with a history of pneumonia were 2.37 times more likely to develop the infection. This finding is congruent with a study conducted in Sub-Saharan African Countries, Europe and Italy. The possible explanation is that acute pneumonia can be caused by massive Mycobacterium tuberculosis infection or inhaled tuberculoprotein which causes acute exudative hypersensitivity (Wei et al 2020:278-284; Luciani, Bentivegna, Spuntarelli, Amoriello, Guerritore, Chiappino, Nalli et al 2020:2419-2422) (see Table 4.31).

4.5.2.2.4. Host factors associated with TB infection

Host factors associated with TB infection were assessed among the respondents of the study as depicted in Table 4.32.

TABLE 4.32: HOST FACTORS ASSOCIATED WITH TUBERCULOSIS INFECTION AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Host factor	Cases (*N* = 107)	Controls (*N* = 214)	Crude Odds ratio	p-value
	N (%)	N (%)	(COR)	
Smoking				
Yes	9(8.41)	2(0.93)	9.66(2.25, 45.66.69)	0.00 **
No	98(91.59)	212(99.07)	1.00	
Asthma				
Yes	4(3.74)	5(2.34)	16.16 (3.40, 73.93)	0.00**
No	103(96.26)	209(97.66)	1.00	
Taking ART				
Yes	106(100)	208(97.2)	0.00(0.00, .01)	0.00 **
No	1(0)	6(2.8)	1.00	
Taking IPT				
Yes	64(59.81)	202(94.39)	0.09 (0.04, 0.17)	0.00 **
No	43(40.19)	12(5.61)	1.00	
Taking CPT				
Yes	97(90.65)	159(74.3)	0.33(0.16, 0.67)	0.00 **
No	10(9.35)	55 (25.7)	1.00	
History of Pneumonia				
Yes	73(68.22)	81(37.85)	3.51 (2.16, 5.79)	0.00 **
No	34(31.78)	133(62.15)	1.00	
Previous History of TB				
Yes	100(93.46)	2(0.93)	1361 (325, 9618)	0.00**
No	7(6.54)	212(99.07)	1.00	
Viral load test				
<1000 copies/mL	97(90.65)	207(96.73)	0.14(0.072, 0.269)	0.00**
≥1000 copies/mL	10(9.35)	7(3.27)	1.00	
Being bedridden				
Yes	22(20.56)	17(7.94)	2.93(1.49, 5.83)	0.002**
No	85(79.44)	197(92.06)	1.00	

** *Associated factors (P-value <0.05)*

- **Smoking**

Smoking was identified as associated with TB infection OR=9.66, 95% CI (2.25, 45.66), PV<0.001. Respondents who were smoking cigarettes were 9.66 times more likely to develop TB infection. This finding is consistent with studies conducted in different parts of Ethiopia (Arnedo-Pena et al 2019:1-3; Shimeles et al 2019:1-4; Alemu et al 2020:1-3). This is because alveolar macrophages demonstrate an impaired immune response to respiratory pathogens, including mycobacterium tuberculosis. Alveoli macrophages from smokers show reduced metabolic activity and reduced metabolic reserves. This enables tubercle bacilli to multiply and cause infection (Gleeson, O'Leary, Ryan, McLaughlin, Sheedy & Keane 2018:572-579) (see Table 4.32).

- **Bronchial asthma**

Bronchial asthma was associated with TB infection OR=16.16, 95% CI (3.40, 73.93), PV<0.001. Clients with a history of bronchial asthma had a 16.16 times higher risk of contracting TB infection compared to those without the condition. This result is consistent with research done in India and Ukraine showing that TB can cause obstructive pulmonary function impairment, which in turn can contribute to the pathogenesis of chronic obstructive pulmonary diseases such as bronchial asthma (Kumar & Agrawal 2019:304-307; Tiys, Demenkov, Kolchanov and Ivanisenko 2020:193-194) (see Table 4.32).

- **Taking ART**

Taking ART at a good adherence level was negatively associated with tuberculosis infection OR=0.001, 95% CI (0.001, 0.01), PV<0.001. The chances of developing TB infection in clients who have been taking ART is almost zero (0). This finding is consistent with the study conducted in Sub-Saharan African Countries and in different parts of Ethiopia (Melkamu et al 2020:1-12; Belay, Endalamaw & Ayele 20191-8; Mandalakas, Kay, Bacha, Devezin, Golin, Simon, Dilsher Dhillon et al 2020:2933-2934). This is explained as follows: antiretroviral drug therapy protects against tuberculosis by facilitating the restoration of the immune function in PLHIV, thus impeding the progression of latent M. tuberculosis infection to active tuberculosis (Dye & Williams 2019:405-406) (see Table 4.32).

- **Taking isoniazid prophylaxis therapy (IPT)**

Taking isoniazid prophylaxis therapy (IPT) was found to have a protective effect against TB infection OR=0.09, 95% CI (0.04, 0.17), PV<0.001. The chance of contracting TB infection in respondents who have been taking IPT is almost nil. This finding is in line with studies conducted in different parts of the world and Ethiopia. This is due to the fact that IPT prevents tuberculosis across PLHIV by inhibiting the progress of latent tuberculosis to active TB (Melkamu et al 2020:1-12; Gunda et al 2018:1-6; Alemu et al 2020:62; Gupta, Montepiedra, Aaron, Theron, McCarthy, Bradford, Chipato et al 2019:1333-1346) (see Table 4.32).

- **Taking cotrimoxazole prophylaxis therapy**

It has been identified that taking CPT has reverse association with TB infection, OR=0.33, 95% CI (0.16, 0.67), PV<0.001. For respondents who have been taking CPT, there is less probability of acquiring TB infection. This finding is congruent with studies conducted in different parts of Ethiopia, AOR=0.34; 95%CI (0.20, 0.56) (Belew et al 2020:1-4). Moreover, a Swiss HIV cohort study revealed that CPT reduced the incidence of TB and other serious bacterial infections among HIV-infected people in Asian countries (Ku, Jiamsakul, Joshi, Pasayan, Widhani, Chaiwarith, Kiertiburanakul et al 2019:e25264). Further recent evidence in Ethiopia has shown that for missed cotrimoxazole preventive therapy the chances of getting TB infection were two times more than those who get the prophylaxis (AHR = 2.4, 95% CI: 1.84–4.74,) (Kebede, Kebede, Kebede & Agmasu 2021:1687-9686) (see Table 4.32).

- **Previous history of tuberculosis**

Previous history of tuberculosis was found to be associated with TB infection, OR=1365, 95% CI (325, 9618), PV<0.001. Clients with a previous history of tuberculosis were 1365 times more liable to develop tuberculosis infection. This finding is consistent with the study conducted in Ethiopia in which the odds of TB infection among HIV infected adults and adolescents were 2.83 times higher in previous TB history in the family compared to non-TB history (Shimeles et al 2019:1-3). A study conducted in Nigeria revealed similar findings, namely that patients who had a previous history of TB had an augmented risk of developing TB in spite of receiving ART with 8% prevalence. The host's immune system responds to the invading mycobacterium and triggers granuloma formation during primary infection.

Granuloma is a well organised structure consisting of many immune forming cell types (such as macrophages, neutrophils, natural killer cells and T-lymphocytes and B-lymphocytes) that surround a caseous necrotic core of mycobacterium tuberculosis infected alveolar macrophages. The granuloma is expected to protect the host by restricting and preventing dissemination of MTB, but studies using the zebrafish model for TB have demonstrated that granulomas can be conducive to mycobacterium tuberculosis proliferation and spread (Balcells, Yokobori, Hong, Corbett & Cervantes 2019:158-163) (see Table 4.32).

- **Viral load test level**

The level of viral load test finding was found to have a direct association with tuberculosis infection. As the level of viral load test finding decreases, the chance of contracting TB infection decreases, OR= 0.14, 95% CI (0.07, 0.27), PV<0.001. The amount of the virus (HIV) in the blood determines one's susceptibility to TB infection. This conclusion is consistent with a systematic review carried out in 45 countries of the world at which a greater degree of immunosuppression at diagnosis or higher viral load increased the TB risk (Duarte et al 2018:115-119). According to the collaborative analysis of cohort studies in South Africa there was association between TB infection and viral load test level, OR= 1.41, 95% CI (1.15–1.75), p < 0.001) among people whose viral load test was less than 10,000 copies/mL Time-updated analyses further confirmed the association of viral load with tuberculosis infection (Fenner, Atkinson, Boulle, Fox, Prozesky, Zürcher, Ballif et al 2017:1-4) (see Figure 4.32).

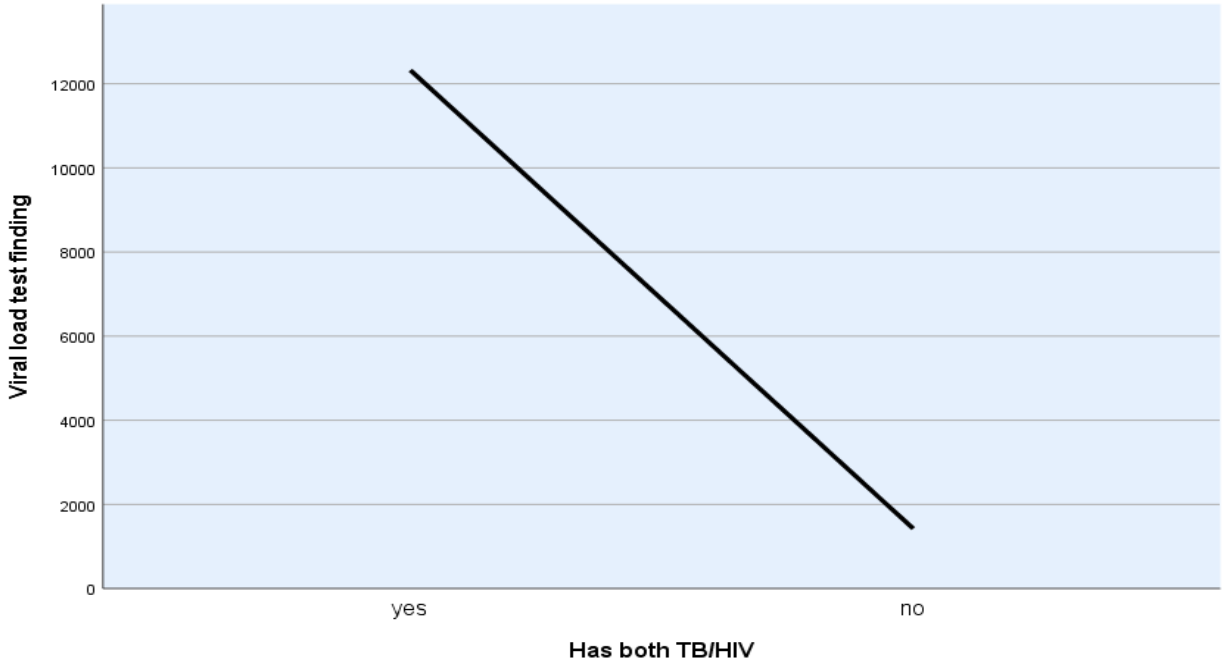


Figure 4.3: Multinomial logistic regression variable plot showing viral load level findings associated with tuberculosis infection among HIV-positive adolescents in public health facilities, Hawassa Town, Southern Ethiopia

In this study it was identified that the increased viral load level among the respondents of the study had caused significant susceptibility to tuberculosis infection.

- **Being bedridden**

It was revealed that being bedridden had association with tuberculosis infection, OR=2.93, 95% CI (1.49, 5.83), PV<0.001. The chances of contracting tuberculosis is almost three times greater among bedridden clients (respondents) than ambulatory ones. The finding of this study is consistent with studies conducted by Temesgen et al (2019:4&5) in which the hazard of developing TB among HIV-positive adults classified as ambulatory and bedridden at baseline was 1.8 (95% CI: 1.1, 3.1) times higher compared to those who were ambulatory clients. According to the study conducted by Ahmed et al (2018:1-2), PLHIV who have been in bedridden functional status at baseline were 5.45 times at more risk of developing TB compared with PLHIV not in bedridden functional status (AHR 5.45, 95% (see Table 4.32).

4.5.2.2.5. Environmental factors associated with TB infection

Environmental factors associated with TB infection were assessed among the respondents of the study as depicted in Table 4.33.

TABLE 4.33: ENVIRONMENTAL FACTORS ASSOCIATED WITH TUBERCULOSIS INFECTION AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Environmental factors	Cases (N = 107)	Controls (N = 214)	Crude Odds ratio (COR)	p-value
	N (%)	N (%)		
Wall of house				
Mud/mud brick	44(41.12)	71(33.18)	1.41 (0.87, 2.27)	0.19
Cement	63(58.88)	143(66.82)	1.00	
Separate kitchen				
Yes	66(61.68)	109(50.93)	1.55 (0.96, 2.49)	0 .09
No	41(38.32)	105(49.07)	1.00	
Waste disposal site				
In the compound	17(15.89)	18(8.41)	2.05 (1.01, 4.17)	
Outside	90(84.11)	196(91.59)	1.00	0.04**
Floor of house				
Earth	26(24.3)	38(17.76)	1.48(0.84, 2.61)	0.16
Cement	81(75.7)	176(82.24)	1.00	
PPR				
1	48(44.86)	106(49.53)	1.00	0.43
≥2	59(55.14)	108(50.47)	0.82(0.51, 1.32)	
Ceiling				
Yes	74(69.16)	139(64.95)	1.21(0.74, 2.00)	0.45
No	33(30.84)	75(35.05)	1.00	
Number of windows				
1	38(35.51)	94(43.93)	1.45(0.90-2.34)	0.12
>2	69(64.49)	120(56.07)	1.00	
House shared with domestic animals				
Yes	21(19.63)	22(10.28)	2.13(1.11, 4.08)	0.02**
No	86(80.37)	192(89.72)	1.00	

** *Associated factors (P-value <0.05)*

- **Waste disposal site**

An unprotected waste disposal site in the living compound was associated with TB infection, OR=2.05, 95% CI (1.01, 4.17), PV=0.04. The chances of being infected with tuberculosis was two times greater among those clients who disposed of waste everywhere in their compound than those who disposed of it far away their compound. The finding of this study is different from the study conducted in the western part of Ethiopia by Olijira (2016:72-83), in which there was no association between tuberculosis and waste disposal behaviour of respondents of the study. The probable difference could be due to a difference in the source and production of waste. Hawassa Town is one of the modern towns in Ethiopia which is highly industrialised and its waste production might be different from that of the western part of Ethiopia (see Table 4.33).

As demonstrated by a study conducted in India on improper health care waste management, improper waste disposal has negative consequences for a variety of people, including exposing the general public, healthcare workers, waste handlers, caregivers, patients and animals to injuries. More than 30% of the 3–6 billion injections that were administered every year, in almost 10 of the health care facilities nationwide, were done with used syringes recycled by unskilled scavengers who sold them on the black market. Furthermore, community healthcare workers, waste handlers, and the general public who were exposed to health care waste could be at risk of infection with hepatitis A, B and C and it could be a cause for diseases like diarrhoea, leptospirosis, typhoid, cholera, HIV and tuberculosis (Hangulu & Akintola 2017:1-10) (see Table 4.33).

- **Sharing a house with domestic animals**

Sharing a house with domestic animals was associated with infection with tubercle bacilli, OR=2.13, 95% CI (1.11, 4.08), P=0.02. The probability of being infected with tubercle bacilli is 2.13 times higher, compared with houses the were not shared with domestic animals. Domestic animals can harbour infectious agents like tubercle bacilli and can spread the disease to human beings as zoonotic infectious diseases while they have close proximity in residential areas. Mycobacterium isolates from small ruminants, pigs, cattle and camels in different settings of Ethiopia may suggest the circulation of the microorganisms between animals and human beings as sharing of houses with domestic animals is common in the

country (Romha, Gebru, Asefa & Mamo 2018:1-17). According to a study conducted in Spain, in which most direct and indirect interactions occurred when there was close proximity among cattle, over 90 % of indirect interactions by wildlife and livestock took place within the estimated 3-day environmental survival time of Mycobacterium bovis in this habitat (Cowie et al 2016:51-64) (see Table 4.33).

- **Environmental factors not associated with tuberculosis infection**

Among the environmental factors such as walls of the house, separate kitchens, floors of house, persons per room (PPR), celling of the house and number of windows were analysed and found to have no association with tuberculosis infection in this study, as depicted in Table 4.33.

4.5.2.2.6. Factors independently associated with TB infection

To exclude confounding variables multivariable analysis with a multinomial logistic regression model was performed. Factors independently associated with TB infection were identified among the respondents of the study as depicted in Table 4.34.

TABLE 4.34: FACTORS INDEPENDENTLY ASSOCIATED WITH TUBERCULOSIS INFECTION AMONG HIV-POSITIVE ADOLESCENTS IN PUBLIC HEALTH FACILITIES, HAWASSA TOWN, SOUTHERN ETHIOPIA

Independent predictor	Crude odds ratio (COR)	Adjusted odds ratio (AOR)	p-value
Taking IPT			
Yes	0.62 (0.16, 0.88)	0.09 (0.01, 0.69)	0.02 **
No	1.00	1.00	
WHO Clinical staging			
Stages III and IV	187(52.80, 172.87)	3.64(2.95, 4.49)	0.00 **
Stages I and II	1.00	1.00	
Previous history of TB			
Yes	1361 (325, 9618)	222.18(127.06,389.59)	0.00 **
No	1.00	1.00	
House shared with domestic animals			
Yes	2.13(1.11, 4.08)	1.10(0.10, 11.69)	0.93
No	1.00	1.00	

Independent predictor	Crude odds ratio (COR)	Adjusted odds ratio (AOR)	p-value
History of pneumonia			
Yes	3.51 (2.16, 5.79)	0.25(0.04, 1.47)	0.12
No	1.00	1.00	
History of asthma			
Yes	16.16 (3.40, 73.93)	1.73 (0.45, 6.60)	0.419
No	1.00	1.00	
History of smoking			
Yes	9.66(2.25, 45.66.69)	117.42(146.83,940.15)	0.00**
No	1.00	1.00	

** *Associated factors (P-value <0.05)*

In this section all the identified factors associated with tuberculosis infection were checked for confounding effect using a multinomial logistic regression model. The following four factors were found to be independently associated with tuberculosis infection. These were taking IPT, AOR=0.09, 95% CI (0.01, 0.69), which shows IPT has a preventive effect against tuberculosis. WHO clinical stages III and IV have independent association with tuberculosis infection, AOR= 3.64, 95% CI (2.95, 4.49). Previous history of tuberculosis was found to have an independent association with tuberculosis infection AOR=222.18, 95% CI (127.06, 389.59). Similarly, a history of smoking had a direct and independent association with tuberculosis infection AOR=112.4, 95%CI (146.83, 940.15) (see Table 4.34).

4.6. CONCLUSION

The qualitative phase of this study demonstrates the different qualitative study steps to explore and describe experiences of the adolescents, their guardians and public officials concerning the TB/HIV prevention programme's availability and accessibility in Hawassa town. The different challenges in the course of TB/HIV prevention and control were communicated by the participants of the study. Data was collected through focus group discussions and key informant interviews during the allocated study period in Hawassa town.

The analysis revealed findings that the TB/HIV prevention and control activities in the study area (Hawassa town) have been given less attention by public media, the school community, partners, health care service providers, and leaders at different levels in the community.

These factors were further intensified by a lack of budget and commitment for full implementation of the programme.

As effective prevention and control of the spread of TB/HIV, it was recommended that strengthening behavioural change by communication activities through integrated public and private media efforts were crucial. Controlling illegal acts such as narcotic drug sale/trafficking, recruitment of adolescents in night clubs, and promoting alcoholic drinks in public was suggested among the good measures to reduce the magnitude and severity of the problem. Moreover, strengthening the health system through capacity building training sessions, community engagement, intersectoral collaboration, good leadership and governance were mentioned as major activities to fight against TB/HIV dual infection.

According to TB/HIV programme focal persons' recommendations, regular policy dialogue, equitable distribution of resources, significant community engagement and attention to good governance and leadership approaches need attention. Moreover, some of the objectives for prevention of TB/HIV should be revised to incorporate appropriate implementation strategies.

Data was collected for the study's quantitative phase in two stages. In chronic care facilities, individual interviews with adolescents living with TB/HIV were conducted, and then their health records were reviewed to look for other risk factors for tuberculosis. Both cases and controls in the study were teenagers between the ages of 13 and 24. Cases were those clients who were following their treatment in chronic care centres and diagnosed with both pulmonary TB and HIV, whereas controls were those clients who were following their treatment in chronic care centres and diagnosed with HIV only.

The following factors were found to be independently associated with tuberculosis infection: taking IPT and showing that IPT has a preventive effect against tuberculosis. WHO clinical stages III, IV and a previous history of tuberculosis were found to have an independent association with tuberculosis infection. A history of smoking was found to have direct and independent association with tuberculosis infection. The next chapter, Chapter 5, presents a strategy for the prevention of tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia.

CHAPTER 5
PROPOSED ALTERNATIVE STRATEGY FOR PREVENTION OF DUAL TB/HIV INFECTION AMONG THE ADOLESCENTS IN HAWASSA TOWN, SOUTHERN ETHIOPIA

5.1. INTRODUCTION

This chapter discusses and outlines an evidence-based alternative strategy on TB/HIV prevention and control to reduce adolescents' morbidity and mortality in Ethiopia, especially in Hawassa in the southern part of the country. The chapter argues for an integrated TB/HIV strategy which combines interventions directed at prevention as well as control of tuberculosis infection among HIV positive adolescents in Hawassa, Southern Ethiopia to prevent mortality associated with this group.

The strategy further addresses the determinants of TB/HIV dual infection and aspects of case management, thus presenting a comprehensive prevention package which could be an alternative for reducing consistently high rates of adolescent mortality from TB and HIV. The study objectives were to:

- identify and describe the determinants of TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia
- explore and describe the current interventions to prevent and control TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia
- explore challenges in preventing and controlling TB/HIV infection among adolescents in Hawassa, Southern Ethiopia
- develop an alternative strategy for prevention

Based on the objectives above, objective 1, identification and description of the determinants of TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia, was addressed under subheading *4.5.2.1.* Objective 2, exploring and description of the current interventions to prevent and control TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia, was addressed in *4.5.2.2.* Objective 3, that is, challenges in preventing and controlling TB/HIV infection among adolescents in Hawassa, Southern

Ethiopia, was addressed under subheading *4.3.2.4* of this thesis. The fourth objective, developing an alternative strategy for prevention and control of TB/HIV among adolescents in Hawassa, Southern Ethiopia, is addressed in this chapter, Chapter 5. Therefore, it is possible to say that all of the study's goals have been achieved. Key findings of the study are summarised in Table 5.1 below.

TABLE 5.1: KEY FINDINGS OF THE STUDY AND THE NEED FOR INTEGRATED TB/HIV PREVENTION

Key findings of the study (challenges)	Risks	Suggested integrated TB/HIV preventive activities
Adolescents are deprived of special attention to sexual and reproductive health care.	Adolescents may consider risky sexual behaviour as normal and may not take proper care of themselves.	Communication about behavioural change and discipline among adolescents. Their active involvement in the care and prevention activities will be ensured.
Failure to exercise good governance and leadership in the prevention and control of TB/HIV transmission	Inability to utilise allocated budget items for TB/HIV prevention programmes properly, inability to make feasible plans and follow their implementation, in terms of monitoring and evaluation, inability to work on programme sustainability, poorly motivated staff and community members.	Good governance and leadership in the day-to-day health care service activities. Proper planning, implementation, monitoring evaluation and staff motivation will be emphasised.
The rapid growth of industrial parks and migration of people from abroad and the countryside to those areas for new job opportunities is causing high numbers of commercial sex workers in Hawassa town. Those TB/HIV transmission hot-spot areas are not getting good attention for behavioural change communication activities.	Rapid transmission of TB/HIV and this may increase illness and death due to the dual infection	Integrated TB/HIV care, support and preventive activities including increasing awareness using different risk communication approaches helps adolescents to improve their knowledge, attitude and skill towards avoiding risky sexual behaviours and develop health care seeking

Key findings of the study (challenges)	Risks	Suggested integrated TB/HIV preventive activities
		behaviour whenever necessary.
Developmental partners are gradually decreasing their support on the existing TB/HIV prevention efforts of the government and its stakeholders	Lack of technical and financial support may largely affect availability of goods and services to run the programme.	Conducting developmental partners and stakeholders' analysis in the proposed strategy.
Inequitable distribution of resources reflected with shortage of budget to purchase laboratory and medical goods and supplies	Important TB/HIV preventive activities may not be performed routinely.	Ensuring programme sustainability through community involvement for resource mobilisation and wise use of resources
Shortage of health care service providers to assign to newly established HIV mainstreaming structures.	Health care facilities and health offices may not get the required number and types of health professional to run the TB/HIV prevention programmes	Considering capacity building training sessions and designing staff retention mechanisms
Community based TB/HIV preventive activities are not getting good attention for supportive supervision and resource allocation	Any activity which does not involve the community may gradually lose credibility and sense of ownership leading to failure to ensure sustainability.	Performing regular planning, monitoring and evaluation activities which are tailored to involve the community may ensure programme sustainability
The importance of community involvement in dissemination of health information did not get attention by the concerned authorities.	Dissemination of health information without the active participation of the community may not bring the desired outcome (result).	Involvement of the community is a key factor in dissemination of health information, and this will be considered in the prevention strategy.
Inability to implement legal enforcement in reference to the existing rules and regulations, may aggravate risk behaviours such as drinking alcohol, chewing chat, and smoking cigarettes, which were identified to be	Adolescents may not be motivated to take care of themselves against risky behaviours and this may lead them to acquire TB/HIV infection.	Law makers and implementers should work hand in hand to execute legal enforcement against substance use and misbehaviour.

Key findings of the study (challenges)	Risks	Suggested integrated TB/HIV preventive activities
critical challenges for TB/HIV prevention activities.		
The main determinant factors responsible for contracting tuberculosis in Hawassa town were found to be having WHO clinical staging III and IV, viral load tests greater than 1000 copies/mL, being bedridden, bronchial asthma, previous history of tuberculosis, history of pneumonia, history of smoking, and disposing waste everywhere in the compound (clinical & environmental factors).	Failure to identify and avoid determinant factors of TB among HIV positive individuals as early as possible may lead to serious health related complications and death.	Implementing an integrated TB/HIV prevention strategy helps to prevent/treat the occurrence of many of the determinant factors of tuberculosis among people living with HIV/AIDS.

According to the findings as presented in Table 5.1 above, a strategy that would make an impact on TB/HIV prevention is proposed. Such a strategy embraces integration of TB/HIV preventive activities (WHO 2015:1-12) that could hopefully pave the way to reducing both mortality and morbidity due to TB/HIV dual infection.

5.2. A STRATEGY FOR TB/HIV PREVENTION

In this section, an alternative strategy for prevention of TB/HIV is proposed. Palladan and Adamu (2018:1033) highlight the management activities as follows: a strategy is of paramount importance, as it outlines the organisational vision, mission, principles, philosophies, objectives, strategies and well-designed policies. It also encompasses the development of long-term plans for efficient management of environmental opportunities and threats in line with the organisational strengths and weaknesses (McKeon 2019:1-5). To reduce adolescent morbidity and death from TB/HIV dual infection, this study defines a strategy as a method or plan for implementing integrated TB/HIV preventative measures.

5.3. THE RATIONALE FOR INTEGRATION OF TB AND HIV PREVENTION PROGRAMMES

According to the WHO regional office for Europe (2016:4-5),

> *"Integrated health services delivery is defined as an approach to strengthen people-centred health systems through the promotion of a comprehensive delivery of quality services across the life-course, designed according to the multidimensional needs of the population and the individual, and delivered by a coordinated multidisciplinary team of providers working across settings and levels of care. It should be effectively managed to ensure optimal outcomes and appropriate use of resources based on evidence, with feedback loops to continuously improve performance and to tackle upstream causes of ill health and to promote well-being through intersectoral and multisectoral actions".*

The rationale for integrated TB and HIV prevention programmes at peripheral level is to form a means for providing well-defined direction. The integration identifies and categorises areas of collaboration, develops the regional TB/HIV strategic plan, guides and supports the multi-phased implementation of TB/HIV interventions, monitors and evaluates the implementation process, and makes required revisions and plans for scaling up of the existing interventions for better results (WHO 2015:5-10). Moreover, the integration enhances universal access to TB/HIV treatment and maximises its preventive benefits through a five-point agenda towards simplification and improved effectiveness and efficiency, optimising drug regimens, advancing the type of care and prevention given. It helps to provide simplified platforms for advanced diagnosis, treatment and monitoring the outcome of the treatment, adapting delivery systems, reducing treatment costs, and effective community mobilisation (WHO 2012:10).

The design of an improved TB/HIV prevention and control strategy is envisaged to give emphasis and make possible implementation of high-impact integrated prevention and treatment services. It further draws efforts of stakeholders to address the social and structural as well as economic factors that contribute to double TB/HIV infection in adolescents. This may help service providers to give attention to improving access and quality of health care services. This innovative way helps to achieve reductions in the

morbidity and mortality associated with TB and HIV amongst this group. Greater priority to primary preventive activities and their implementation strategies are further considered to address the social and structural drivers of TB/HIV infections through multi-sectorial approaches (Ninsiima, Chiumia & Ndejjo 2021:1-17).

5.4. DEVELOPMENT OF AN ALTERNATIVE STRATEGY FOR PREVENTION OF TB/HIV AMONG ADOLESCENTS

This section argues that the proposed strategy would be more effective than the current TB/HIV prevention approach in Ethiopia because for each identified problem it uses comprehensive implementation strategies to prevent both TB/HIV in an integrated fashion. The section is linked to Objective 6, which is to develop a strategy that would prevent tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia.

Based on the findings of this study, the researcher designed an alternative integrated TB/HIV prevention strategy. The strategy depicts four result levels (input, output, outcome and impact) of development and implementation. It aids in the development, execution, supervision, and evaluation of integrated TB/HIV prevention initiatives in Hawassa town. The plan could possibly be expanded to other regions of Ethiopia.

Figure 5.1 below depicts steps and various approaches in the development of a TB/HIV prevention strategy that will be discussed. The five connected steps of Thompson and Strickland's (1992:4) strategy formulation were used to create an integrated TB/HIV prevention approach. The five steps that were taken to design the approach are shown in Figure 5.1.

Figure 5.1: Steps of strategy development

Source: Adapted from Thompson & Strickland 1992:4

This strategy considered important factors which are relative to the main findings of the study, and these are: stakeholders' collaboration, strengthening partnerships, using

available technology, policy dialogue, capacity building, systemic change and integration. Each of the strategic approaches offers an opportunity to bring change and improvement in the area of TB/HIV prevention and control (American Institute of Research [AIR] 2022).

5.5. AN ALTERNATIVE STRATEGY FOR PREVENTION OF DUAL TB/HIV AMONG THE ADOLESCENTS IN HAWASSA TOWN, SOUTHERN ETHIOPIA

5.5.1. Vision

Reduced adolescent morbidity and mortality rates due to TB and HIV infections in Hawassa, Ethiopia.

5.5.2. Mission statement

To curtail adolescent mortality and morbidity from TB and HIV by integrated, evidence-based and client-centred driven promotive, preventive and curative services. Such services will be implemented by the Ministry of Health in collaboration with all stakeholders and developmental partners.

5.5.3. Goal

To reduce illnesses and deaths due to TB/HIV through reduction of the HIV epidemic to less than 1 per 10,000 population, viral load to the level of 95% and TB by 90% by 2025**.**

5.5.4. Strategic objectives of TB/HIV prevention and control

The envisaged strategy has nine strategic objectives. Each strategic objective has a set of operational objectives which translate to detailed implementation as depicted in Table 5.2 below.

TABLE 5.2: NINE STRATEGIC OBJECTIVES WHICH ARE ALIGNED TO KEY FINDINGS

Strategic Objectives		Identified problems to be addressed by the objectives
I.	Improve access to care and treatment	Identified clinical and environmental factors for occurrence of TB among HIV patients
II.	Build community ownership through community involvement	Lack of attention to community involvement
III.	Implement equitable resource mobilisation and utilisation	Inequitable distribution of resources

IV.	Reduce new HIV and TB infections	High number of commercial sex workers Substance use leading to risky sexual behaviour
V.	Integrate TB/HIV prevention and control activities.	All the identified problems fall on this strategic objective (Integration as a cornerstone)
VI.	Improve TB/HIV pharmaceutical supply chain management	Shortage of budget to purchase medical equipment and supplies
VII.	Establish evidence-based decision making through strengthening evidence generation on sexual and reproductive problems of adolescents	Adolescents are deprived of special attention in sexual and reproductive health care. Failure to exercise good governance and leadership
VIII.	Improve trained human resources for health and strengthen the leadership	Shortage of trained health professionals Failure to exercise good governance and leadership
IX.	Build resilient health infrastructure targeted to TB control	Identified clinical and environmental factors for occurrence of TB among HIV patients

Figure 5.2 below reflects a flow diagram covering the overall goals of the strategy in the first rank, followed by strategic objectives for HIV prevention and transmission and strategic objectives for TB prevention and transmission in the second rank.

Figure 5.2 further reveals that integration takes place in the third rank and thus reveals an integrated TB/HIV prevention package of strategies at health service delivery institutions and in the community in the third rank. A package of operational objectives aligned to each strategic objective occupies the fourth rank.

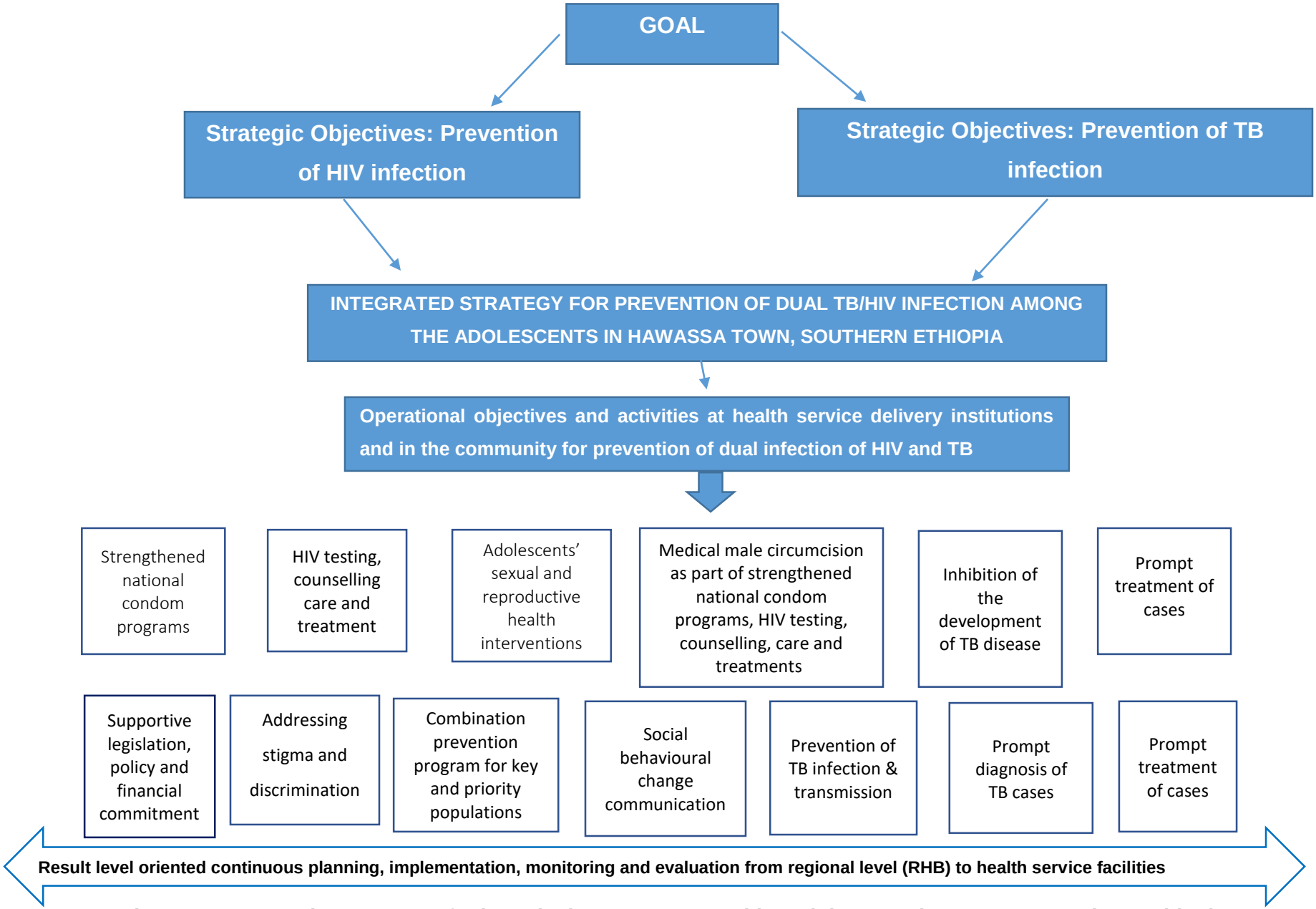


Figure 5.2: Prevention strategy of tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia

5.5.4.1. Strategic objective

(i) To improve the access to care and treatment to TB/HIV, drug resistant TB and sexually transmitted illness (STI)

Operational/Implementation strategies

- Expanding the integration of ART and TB programmes into STI screening programmes such as antenatal screening, and medical male circumcision. By taking those actions, the accessibility of STI services for men will be improved through outreach, mobile and extended working hours for STI and other reproductive health service activities (Bell, Aggleton, Ward, Murray, Silver, Lockyer, Ferguson et al 2020:1-9).
- Improving and expanding pharmacovigilance services for TB and HIV. Pharmacovigilance is a science and activities related to the detection, assessment, understanding and prevention of adverse effects or any other possible drug-related problems (Bihan, Lebrun-Vignes, Funck-Brentano & Salem 2020:591-598). This will be practical through capacity building of health professionals and administrative staff at primary health care facilities to identify, report and respond to side effects of drugs timeously. The Food, Medicine and Healthcare Administration and Control Authority of Ethiopia (FMHACA) needs to be strengthened for optimisation of treatment guidelines and policies (Adenuga, Kibuule, Bamitale & Rennie 2020:1111-1116).
- Providing access to essential health care packages such as reproductive, maternal, neonatal, child, adolescent health and major communicable diseases to all people living with TB, HIV and other STIs. All people living with TB, HIV and other STIs will have access to essential health care packages dealing with restoring and maintaining access to essential lifesaving services because they play a pivotal role in all humanitarian health response strategies (Roxo, Mobula, Walker, Ficht & Yeiser 2019:1-13).
- As a major national initiative to scale up comprehensive sex education and linkage to reproductive maternal neonatal children health (RMNCH) services, providing comprehensive sexuality education through inculcating it in higher educational institutions' curriculum. An integrated school health programme package consisting of access to sexual and reproductive health services will be implemented in all regions. Schools will offer counselling, contraception, condoms, optional medical male

circumcision, pregnancy testing, and HIV testing, among other sexual and reproductive health services. (WHO 2019e:1-20).

- Occupational health service programmes focusing on TB/HIV and other sexually transmitted illness prevention will be improved. Strengthening research projects focusing on health problems of adolescents will provide solutions for hidden problems of adolescents. Ethical principles in maintaining patients' confidential medical records need great care and they should be secured at all times. Using special patients' identification marks needs to be avoided. Rather, use simple codes to record HIV status and provide the necessary care and support services (Barron, Peter, LeFevre, Sebidi, Bekker, Allen, Parsons et al 2018:559).
- Providing emergency and critical care services including treatment and support for disabilities of people who are infected with TB and HIV will be considered through providing age-based appropriate psychosocial therapy, mental health problem screening and treatment accompanied with harm reduction services, including rehabilitation services for self-support and being productive (Gooding 2019:101498).
- Promoting innovation in terms of increasing treatment uptake and improving treatment outcomes. This can be practical through the use of self-testing technologies, increasing accessibility of adolescent and youth friendly clinic hours; encouraging community-based initiation; provision of extra work hours and weekend time services for providing the necessary care and support to clients with HIV and TB treatment; assigning adequate health professionals and expansion of treatment sites for more workplaces and prompt STI treatment for individuals who are at high risk of acquiring STIs. Applied research projects on those innovations will maintain the national standards that will be developed and updated in line with the latest global evidence (Ford, Ball, Baggaley, Vitoria, Low-Beer, Penazzato, Vojnov et al 2018:76-86).

(ii) To build community ownership through community involvement

Operational/Implementation strategies

- Encouraging civil society organisations to work together with the community at different levels to provide improved accessibility to integrated services for TB/HIV diagnosis, treatment, and prevention. At all levels of the health system, different sectors running

TB/HIV prevention and control programmes are required in order to ensure strong and effective collaboration between TB and HIV programmes and to create a platform among stakeholders. These sectors include partners, private institutions, and national coordinating bodies. To guarantee the successful implementation of integrated health services, persons who have certain health issues should be viewed as programme owners. National TB/HIV coordination initiatives should include the Federal HIV AIDS Prevention and Control Office (FHAPCO), which coordinates the multisectoral response to HIV (WHO 2018:1-36).

- Engagement of community health workers to facilitate linkages for resource mobilisation in terms of food security interventions, government grants and social welfare support and income generation activities. Through this approach they will be responsible for helping people in linking with community-based organisations to raise TB/HIV awareness to grassroots level. They are key agents in identifying basic health needs through designing appropriate outreach strategies, creating demand, reducing stigma and increasing uptake. They can take the lead for local income generating activities at their catchment area for sustainability of TB/HIV preventive programmes (WHO 2020a:14-20).

(iii) To implement equitable resource mobilisation and utilisation for the prevention and control of TB/HIV

Operational/Implementation strategies

- Promoting human rights issues among the community and key stakeholders to enable an equitable and effective response; this strategy will be achieved by the implementation of planned interventions based on the UNAIDS' guidance for developing human rights programmes in the context of HIV. The key components of the programme include reduction of stigma and discrimination, assessing and reforming the existing laws, regulations and policies in the light of prevention and control of TB and HIV; availing legal services and making them accessible; providing capacity building training to healthcare providers on medical ethics and human rights; reducing violence against women and increasing their economic, legal and social empowerment. These measures are expected to address all forms of stigma, facilitate access to justice, and promote an environment that enables and protects human and

legal rights and prevents HIV and TB-related stigma and discrimination (Lazarus, Harmon, Kamarulzaman, Anderson, Leite, Behrens, Bekker, Bhagani, Brown, Brown & Buchbinder 2021:1-14).

- Allocating resources to expand capacity building programmes to reduce stigma and discrimination. This direction in the formulated programme assists law makers to protect adolescents affected by TB/HIV against discrimination and violence. It helps to support access to HIV prevention, treatment, care and support. Providing human rights and ethics training capacitates health professionals in combating stigma and discrimination (Feyissa, Lockwood, Woldie & Munn 2018:405).

(iv) To reduce new HIV and TB infections

Operational/Implementation strategies

- Adhering to the modelling of UNAIDS, attainment of ending the AIDS epidemic by 2030. In this case the country's strategies have to be designed to achieve '90-90-90' treatment targets with all the other strategic objectives. The treatment objective is to suppress viral load as a major preventive measure (Marsh et al 2019:213-214).
- Scaling up high-impact prevention measures: strategy can be put into practice by distributing a thorough set of context-specific, highly effective, combined prevention efforts that are carefully focused across the regions; and paying more attention to areas where there is a higher risk of contracting an STI and providing them with tailored treatments, including the provision of fair social support. Moreover, the strategic plan should encompass provision of service to men to get medical circumcision and providing pre-exposure prophylaxis to those who are at risk, including adolescents, sex workers and injectable drug users. Human papilloma virus vaccine (HPV) has to be saved for those who are in need. According to demand, post-exposure antiretroviral treatment will be made available for those who have been exposed to HIV, including sexual assault survivors. Awareness and demand increment will be made to stimulate the uptake of pre and post exposure prophylaxis services (Logie, Wang, Lalor, Williams & Levermore 2021:330-343).
- The delivery of a comprehensive approach to sexual and reproductive health and rights (SRHR) targeting adolescents is supported by five principles. These are: accountability,

equity, quality, multi-sectoral collaboration, and meaningful engagement. All SRHR interventions included in the package are highly recommended for adolescents, given the diversity of adolescents' reproductive health and rights needs and considering their specific traits, circumstances, and experiences. It is important to ensure that this package is available, accessible, and acceptable to adolescents. It requires an approach appropriate for adolescents as they have peculiar characteristics that biologically and socially distinguish them from other age groups and recognise that they may face challenges when accessing reproductive health services (Engel, Paul, Chalasani, Gonsalves, Ross, Chandra-Mouli, Cole et al 2019:41-50).

- Ensuring tuberculosis preventive therapy for all members of the household and other vulnerable groups. This can be effected through identification screening and early initiation of appropriate therapy. Conducting TB contact tracing is recommended especially for drug resistant TB. For those who have a history of contact, isoniazid prophylaxis therapy is given with a newer regime; accordingly, by the end of 2022, the isoniazid and rifapentine combination (3HP) could reach 90% of PLHIV cases (Diallo, Adjobimey, Ruslami, Trajman, Sow, Baah, Marks et al 2018:454-463).
- The yearly plan should consider priority for activities aimed at preventing new infections among people who are not already infected (Sweeney, DiNenno, Flores, Dooley, Shouse, Muckleroy & Margolis 2019:1-5).
- Employing evidence-based behavioural, biomedical and structural interventions: this could be achieved through strategic joint programmes addressing TB, drug resistant TB, HIV and other sexually transmitted illnesses (Hosek & Pettifor 2019:120-128).
- Eliminating mother-to-child transmission of HIV; this strategy ensures consistent use of antiretroviral therapy during antenatal, intranatal and postnatal periods. Universal screening of all pregnant women against HIV and provision of tenofovir prophylaxis in the last trimester will be considered (Bierhoff, Angkurawaranon, Rijken, Sriprawa, Kobphan, Nosten, Van Vugt, McGready & Devine 2021:1-9).
- Maintaining occupational health precaution and safety; in this case protecting health workers' safety needs as a priority. Health workers should be oriented to detect symptoms of common infectious diseases including TB, HIV and hepatitis. They need regular medical check-ups at least once a year. All workers are encouraged to get voluntary counselling and testing (VCT) service, and those with known HIV infection

should be cautious in taking care against exposure to TB and take IPT (WHO 2022b:32).

(v) To integrate TB/HIV prevention and control activities

Operational/Implementation strategies

- Establishing and strengthening mechanisms for integrated delivery of TB and HIV services; this can be achieved through initiating early ART and reducing the burden of HIV among people with symptomatic TB by offering regular HIV testing. The achievement of TB/HIV collaborative activities is largely dependent on the adequacy of human resources in health care service institutions. Effective TB/HIV collaboration calls for placement and retaining of qualified health workers at all levels, who properly take over their responsibilities at different levels (De Vries, Van de Berg, Van Dam, Hasanova, Pareek, Van der Werf & Podlekareva 2020:1-5).
- Implementing the national health policy pertaining to TB/HIV collaborative management; this needs inclusion of policy dialogue beyond the public and health sector. This can be done with securing funding and using integrated patient-centred health service models accompanied by capacity building and improving health information and communication systems. Establishing continuous surveillance systems to generate the required information to measure the outcome and impact of integrated disease prevention strategies needs attention. Applying research to real-world problems enables evaluation of the efficacy and efficiency of integrated TB/HIV service delivery strategies (De Vries et al 2020:1-5).

(vi) To establish improved TB/HIV pharmaceutical supply chain management

Operational/Implementation strategies

- “Supply chain management is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations and at the right time, in order to minimize system wide costs while satisfying service level requirements” (Abbas, Afaq, Ahmed-khan & Song 2020:852). Pharmaceutical chain management requires the employment of efficient optimisation techniques to provide institutions with informed

decision making by relying on available data. This can be achieved through establishing appropriate relationships among manufacturers, distributors and health facilities providing TB/HIV care and support (Bastani, Dehghan, Kashfi, Dorosti, Mohammadpour, Mehralian & Ravangard 2021:1-14).

- Improving the capacity of pharmacy professionals on rational use of drugs and TB/HIV pharmaceutical supply chain management through training. The primary objective of the training is to develop the skills of the pharmacists and drug prescribers on proper management of TB/HIV drugs dispensed in different health institutions. Pharmacy professionals will be cautious enough in monitoring clients on rational use of drugs and strictly follow its adverse effects. This may promote good adherence and treatment outcomes on patients' part (United States Agency for International Development [USAID] 2018:1-21).

(vii) To establish evidence-based decision making through strengthening evidence generation on sexual and reproductive problems of adolescents

Operational/Implementation strategies

- Establishing regular monitoring and evaluation systems on collection, retrieving and reporting of data: this can be practical for routine TB/HIV service provision activities, particularly to the youth, adults, and vulnerable populations, such as children and adolescents. This could be used to assess how well services are covered in terms of uptake, loss to follow-up, and connections across programmes and services. It may require consistent information, accountability for the reports being shared accurately and on time (WHO 2020d:1-5).
- Supporting stakeholders to be effective in generating and using data to improve TB/HIV programs in a sustainable fashion. Health and demographic surveys will receive priority funding. Funding for demographic and health surveys will be prioritised. Standards will be designed, and results will be communicated timeously and widely, which would enable evidence-based decision-making and drive improvements in health seeking behaviour and delivery of essential service packages (Fazaludeen, Koya, Lordson, Khan, Kumar, Grace, Nayar, Kumar, Pillai, Sadasivan, Pillai & Abdullah 2022:1-9).

(viii) Improve trained human resources for health and strengthen the leadership

Operational/Implementation strategies

- Strengthen community participation and leadership: this can be achieved through building community platforms to strengthen community engagement and leadership at all levels of the response. An improvised framework will be developed from community responses, consisting of clear definitions of roles, scopes, activities and expected outcomes. Community leaders play an active role in making behavioural change and assist locally tailored HIV treatment, prevention and control services. Special emphasis is given to TB and HIV programmes, which require good governance and leadership. Moreover, decentralisation of those programmes increases equitable service coverage and accessibility. Establish the link and coherence between the regional and national strategic plans with the operational plan in the light of decentralisation (Questa, Das, King, Everitt, Rassi, Cartwright, Ferdous et al 2020:1-20).
- Encouraging private sector engagement. This can be achieved through special efforts to increase private sector engagement in zonal and regional TB/HIV prevention and control programmes. By establishing partnerships and networks among private healthcare providers, such as nurses, midwives, doctors, pharmacists, and practitioners of traditional medicine, it is possible to more effectively accomplish shared objectives by going beyond individual capacities. Within these processes, formal, legal, and informal sub-processes grow in either sequential or cyclical manner as a joint effort towards the jointly defined goal through jointly decided procedures and practices (Arinaminpathy, Deo, Singh, Khaparde, Rao, Vadera, Kulshrestha, Gupta, Rade, Nair & Dewan 2019:1-9).
- Improving intersectoral collaboration in achieving epidemic control requires the collaboration of all stakeholders based on the mandates they are given across all tiers of the health system. TB and HIV related interventions in the health system can be supported by monitoring and evaluation units to develop a joint accountability framework (WHO 2012:17-21).

(ix) To build resilient health infrastructure for better prevention and control of TB/HIV

Operational/Implementation strategies

- Taking strong commitment and joint action to establish infrastructure considering TB/HIV prevention and control precautions. This can be achieved through intersectoral collaboration among stakeholders such as the Ministry of Environmental Protection, the Ministry of Health, the Ministry of Education and the Ministry of Transport to work collaboratively and consider TB/HIV prevention precautions in the design and construction of infrastructure in their industry. Infrastructure has to be designed to consider avoidance of overcrowding and poor ventilation to reduce TB transmission to susceptible hosts (Kielmann, Karat, Zwama, Colvin, Swartz, Voce, Yates et al 2020:1-4).
- The work environment can negatively or positively influence the activities of the service providers and their ability to innovate various implementation strategies. A good work environment reduces workload and unnecessary mental strain. A disorganised work environment disintegrates the teamwork approach. Outpatient HIV services will be fully integrated with other basic services. Expanding outpatient chronic care centres will minimise unnecessary workload and reduce geographical barriers which are usually a factor in low service accessibility. Planning for adequate space for TB/HIV services within a given health institution must consider the existence of basic clinical services (Anku et al 2020:e235843).
- Improving room air ventilation to make patient waiting areas relatively wide, open and well-ventilated; this may help to maximise cross-ventilation. TB infection control is considered as integral to new building plans (Escombe, Ticona, Chávez-Pérez, Espinoza & Moore 2019:1-7). Institutions which provide service for TB/HIV care and treatment should consider arranging separate rooms to screen all patients at arrival. For infection prevention and control precaution, screening of all patients on arrival for chronic cough, fever, weight loss, night sweats, haemoptysis, or contact with a chronic cougher is mandatory. If a patient exhibits one of the symptoms, he/she will be eligible for isoniazid (INH) prophylaxis therapy and have a right to rapid TB diagnostic services and treatment. Patients with known or suspected drug-resistant TB should be separated from other suspected TB patients (Beshaw, Balcha & Lakew 2021:617).

Patients suspected of having TB should be allowed to move to the front of the queue for all services and need a prompt diagnostic workup for tuberculosis such as a “spot-morning-spot” sputum test for acid-fast (TB) bacilli (Mahapatra, Gupta, Paul, Raj & Gupta 2020:54-58).

5.5.5. Infection prevention activities

The TB/HIV integrated prevention plan will be expanded to better target interventions to adolescents’ needs, making better use of community-based service delivery that has been shown to be effective. As the first level of implementation, the strategy has eight HIV prevention, and four tuberculosis prevention packages as follows:

5.5.5.1. HIV prevention activities integrated with TB prevention activities

5.5.5.1.1. Strengthened national condom programmes

Condoms have prevented a number of infections since the beginning of the HIV epidemic. Condoms, both male and female, are highly cost-effective. They are used to prevent HIV, STIs and unplanned pregnancy. For effective distribution and utilisation, adequate male and female condom procurement, promotion and behavioural change communication are needed through social marketing, private sector sales and other channels for an expanded and sustainable service (Mahapatra, Walia, Patel, Battala, Mukherjee, Patel, Subramanium, Atmavilas & Saggurti 2020:1-17).

Consistent and correct use of male condoms reduces sexual transmission of HIV and other STIs in both vaginal and anal sex by up to 94%. Effective condom programming is particularly important for key populations. Unprotected sex and other high-risk behaviours such as substance use and drinking alcohol are the problems of key populations, particularly adolescents among the key populations (UNAIDS 2020c:38-39).

5.5.5.1.2. Supportive legislation, policy and financial commitment

For designing and establishing programmes the need for policy is mandatory, as it provides a constant reference point before, during and after a programme is implemented (WHO 2020b:1-10). Policy and legislative context is important in supporting and guiding sexual education implementation in schools and elsewhere

where adolescents are available. This helps to plan, implement and evaluate reproductive health services in any given institution. Sexuality problems affecting young people can easily be managed when there are supportive legislation and applicable policy documents (Panchaud, Keogh, Stillman, Asare, Motta, Sidze & Monzón 2019:277-296).

5.5.5.1.3. HIV testing, counselling, care and treatment

Voluntary HIV testing and counselling followed by prompt initiation of antiretroviral therapy for all diagnosed HIV-infected individuals is now becoming a universal health standard (Perriat, Balzer, Hayes, Lockman, Walsh, Ayles, Floyd et al 2018:1-15). Health professionals should perform counselling and test for HIV routinely in their day-to-day practices. This service can also be offered to injectable drug users, those who have multiple sexual partners, sex workers, or those who have sexually transmitted infections. People with a new diagnosis of HIV infection need referral to a clinical setting where a full HIV diagnostic workup can be performed and antiretroviral therapy can be started rapidly. Treatment adherence and successful antiretroviral therapy helps persons with HIV infection to have a normal life and can reduce transmission of HIV to others (Saag 2021:2131-2143).

5.5.5.1.4. Addressing stigma and discrimination

TB/HIV related stigma and discrimination in health service institutions are becoming a powerful barrier to achieving global initiatives to end the spread of HIV/AIDS. Evidence-based approaches for measuring and reducing stigma and discrimination in healthcare settings can bring effective solutions. Practice of a quality improvement approach with planned measurement of stigma and discrimination among healthcare professionals and PLHIV for root cause analysis and team-based learning has proved to be an effective approach to address stigma and discrimination in local contexts and develop interventions to address individual and organisation level causes of stigma and discrimination (Ikeda, Nyblade, Srithanaviboonchai & Agins. 2019:1587).

5.5.5.1.5. Adolescents' sexual and reproductive health interventions

Introduction of a comprehensive approach to sexual and reproductive health and rights targeting adolescents is expressed by five principles as: quality, equity, multisectorality,

accountability, and meaningful engagement. All sexual and reproductive health and rights interventions included in the package are highly important to adolescents, considering the diversity of adolescents' sexual and reproductive health and rights needs and their experiences. It is important to ensure the package is available, accessible, and acceptable to adolescents' requirements (Engel et al 2019:41-50).

5.5.5.1.6. Combination prevention programme for key and priority population

Prevention and control of sexually transmitted infections is one of the six pillars of HIV prevention in Ethiopia. Sexually transmitted infection prevention is a part of combination infection prevention for key and priority populations including adolescent girls and young women. Sexually transmitted illnesses (STI) prevention includes implementation of social behavioural change communication, condom promotion and distribution, early diagnosis, treatment and surveillance which targets particularly adolescents, young women, their partners and key priority population groups (Federal HIV AIDS Prevention & Control Office [FHAPCO] 2018:14-20).

5.5.5.1.7. Medical male circumcision as part of the adolescent and youth friendly services

Medical male circumcision decreases men's risk of acquiring HIV. Voluntary medical male circumcision has been recommended by the WHO. It was revised in 2020 as a public health HIV prevention intervention measure. In addition to providing lifelong partial protection from HIV and other STIs, medical male circumcision serves as an entry point into HIV prevention and care services for men (Van-Lith, Mallalieu, Patel, Dam, Kaufman, Hatzold, Marcell et al 2018:205-212).

5.5.5.1.8. Social behavioural change communication

Communication plays a pivotal role in acquiring knowledge and fulfils a vital societal need. Human beings are members of a social community. In this case a behavioural change communication process attempts to convince the affected group to engage in certain healthy behaviour through accessing information (Awasthi & Awasthi 2019:1-4).

The ability of people to achieve positive sexual health depends on, among other things, their access to comprehensive information about sexuality, their knowledge about sexual risks, their vulnerability to the adverse consequences of sexual activity and on

their access to good quality sexual health care, which includes brief behaviour interventions and communication programmes. Brief sexuality related communication intervention helps to change sexual behaviour or maintain safer sexual behaviours to achieve better sexual health goals. The principles of sexual behaviours such as initiation, response, attendance and personalisation encompass proven behaviour change and reduces the risk which arises from unsafe sexual practices causing unintended pregnancies, HIV infection and other sexually transmitted infections (DeVasconcelos, Toskin, Cooper, Chollier, Stephenson, Blondeel, Troussier & Kiarie 2018:1-27).

5.5.5.2. Tuberculosis prevention activities integrated with HIV prevention activities

5.5.5.2.1. Prevention of TB infection and transmission

The commonest and effective prevention measures of tuberculosis infection transmission include improving ventilation, prevention of malnutrition, conducting active case finding, providing adolescent friendly TB services, prevention of HIV and improving socio-economic status. Active case finding, rapid diagnosis including diagnosis of drug resistance TB and prompt effective therapy are now recognised as the most important interventions to stop tuberculosis transmission. Most infection control measures focus on diagnosing TB cases because most transmission is from patients with unsuspected TB cases (Migliori et al 2019:1-2).

5.5.5.2.2. Inhibition of the development of TB

Isoniazid preventive therapy together with other interventions such as active case finding, and infection control have been widely recommended to reduce the burden of TB in PLHIV. Isoniazid preventive therapy has been proven to be safe with minimal side effects such as inflammation of the liver and gastrointestinal (GI) symptoms. If taken with or without ART, isoniazid preventative treatment can reduce new TB infections among PLHIV by up to 70% (Sabasaba, Mwambi, Somi, Ramadhani & Mahande 2019:1-8).

The newly synthesised multi-stage TB-vaccines could increase BCG-primed immunity, decrease bacterial loads and provide efficient protection against progressive TB-

infection, especially in the latent phase. These types of vaccines administered before and after TB-infection can act as pre and post exposure prophylaxis and they are also used as therapeutic vaccines and as a new generation BCG prime-boosters (Khademi, Derakhshan, Yousefi-Avarvand, Tafaghodi & Soleimanpour 2018:31-44).

5.5.5.2.3. Prompt diagnosis of TB cases

Accurate and prompt diagnosis of tuberculosis has paramount importance for tuberculosis control. Proper history taking and physical examination give significant evidence for detecting tuberculosis in any form. If such procedures are supported with laboratory diagnosis, the probability of yielding the exact diagnosis of the bacteria can be ensured. Currently bacteriological microscopic examinations (AFS) sensitivity is decreasing. Advanced diagnostic technology (molecular tests) Xpert MTB/RIF (Xpert) assay is showing remarkable achievement in the accuracy of TB diagnosis (Wang, Liu, Peng, Luo, Tang, Lin, Hou et al 2020:119).

5.5.5.2.4. Prompt treatment of cases

One of the main strategies to control tuberculosis is early diagnosis and prompt treatment initiation based on current treatment guidelines. Delay in TB diagnosis and treatment at individual level can exacerbate illness, prolong suffering and increase the risk of death. Moreover, delay in TB diagnosis may increase the probability of transmission of tubercle bacilli to close contacts and spread the disease (Soltobekova, Kozukeev, Yiehdego, Labib, Hovhannesyan & Rossi 2022:1-13).

5.5.6. Monitoring and assessment

Periodic monitoring and assessment activities are done to evaluate the level of the implementation of TB HIV integrative prevention activities through collection of the necessary data, analysis of the collected data and programme improvement through data interpretation and distribution. It also seeks to establish uniformity across all parties involved in collaborative TB/HIV operations and harmonisation of data gathering at all levels by creating a core set of internationally recognised, standard performance indicators for programmes. The data collected using these standardised indicators will provide further evidence for policies related to integrated TB/HIV preventive activities (Deshmukh & Sachdeva 2016:23-30) (see Figure 5.2).

5.5.6.1. Monitoring

Monitoring is the continuous assessment of goods, services and performance of programmes through input, process and outcome data collected regularly from supportive supervision, regular reports, routine record keeping and surveillance (Wroblewski & Lipinsky 2018:22-27). In the context of TB/HIV integrated preventive programme, activities such as national condom programme, HIV testing and counselling, adolescent sexual and reproductive health interventions, male medical circumcision, behavioural change communication, prevention of malnutrition, active TB case finding, adolescent friendly TB services, INH prophylactic therapy, BCG vaccination, early initiation of ART for TB patients with HIV, etc., are monitored.

5.5.6.2. Evaluation

Evaluation is the periodic assessment of achievements of programmes through information generated from ongoing monitoring and performance indicators. It helps to identify the cause of under-achievement and make timely corrections (Engelhardt 2018:128-140). In the context of TB/HIV integrated preventive activities, the achievement of activity performance under monitoring are assessed in the light of the programme objectives.

5.5.6.3. Inputs

Inputs are any available resources in terms of financial, human and time used to run programmes or services. These are records/reports, laboratory goods/supply, trained health professionals on TB/HIV management and prevention, infrastructure designed for TB/HIV prevention, health information, etc. (African Union 2020:14-20).

5.5.6.4. Outcomes

Outcomes are the effects of activity performance expressed in short and medium terms such as change in one's knowledge, attitudes, and behaviours. For TB/HIV integrated preventive activities outcomes to be monitored and evaluated are appropriate and timely decisions made, decreased transmission of TB/HIV, improved human resources, improved medical supply and management, improved quality of TB/HIV diagnosis, improved TB/HIV testing capacity, improved people's awareness on TB/HIV, etc. (Anaya 2021:80-140).

5.5.6.5. Outputs

Outputs are the expected results of activities performance in terms of deliverables such as the number of sessions completed; the number of people trained; the number of services availed, etc. For this study, a number of retrieved and reported data, number of buildings established considering TB/HIV prevention and number of civil society organisations were included among the prominent outputs. Whereas the community was engaged in the programme, the number of integrated pharmaceutical chain management and number of expanded TB/HIV diagnosis technology centres were taken as additional outputs. Finally, the number of tested clients for HIV and screened for TB, the number of people who attended behavioural change communication sessions, etc., are among the very important expected outputs of the programme (International Organization for Migration [IOM] 2021:7-14).

5.5.6.6. Processes

Processes are series of activities that are conducted to achieve the desired objectives of programmes (Kabonga 2019:1-10). Among all components of integrated TB/HIV prevention activities, data collection, retrieving and reporting are the commonest ones. Establishing infrastructures considering TB/HIV prevention, engaging civil society organisations and including the wider community are frequently mentioned. Integrated pharmaceutical supply chain management, expanding advanced TB/HIV diagnosis technology, and behavioural change communication are considered as key processes.

5.5.6.7. Impact

Impact is described as the long and cumulative effect of a series of interventions over a period of time based on specific objectives or goals. These are improved health status, and reduced TB/HIV related morbidity and mortality (Anaya 2021:80-140).

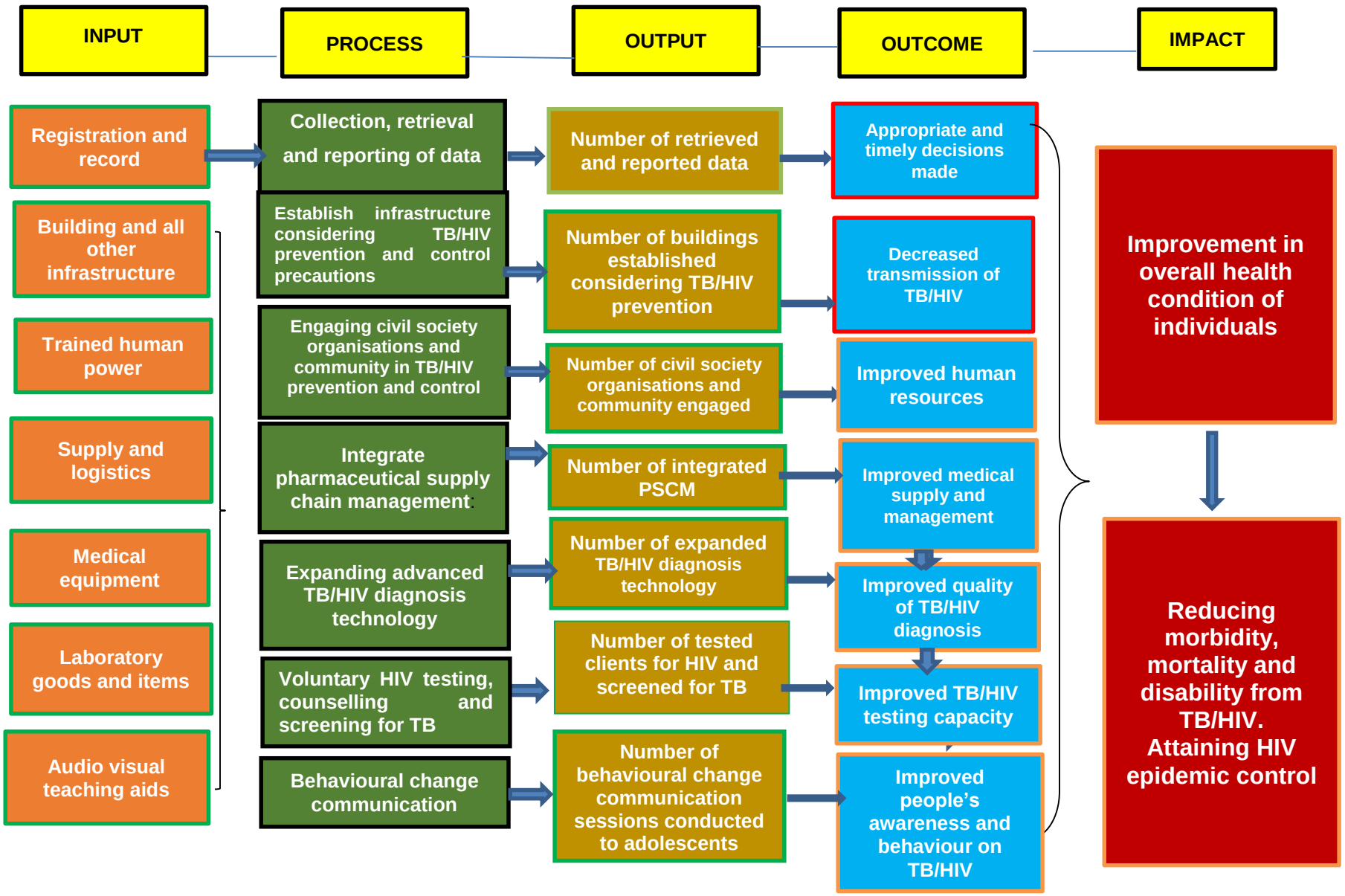


Figure 5.3 Strategy monitoring and evaluation of TB/HIV framework for the adolescents in Hawassa, Southern Ethiopia, 2022

Source: The researcher

5.6. VALIDATION OF TB/HIV STRATEGY

Strategy validation is the process through which the strategists know the extent to which a strategy is able to achieve its objectives. It helps researchers to compare and contrast objective realities (Higgins et al 2021:2356-2369). The strategic document was validated in terms of functional evidence indicating the degree to which short and long-term goals and objectives are being met; realism/practicality indicating recognition of any real or potential weaknesses or deficiencies in strategy formulation stage. Checking consistency in direction was used to indicate integration of plans and plans implementation; assumptions validity was used to indicate all important trends and impacts identified and critically estimated. However, contingencies recognition was considered to indicate the impact of one or more contingent events on strategic assumptions. Lastly, appropriateness was checked to indicate whether the strategy is consistent against management styles, values, and risk preferences (Hieu & Nwachukwu 2019:43-44).

5.6.1. The validation process of the TB/HIV prevention strategy

To review the suggested strategy, seven individuals were chosen. Technical specialists, university teaching staff (professors) who specialise in public health, coordinators of TB/HIV care and support programmes, and the director of the Southern Ethiopia Regional Health Bureau made up the evaluation committee. Reviewers were contacted telephonically and by e-mail. They were requested to review the strategy for effective TB/HIV prevention and control activities. The selected persons accepted taking part in the evaluation and verification procedure. The strategy with its description was sent by e-mail to all reviewers, who were asked to examine and confirm the alternative strategy through written comments. Each reviewer was given one months to respond and give his/her feedback. Reminders were sent prior to the expiration of the specified timeline to get their comments. The email feedback was collated and used to revise the strategy.

5.7. ENSURING IMPLEMENTATION OF INTEGRATED TB/HIV PREVENTION STRATEGY AT ADMINISTRATIVE LEVEL

The administrative body of the TB/HIV integrated prevention and control will be the MoH through its regional health bureaus located in all regions of the country. This may extend up to the district level health management. The implementers will be health professionals in different health care facilities, developmental partners working on health and stakeholders including the community. Since the ever-growing prevalence of TB among HIV positive adolescents was identified in the southern part of Ethiopia, Hawassa town,

the proposed alternative strategy will be first implemented in this area and scaled up to other regions of the country based on findings from further studies.

5.7.1. Implementation of the strategy in Hawassa town, Southern Ethiopia

The Government of Ethiopia is working hard to strengthen the healthcare system to align it with the sustainable developmental goals (SDGs). The government has made significant investments in the public health sector that have led to improvement in health outcomes. Nevertheless, communicable diseases like HIV/AIDS, TB, malaria, respiratory infection, and diarrhoea remain a serious challenge in Ethiopia.

The implementation of integrated TB/HIV preventive activities requires prioritisation of technical interventions as proposed in the strategy according to the respective countries' TB/HIV epidemiology and available resources. The regional strategy identifies mechanisms and recommends areas for collaboration between the two programmes for mutual benefit (WHO 2003:21-30).

Currently, all over the regions of Ethiopia, health policies and strategies are implemented from the top down, i.e., from the Ministry of Health to district level health posts, each of which takes their own responsibility based on their geographical location, the number of populations they serve, and the magnitude of the health problem to be managed. The researcher in his study has identified various gaps in the prevention and control of TB/HIV in Sidama Region, Hawassa town and suggested an alternative strategy to be implemented at all levels of health care service delivery institutions of the region.

All health care service delivery institutions in the region are expected to integrate ART and TB programmes into STI screening programmes, antenatal screening programmes, and medical male circumcision as part of the adolescent and youth friendly services. Comprehensive sex education by using a behavioural change communication model and linkage to reproductive maternal neonatal children health (RMNCH) service has dual importance in providing comprehensive sexuality education through higher educational institutions’ curriculum. Sidama Regional Education Bureau and Sidama Regional Health Bureau will play an active role in inculcating it in the existing curriculum. Moreover, an integrated school health programme package consisting of access to sexual and reproductive health services will be strengthened in all zones of the regions. All primary, secondary schools and tertiary institutions in the region will provide counselling and contraception, condoms, optional medical male circumcision, and services for HIV and pregnancy testing in addition to supplying condoms and condom distribution. Public and

social media will be encouraged to disseminate periodical information targeting adolescents.

Adoption and successful implementation of DOTS and Stop TB strategies will be offered in all public health facilities in Sidama Region, Hawassa town, including private clinics to enhance the public–private mix (PPM). This helps for massive expansion of services resulting in improved access to quality DOTS services. In order to create a platform among stakeholders, regional coordinating organisations are required at all levels of the health system to promote strong and effective coordination between TB and HIV integrated preventative activities. The programme needs strong funding and implementing partners support to ensure sustainability and long-lasting service output and outcome. Special efforts will be focused on increasing private sector engagement in all zones of Sidama Region including Hawassa town on TB/HIV prevention and control programmes. Establishment of collaboration and networking with professional associations, private healthcare providers including health officers, nurses, midwives, physicians, pharmacies and traditional medicine practitioners to enable the possibility of better achieving common goals by surpassing individual capabilities. Moreover, occupational health service programmes for those health professionals focusing on TB/HIV and other sexually transmitted illness prevention in Hawassa town and all over Sidama need to be improved in line with updated TB/HIV care and support guidelines.

The Ministry of Justice, higher education institutions in collaboration with the Sidama Regional Health Bureau and other developmental partners in the region will formulate directions in the ongoing programmes to assist lawmakers in protecting people infected with TB/HIV against discrimination and violence. This can be done through educating healthcare workers on human rights and ethics, so they are better equipped to fight stigma and prejudice against TB/HIV patients.

To implement pharmacovigilance, consideration must be given to enhancing the abilities of administrative and medical staff at primary healthcare facilities in the area to recognise, report, and promptly address drug adverse effects. The regional health bureau and other developmental partners in the region should take the leading role to initiate provision of essential health care packages such as reproductive, maternal, neonatal, child, adolescent health and major communicable diseases to all people living with TB, HIV and other STIs. To ensure tuberculosis preventive therapy in all health service delivery institutions of the region, identification screening and early initiation of appropriate therapy

will be implemented, considering isoniazid prophylaxis therapy with a newer regime, the isoniazid and rifapentine combination (3HP) will reach 90% of PLHIV by the end of 2022 using modern technology outputs to integrate pharmaceutical supply chain management. Improving the region's pharmaceutical chain management, TB/HIV care, and rational drug use necessitates the establishment of appropriate relationships among manufacturers, distributors and health facilities providing TB/HIV care and support in the region and outside of the region including the capital city of the country, Addis Ababa.

Routinely monitoring and evaluating the delivery of TB/HIV services, particularly to children, adolescents, and adults, including important and vulnerable populations. This may help to measure the adequacy of service coverage such as uptake, loss to follow-up, linkage between programmes and services. This may call for consistent information dissemination through periodic written reports and consultative meetings with other programme partners and health service providers, such as zonal and district health offices. Sidama Regional Health Bureau should summarise the report and give timeous feedback and technical support, if necessary.

Building a community platform at the regional, woreda, and district levels in the Sidama region to improve leadership and community involvement in the response at all levels. A region-specific and improvised framework will be developed in collaboration with developmental partners with clear definitions of roles, scopes, activities and expected outcomes. Religious and community leaders from regional to village level in Sidama region are expected to play an active role in making behavioural change and assisting locally tailored TB/HIV treatment, prevention and control services. Great emphasis has to be given to making TB and HIV programmes transparent to the community, which requires good governance and leadership. Moreover, decentralisation of those programmes up to grassroots level by considering community involvement will increase equitable service coverage and accessibility.

The Sidama Regional State in collaboration with the federal government of Ethiopia and key developmental partners have to demonstrate strong commitment to take joint action for establishing infrastructure considering TB/HIV prevention and control precautions. Moreover, intersectoral collaboration among stakeholders such as the Ministry of Environmental Protection, the Ministry of Health, the Ministry of Education and Ministry of Transport through their branch offices in Sidama region have to work collaboratively whenever designing and constructing infrastructure in their industry. Infrastructure has to

be designed considering avoidance of overcrowding and poor ventilation which are well known for facilitating TB transmission.

Higher education institutions and research centres in Sidama Region such as Hawassa University College of Medicine and Health Science and the Regional Public Health Laboratory are producing a number of research studies on different health issues. Strengthening research focusing on health problems of adolescents will be one of the major assignments of Sidama Regional State to find solutions for hidden problems of adolescents in the region. Moreover, the link and coherence between the regional and national strategic plan with the operational plan will be firmly established.

5.8. STRENGTHS AND WEAKNESSES OF THE STRATEGY

This strategic plan was created using the study's findings and the current body of literature. It is possible that the TB/HIV determining variables and corresponding preventative interventions do not fully cover the range of influence. It is possible that there may be individual variances in how the identified determining factors affect people. From the perspective of quantitative study design, this may limit the function of the strategy. Future research can, however, successfully address this area of concern in order to improve the strategy's functionality. The strategy is also more flexible in its current version because it expressly considers the literature review and high degree of validity of the research results. The suggested strategy offers an alternative for promoting integrated TB/HIV prevention for medical professionals, support employees, and developmental partners.

5.9. CONCLUSION

The chapter discusses, outlines and proposes an evidence-based alternative strategy on integrated TB/HIV prevention and control to reduce adolescents' morbidity and mortality in Ethiopia. The rationale for an integrated TB and HIV prevention strategy at peripheral level is to form a means for providing well defined direction. The strategy has vision, a mission, goals and nine strategic objectives. The approach to developing the strategy and its components has been clearly described. The relationships and hierarchy of each component of the strategy are linked to regular planning. Through the collection of the necessary data, analysis of the collected data, interpretation, and dissemination of the data for programme improvement, activities for periodic monitoring and evaluation are carried out to assess the standard of implementation of TB HIV integrative prevention activities. The strategy has been developed after extensive literature review and critical

discussion of its advantages, disadvantages, and literary contribution. The validation processes of the strategy and its subsequent practical administrative measures were mentioned as important in the overall implementation process. The implementers will be health professionals in different health care facilities, developmental partners working on health and stakeholders including the community. The next chapter deals with the contribution, conclusions, limitations and recommendations of the study.

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

6.1. INTRODUCTION

This chapter offers the study's overarching conclusions, which were derived from its findings. The goal of the study was to provide a tuberculosis prevention approach for adolescents who are HIV positive in Hawassa, Southern Ethiopia. A package of the activities for implementation of the proposed strategy is presented. The chapter further proposes a framework for monitoring and evaluation of the proposed implementation of TB/HIV prevention for the adolescents in Hawassa, Southern Ethiopia.

This chapter provides an overview of the study's benefits and contributions. Additionally, the potential research directions for reducing dual HIV/TB infection are highlighted. This chapter also discusses the study's weaknesses.

6.1.1. The purpose and objectives of the study

The purpose of the study was to investigate the determinants of TB among HIV positive adolescents in Hawassa, Southern Ethiopia. The study aimed to do this by describing different determinant factors and identifying the gaps and challenges to develop a strategy for prevention of TB among HIV positive adolescents to ultimately lower death and morbidity from the common health issues.

The following research goals were addressed in this regard:

1. To explore and describe experiences of the adolescents on the TB/HIV prevention programme’s availability and accessibility in Hawassa, Ethiopia.
2. To explore and describe experiences of the officials on the availability and accessibility of TB/HIV prevention programmes for the adolescents in Hawassa, Ethiopia.
3. To explore and describe challenges associated with implementation of interventions to address TB/HIV dual infection in Hawassa, Southern Ethiopia.
4. To explore and identify the determinants of TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia.
5. To describe the determinants of TB infection among HIV positive adolescents in Hawassa, Southern Ethiopia.

6. To develop a strategy that would prevent tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia.

Based on the above goals, objective 1 of the study—exploring the opinions of the teenagers and their parents regarding the accessibility and availability of the TB/HIV prevention program—was covered under subheading 4.3.2.1 in Chapter 4. Exploring and describing experiences of the public officials on the availability and accessibility of TB/HIV prevention programmes for the adolescents in line with objective 2 were discussed under subheading 4.3.2.2 in Chapter 4. Under subheading 4.3.2.4, it was discussed how to examine and describe the difficulties that can arise while implementing interventions to deal with TB/HIV dual infection, which is a response to goal 3. Chapter 4's subheadings 4.5.2.1 and 4.5.2.2 in the quantitative phase addressed Objectives 4-5. *O*bjective 6 was addressed in Chapter 5. Therefore, it is possible to say that all of the study's goals have been achieved.

6.2. RESEARCH DESIGN AND METHOD

Both qualitative and quantitative research designs were used in the study. Adolescents in chronic care facilities with TB and HIV were interviewed using an interviewer-administered structured interview guide and questionnaire respectively (see Chapter 3). For the qualitative part of the study, twelve FGDs and four key informant interviews were conducted sequentially. The same participating units' chosen adolescents and their guardians were questioned to learn more about the current TB/HIV control initiatives., the role of the media in prevention of TB/HIV, the ever-faced challenges in controlling the pandemic and government efforts to control the problem. Government officials (program coordinators) were interviewed to assess the current preventive measures against TB/HIV infection, the role of different sectors in the prevention of TB/HIV, challenges encountered in the prevention of TB/HIV and their recommendations for ongoing challenges. Data was analysed manually with thematic analysis.

As to the quantitative part of the study, the participants were adolescents with both TB and HIV and those with only HIV from chronic care centres. A standardised questionnaire that was administered by the interviewers was used to gather the data. A total of 321 TB patients, of which 107 had both TB and HIV and were labelled as “cases”, and 214 of them with only HIV and were labelled as “controls”, selected from four public health facilities participated the study. Epi info version 7.2.5 and SPSS version 26.0 were used for the data analysis.

6.3. SUMMARY OF FINDINGS

Based on the identified problems that indicate the existing strategy is not comprehensive enough to address implementation of all the necessary prevention activities, the health system of the country and its various strategies to combat infectious diseases, including TB/HIV, was explored and gaps were identified. The existing effort in controlling TB/HIV dual infection among the community members, the stakeholders and the government was explored, aimed at identifying their challenges and suggestions.

The study revealed the lived experiences of government officials, adolescents and their guardians in the care and prevention of TB /HIV in the southern part of Ethiopia, Hawassa. It disclosed that multiple factors in the community were speeding up the transmission of TB and HIV among the youth and adolescents. Various sectors were found to be responsible for this phenomenon. There was reluctance from the Ministry of Health and the regional health bureau in allocating a reasonable budget to run the disease prevention activities. Inability to maintain good governance and leadership manifested inequitable distribution of resources, using available budget for non-programme related activities and inconsistent programme monitoring and evaluation. This further intensified the problem with the lack of funds to buy reagents for routine blood tests and other medical supplies for care and support of people living with the problem. Capacity building training sessions were not conducted as usual, and this has brought a critical shortage of trained human resources. Developmental partners were blamed for giving less attention on programme sustainability which they had been supporting financially and technically. The continued deterioration of health professionals' and public media's effort in educating the community as a behavioural change communication approach has contributed significantly to increasing the magnitude of the problem. School health programmes were identified as unfunctional in disseminating TB/HIV related information to the school community. High TB/HIV transmission areas such as bars, night clubs, and substance abuse areas have not been given priority for implementation of prevention activities. The government administrative bodies are less interested in controlling those areas with legal enforcement. The former HIV prevention initiatives in the community, such as community conversation, and active involvement of religious and community leaders in the disease prevention activities were identified as being inactive due to the gradual decline of support from the government and developmental partners.

The existing TB/HIV prevention policy and strategy of the country lacks region-specific approaches in addressing the need and priority areas of the regions. Policy dialogue

platforms have not been considered as a good measure to curb the problem. Adolescents' health problems have not received adequate attention in many of the research programmes in the country.

The study further aimed to assess determinant factors of tuberculosis among HIV positive adolescents to get significant input for the development of alternative prevention strategies. It was found that WHO clinical staging III and IV, viral load tests greater than 1000 copies/mL, being bedridden, bronchial asthma, previous history of tuberculosis, history of pneumonia, history of smoking, house shared with domestic animals, and disposing waste everywhere in the compound had an association with tuberculosis infection. In contrast, taking isoniazid preventive therapy, co-trimoxazole preventive therapy and antiretroviral drugs had a strong association with preventing tuberculosis. Significant association with age, sex, marital status, income, educational status, comorbidity, housing and environmental factors were not identified as causes of tuberculosis.

Based on the above findings, the researcher suggests an alternative integrated prevention strategy for TB/HIV for reducing adolescents' morbidity and mortality in Hawassa town in the southern part of the country. The integration identifies and categorises areas of collaboration, develops the regional TB/HIV strategic plan, guides and supports the multi-phased implementation of HIV/TB interventions, monitors and evaluates the implementation process, and makes required revisions and plans for scaling up of the existing interventions for better results (WHO 2003). Greater priority for primary preventive activities and their implementation strategies are considered to take a multi-sectoral approach to addressing the social and structural determinants of TB/HIV infections. The strategy integrates tuberculosis care and prevention with HIV care and prevention that would reduce the risks of transmission of both tuberculosis and HIV, thus reducing morbidity and mortality due to those infections. The strategy consists of goals, vision, mission and nine strategic objectives arranged in four ranks.

The first rank presents SMART (specific, measurable, attainable, realistic, and time bound) strategic goals indicating the expected impact of the integrated intervention to eliminate tuberculosis and prevention of new HIV infections. The second rank comprises nine strategic objectives to prevent TB and HIV with their detailed implementation strategies. The third rank describes eight prevention packages for HIV infection and four prevention packages for tuberculosis infection. These prevention packages help to

prevent the transmission of the infectious agent from the reservoir of the infection to the susceptible host. The fourth rank describes the need for planning, monitoring and evaluation of the programme based on the strategic objectives. Planning, monitoring and evaluation activities are included at all levels of the programme input, output, outcome and impact by using standardised indicators.

In light of the study's findings, the researcher makes some specific suggestions to Sidama Regional State Health Bureau, Hawassa Health Office, health facilities, TB/HIV patients and the community, institutions and service providers offering health care services in the city and its subdistricts, academic and research institutes, and to legal enforcement bodies and political leaders as follows:

Integration of TB/HIV preventive activities are recommended as a primary measure in the disease prevention process. For effective implementation of the programme, all stakeholders are expected to share significant responsibility in providing training to health service providers including health extension workers. Availing the necessary medical equipment and supplies based on the epidemiology of TB/HIV in each zone of the region is suggested as important activity. Conducting regular review meetings and experience sharing session among health institution representatives, health professionals and stakeholders are considered as helpful to build their capacity. Screening individuals with respiratory symptoms and those who come from infectious agent’s hot spot areas attending health facilities for HIV/TB and other common infections are suggested as the primary preventive measures to inhibit the dissemination of nosocomial infection among service takers and providers.

Community involvement in the care and prevention activity are given emphasis through encouraging the community to be engaged in the establishment of care and support groups to support the service taker for appropriate utilisation of TB/HIV prevention, mobilising the community representatives to initiate patients to make regular follow-up of their treatment, encouraging the community to contribute for collaborative TB/HIV activities, actively developing health worker capacity building training in accordance with national TB/HIV training recommendations, motivating the community to have active involvement at all levels of developing, carrying out, observing, and assessing integrated TB/HIV prevention initiatives, facilitating community sensitisation workshops geared at workers from the zonal, woreda (district), and urban health extension departments, and it

aims to mobilise technical, human, and financial resources to support the overall programme activities.

Strengthening dissemination of information, maintaining the consistency of health information in the form of individual and group education on prevention of TB/HIV and other infectious diseases is recommended. This has to be assisted with relevant health education materials. Moreover, effective utilisation of public and social media is considered as preliminary activity to disseminate the required information.

- Planning, monitoring and evaluation activities are suggested as cross-cutting activities at all prevention levels. They should be combined in TB/HIV integrative activities using standardised process and outcome indicators periodically.
- To fill the wide gap in leadership and governance, it is recommended to assign one responsible person to support effective implementation of collaborative TB/HIV care and support, improve the linkage of the TB/HIV services with other relevant programmes, establish a platform for coordinating, monitoring and evaluating the integrated TB/HIV preventive activities from periodical reports and supportive supervision inputs. It is also suggested to monitor professionals working in different institutions to abide by professional ethics and codes because they are expected to maintain the necessary medical ethics regarding clients' privacy and confidentiality. As to resource utilisation and management, it is recommended to establish regional drug supply management systems in line with the standard and providing all TB/HIV patients with affordable, widely available, and necessary diagnostic testing to satisfy health service institutions' demand all over the region up to grassroots level.
- The researcher can confidently state that he has achieved all the objectives formulated for his study. Finally, the researcher suggests regular academic and applied research on how integrated TB/HIV prevention initiatives are implemented.

6.4. RECOMMENDATIONS

The researcher makes the following suggestions for encouraging the application of the integrated preventative TB/HIV approach in the southern part of Ethiopia Hawassa town based on the study's findings. The researcher suggests particular areas for additional investigation in this field.

6.4.1. Recommendations to reduce the TB/HIV burden

This study demonstrates that adolescents who are HIV positive have a significant TB burden, which needs integration of TB/HIV preventive activities. For effective implementation of the programme, all stakeholders are expected to share significant responsibility as follows:

6.4.2. Recommendations to Sidama Regional Health Bureau

- The Regional Health Bureau needs to provide training to health service providers including health extension workers.
- The Regional Health Bureau should provide the necessary medical equipment and supplies based on the epidemiology of TB/HIV in each zone of the region.
- The Regional Health Bureau should conduct regular review meetings and experience sharing sessions among health institution representatives, health professionals and stakeholders
- The issue of decentralisation of the service packages has to be considered among health service delivery institutions including the private sector, private clinics and hospitals.
- The Regional Health Bureau should facilitate research work for better advancement in TB/HIV diagnosis, treatment and prevention.

6.4.3. Recommendations to health facilities/healthcare providers

Active case finding and prompt treatment of those cases has to be done to shorten the infectious period of the infectious agent. Health professionals should focus particularly on:

- Screening individuals experiencing respiratory symptoms and those who came from infectious agent's hot spot areas attending health facilities for HIVTB and other common infections.
- Health service delivery institutions should apply their maximal efforts in using available resources wisely and efficiently. Professionals working in those institutions are expected to abide by professional ethics and codes.
- Consistency of health information in the form of individual and group education on prevention of TB/HIV and other infectious diseases must be considered in every planning phase of health service delivery activities.
- Program coordinators in every health facility should use checklists with established indicators to periodically monitor and assess TB/HIV integrative actions.

- Healthcare practitioners should respect their patients' confidentiality and privacy in their day-to-day communication.
- One responsible individual is required to facilitate the efficient implementation of cooperative TB/HIV care and support in an autonomous integrated programme for TB/HIV prevention.
- Regular follow-up of care and support provided by health professionals can be ensured by adherence counselling.

6.4.4. Recommendation to TB/HIV patients and the community

- The community is expected to be engaged in the establishment of care and support groups to support the service takers for appropriate utilisation of TB/HIV prevention service packages.
- Community members need to initiate patients to go for regular follow-ups of their treatment.

6.4.5. Recommendations to promote the implementation of integrated TB/HIV preventive activities

- The implementation of integrative TB/HIV care and prevention services in Sidama Region needs further promotion all over the region for effective service utilisation through health education and community mobilisation. This research aims to strengthen the collaborative TB/HIV prevention and care service to bring synergistic effect all over the Sidama region.

6.4.6. Recommendation to the Hawassa City Administration and the regional health offices

- Improved TB/HIV service integration should be supported by Sidama Regional Health Bureau. with other relevant programmes to assist the promotional activities.
- Waiting areas for some integrated TB/HIV prevention and support activities should be in line with the national TB/HIV prevention standard.
- The Regional Health Bureau should establish a platform coordinating the monitoring and assessment of integrated TB/HIV prevention efforts in all regional health facilities. The platform needs to have representatives from integrated TB/HIV control programmes, representatives from people living with TB and HIV, partner organisations working on the same programme and representatives from the community.

- The Regional Health Bureau should facilitate community sensitisation workshops targeted for city health extension personnel and the sub-city health department.
- The community should contribute to the services that combine TB and HIV care. This will ensure that the community takes ownership, which is a standard for providing sustainable services to those who are in need.
- The Regional Health Bureau should actively work on capacity building training based on the national TB/HIV training guideline for health workers. The training is expected to include those who are working in leadership positions, health workers, developmental partners and representatives from the community.
- The Regional Health Bureau should play an active role in mobilising technical, human and financial resources to assist the overall programme activities.
- Sidama Regional Health Bureau has to give due attention to using public and social media to present advocacy and programme communication. Regarding services for TB/HIV prevention, the health bureau and the city administration should increase the health service coverage all over the region up to grassroots level.
- The city administration and the regional health bureau should prepare health education materials to assist the behavioural change communication activities.
- Facilitate conducting ongoing technical assistance for facility and staff levels involved in TB/HIV care and prevention.
- Create local mechanisms for managing the supply of drugs in accordance with the standard.
- Consider process and outcome metrics to monitor and evaluate the programme according to the guidelines for monitoring and evaluating performance.

6.4.7. Recommendation to health care service professionals and institutions they work

- Emphasis must be given to essential TB/HIV diagnostic tests to make them widely available, accessible, reasonably priced, and offered to all TB/HIV patients.
- The continuation of services for end-users has to be ensured by working on reducing health professionals' attrition rate.
- The necessary medical ethics concerning clients' privacy and confidentiality must be maintained.

6.4.8. Recommendations to academic and research institutes

- Academic institutions and research organisations ought to do research into the outcome and impact of TB/HIV integrated prevention activities to deliver evidence-based information for programme improvement and sustainability.
- As a way to facilitate better implementation methods for integrated TB/HIV preventive actions, periodic operational and academic studies on the process of implementation must be conducted.
- The adoption of integrated TB/HIV care services should be the primary focus of applied research to lessen the burden of TB/HIV in adolescents.
- Scaling up of this type of research to a national level to comprehend the degree of programme success in comparison to other areas of the country.
- Considering the existing health seeking behaviour, knowledge, attitudes and practices as primary research topic.

6.4.9. Recommendations to the community

- The community is required to ensure participation at all levels of integrated TB/HIV prevention programmes' design, implementation, monitoring, and evaluation.
- Prevention of discrimination and stigma towards TB/HIV patients.

6.4.10. Recommendation to legal enforcement bodies and political leaders

- Strong measures have to be taken in controlling night clubs, illegal narcotic drug sales/trafficking bound with legislative rules and regulations.
- Exercising good governance and resilient leadership through capacity building and supportive supervision has a paramount importance in controlling TB/HIV and other health problems of the community.

6.5. LIMITATIONS OF THE STUDY

This study attempted to base its generalisations on diverse scientific vantage points. However, it can be affected by the following limitations:

- The study was conducted only in Southern Ethiopia's capital city, Hawassa. This might not be indicative of the situation in other parts of the nation.
- Private health institutions such as private clinics and hospitals were not included in the study. This may affect generalisation to all health facilities in Hawassa town.
- At the time of the interviews with the respondents of the study, they were asked their past medical history. This may cause recall bias. However, the researcher tried to

follow all the necessary scientific procedures to make the study's conclusions trustworthy, valid, and dependable. Moreover, the validity, reliability, and trustworthiness of the research results were further strengthened by the employment of a mixed methodologies approach and its triangulation of data.

6.6. SUGGESTIONS FOR FUTURE RESEARCH

This study assessed various factors responsible for the increased magnitude of tuberculosis among HIV positive adolescents. According to the study, formerly there were a number of TB/HIV preventive activities which were implemented by health institutions, developmental partners, and sector organisations such as education, the media and the community. To date there has been a gradual deterioration of those activities and there is no significant collaboration which can make the disease prevention activity effective. Based on this study's findings, the researcher would like to recommend the following points for further research:

- Knowledge and attitude of school teachers on TB/HIV preventive activities in the school compound.
- Assessment of challenges and opportunities on collaborative TB/HIV preventive activities among the community, developmental partners and other stakeholders.
- Assessment of knowledge, attitude and skill of woreda (district level) health managers toward integrated TB/HIV preventive activities.
- Assessment of knowledge, attitude and skill of women of reproductive age toward BCG vaccination.

6.7. STRENGTH AND CONTRIBUTION OF THE STUDY

6.7.1. Efficacy of the research in terms of the creation of the strategy

To prevent, detect, and treat TB cases among people living with HIV and vice versa, integrated preventative activities are crucial. This serves to ensure proper diagnosis and treatment of cases. To date, the implementation of integrative TB/HIV prevention activities has been the main agenda, especially in developing countries like Ethiopia. This has increased the demand for additional studies on how to integrate and facilitate TB/HIV prevention services to diagnose, treat and prevent infection and reduce both morbidity and mortality due to TB/HIV. The results of this study have added to our understanding of the TB/HIV prevention implementation approach in Hawassa town. Based on the findings of the study, the researcher has developed an alternative strategy for integrated

TB/HIV prevention. This strategy can be used to run TB/HIV prevention activities at different levels of the health service delivery structures not only for Hawassa town but also for other regions of the country.

6.7.2. The study's strength of in terms of its impact on advocating and raising awareness among schools and in the community

The findings of the study indicate that there is a wide gap in individuals' access to comprehensive information about sexual risks, and their vulnerability to the adverse consequences of sexual activity. The proposed alternative strategy encompasses important measures toward developing awareness among community members and the school community through a social behaviour change communication approach.

6.7.3. The study's strength in terms of launching future HIV/TB research and expanding the corpus of knowledge

This study is in line with the focus of the WHO under the initiatives of the "End TB Strategy" (Floyd 2018:299-310). It was found that the prevalence of TB/HIV co-infection has been documented to be high in Ethiopia in comparison with other Sub-Saharan African countries. It was also shown that TB/HIV co-infected individuals have a high risk of psychosocial problems, low quality of life, and have significant problems in physical health compared to people who are not HIV infected and without active TB. An integrated TB/HIV prevention strategy is vitally important for planning, implementation and evaluation of TB/HIV prevention programmes (WHO 2018:1-36). To this end, by improving our knowledge of how integrated TB/HIV activities are implemented in Hawassa town, we can say that this study is highly relevant to the body of knowledge already available on integrated TB/HIV care and prevention.

6.7.4. The study's strength in terms of its impact on policy

This research has given insightful evidence to policy makers to bring adolescents' reproductive and other common health problems to their attention and help them to make the right decisions on issues such as equitable distribution of resources for disease prevention and control activities, community mobilisation for their active participation, and improvement of the existing health sector leadership and governance at all levels in the region.

6.8. CONCLUSION

If TB/HIV is to be prevented successfully, the underlying causes for their occurrence have to be identified. The study used both qualitative and quantitative research designs for its

investigation. For the qualitative phase of the study, twelve FGDs and four key informant interviews were conducted sequentially. For the quantitative phase of the study adolescents with TB and HIV at chronic care centres were interviewed using an interviewer administered structured interview guide and questionnaire respectively (see Chapter 3). This study has clearly indicated the underlying causes of tuberculosis among HIV positive adolescents in Hawassa town as failure to exercise good governance and leadership, shortage of budget to run disease prevention programmes, poor motivation of health professionals, and lack of attention for TB/HIV transmission hot-spot areas. Moreover, poor community-based TB/HIV preventive activities, insignificant community engagement, inequitable resource distribution, lack of TB/HIV preventive implementation strategy, failure to exercise legal enforcement against risky sexual behaviours and lack of adolescent-focused research studies were among all the identified problems which are mainly responsible for high morbidity and mortality due to TB/HIV. Certain factors such as taking IPT, ART and CPT were found to have preventive effect against tuberculosis infection. Designing an alternative strategy for integrated TB/HIV prevention was suggested as having paramount importance for curbing the problem. Hence, the contribution of this study is the development of an alternative TB/HIV preventive strategy that will contribute to promoting better TB/HIV prevention.

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APPENDICES

APPENDIX A:

RECOMMENDATION LETTER

ADDIS ABABA UNIVERSITY አዲስ አበባ ዩኒቨርሲቲ
COLLEGE OF HEALTH SCIENCES ጤና ሳይንስ ኮሌጅ
SCHOOL OF PUBLIC HEALTH የሕብረተሰብ ጤና ት/ቤት
DEPARTMENT OF PREVENTIVE MEDICINE ኘሪቬንቲቭ ሜዲሲን ትምህርት ክፍል

Date: - June 17, 2022

To whom it may concern

Dear Madam/ Sir

This letter confirms the assessment of a thesis work of Yusuf Abdu, whose title is 'Prevention strategy of tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia' submitted to fulfill the Doctor of Literature and Philosophy degree. I have reviewed the document mainly on the methods, the analysis, and the results session. The assumption made to calculate the sample size for quantitative data has given the good research control of the power. The analysis session that described the assumptions behind the analysis of continuous and categorical variables is well described. The issue of multicollinearity, the analysis thought for multivariable analysis to suppress the confounding effect of independent variables make the research work strong. The research work's use of factor analysis to reduce and group variables by construct is another part of the research superiority. Finally, the candidate has practiced the analysis in the result session as planned in the methods. Therefore, I would like to confirm Yusuf Abdu has done his job well.

Sincerely,

Negussie Deyessa, (MD, MPH, Ph.D.)
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APPENDIX B:

CONSENT

PARENTAL CONSENT TO PARTICIPATE IN A RESEARCH STUDY FOR YOUNG PEOPLE BELOW AGE OF 18

TOPIC: Determinants and prevention strategy of tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia.

Researcher: Yusuf Abdu

Parent/guardian: .....Alemitu...Gebru.....

Introduction

Your child is being asked to be in a research study. She/he was selected as a possible participant because he/she is following treatment at **TB/HIV care and treatment centre** You are asked to read this form and ask any questions that you may have before allowing your child to participate in this study,

Purpose of the study

The aim of this study is **to investigate the determinants of and develop the prevention strategy of TB among HIV positive adolescents in Hawassa, Southern Ethiopia.** The information that will be acquired from this study will ultimately facilitate to avail knowledge on determinants of TB among HIV positive adolescents to researchers and policy makers. Young people will benefit from awareness drive by the health care providers targeting them and this in turn will equip them with adequate information to help them make informed choices regarding how to prevent the spread of TB HIV among adolescents

Description of the study procedures

If you decide to allow your child to partake she/he will be asked to answer the questions in relation to adolescent sexual and reproductive health.

Confidentiality

This study is anonymous. We will not be collecting or retaining any information about your child's identity. The records of this study will be kept strictly confidential. Research records will be kept in a locked file and all electronic information will be coded and secured using a password protected file. We will not include any information in any report we may publish that would make it possible to identify your child.

Right to refuse/withdraw

The decision to participate in this study is entirely up to you and your child. Your child may refuse to take part in the study at any time without affecting the relationship with the researcher. The child has the right not to answer any single question as well as to withdraw completely from the interview at any point during the process.

Risks

There are no expected risks; however, there may be unknown risks.

Consent

Your signature below indicates that you have decided to allow your child to participate as a research subject of this study and that you have read and understood the information provided above.

Parent/guardian name:……Alemitu Gebrue

Signature:……  ……date…..January 20, 2022

Researcher's signature:……  ……date.. January 20, 2022

APPENDIX C:
QUESTIONNAIRES

DATA COLLECTION TOOLS FOR QUANTITATIVE STUDY

C.1: Data to be collected via client interviews and clinical record (English version)

Parental/Legal guardian informed consent or child assent form will be used to get consent of the respondent before interview (based on age category).

1) Socio demographic factors associated with TB infection among HIV-positive adolescents

SN	Questions	Responses	Remarks
Q101	Sex	1. Male 2. female	
Q102	Age	|___|___|	
Q103	Educational status	1.No formal education 2.Primary education 3.Secondary education 4.Tertiary education	
Q104	Marital status	1.Single 2.Married 3.Divorced/widowed	
Q105	Employment status	1.Unemployed 2.Employed	If "1" go to Q107, if "2" go to Q106
Q106	Monthly income	|___|___|___|___|___|Ethiopian Birr	
Q107	Residence	1.Urban 2.Rural	
Q108	Religion	1. Muslim 2. Orthodox Christian 3. Protestant 4. Catholic 5. Adventist 6. others	

Q109	Number of family	|___|___|	
Q110	Data collector ID	|___|___|___|	
Q111	Supervisor ID	|___|___|___|	
Q112	Study participant's Registration Number	|___|___|___|___|___|___|___|___|	
Q113	Name of the health facility that the client has follow up		
2) Environmental factors associated with TB infection among HIV-positive adults			
Q201	Wall of house	1. Mud/mud brick 2. Cement	
Q202	Separate kitchen	1. Yes 2. No	
Q203	Waste disposal site	1. In the compound 2. Outside	
Q204	Floor of house	1. Earth 2. Cement	
Q205	*PPR(persons per room)*	*1. <1* *2. 1-2* 3. ≥2	
Q206	*House shared with animals*	*1. Yes* *2. No*	
Q207	*Ceiling*	*1. Yes* *2. No*	
Q208	Number of windows	1. 0 2. 1 3. ≥2	

3) Host factors associated with TB infection among HIV-positive adults			
Q301	History of Smoking	1. Never 2. Past 3. Current	
Q302	History of Bronchial Asthma	1. Yes 2. No	
Q303	History of Diabetes mellitus	1. Yes 2. No	
Q304	Taking ART (anti-retroviral Therapy)	1. Yes 2. No	
Q305	*Taking IPT* *(Isonized Prophylaxis Therapy)*	*1. Yes* *2. No*	
Q306	*Cotrimoxazole Preventive therapy(CPT)*	*1. Yes* *2. No*	
Q307	Previous history of TB	1. Yes 2. No	
Q308	Presence of TB in the family	1. Yes 2. No	
Q309	History of pneumonia	1. Yes 2. No	
Q310	History of RTI (Respiratory tract infection)	1. Yes 2. No	
4) Clinical variable associated with TB infection among HIV-positive adults			
SN	**Questions**	**Responses**	**Remarks**
Q401	WHO clinical stage	1. Stages I 2. Stages II 3. Stages III 4. Stages IV	
Q402	Haemoglobin level	|___|___|	
Q403	Being bed ridden	1. Yes 2. No	
Q404	CD4 count	|___|___|___|___|	

Q405	The recent viral load test result	|___|___|___|___|	
Q406	*BMI*	|___|___|	
Any other comment:			

APPENDIX D

INTERVIEW GUIDE

DATA COLLECTION TOOLS FOR QUALITATIVE STUDY

1. Focus Group Discussion Guide: Adolescents

Place of the interview_____

Name of moderator: _____

Name of note taker: _____

Your age: _____

Your sex: _____

Date of discussion: _____

Start time and Adjourned: _____

Grand tour question

Would you tell me about HIV/AIDS and tuberculosis problems of youth and adolescents in Ethiopia?

Follow-up questions

1. What are the reasons that HIV/AIDS and TB are still problems in Ethiopia and in the world for more than three decades?
2. What are the current efforts to prevent HIV/AIDS and Tuberculosis?
3. Would you comment on the role of media in prevention of TB HIV?
4. What is the contribution of your institution in the control and prevention of TB/HIV
5. Have you ever faced any challenge to conduct those preventive activities?
6. Do you have any comment on the government effort to prevent TB and HIV among youth and adolescent?

Thank you very much for your time and participation!

2. Interview Guide: Public officials/key informants (on the availability and accessibility of TB/HIV programme for the adolescents in Hawassa)

Grand tour question

'Tell me your views about HIV/AIDS and tuberculosis problems among the youth and adolescents in Hawassa, Ethiopia.

Probing questions

1. May you give examples that TB/HIV is a problem of youth and adolescents
2. What are the reasons that HIV/AIDS and TB are still a problem for more than three decades?
3. What are the various preventive measures against those diseases?
4. Where did you get the information?
5. What do you think what should be the role of different sectors such as school, mass media ,social media, etc. in the prevention of TB or HIV among the adolescents
6. What do you recommend to your school for better prevention and control of those important public health problems?

Thank you very much for your time and participation!

3. Interview Guide: Parent or Guardian of an adolescent

Grand tour question

Are HIV/AIDS and tuberculosis problems of youth and adolescents?

Probing questions

What are the indicators that HIV/AIDS and TB are still problems of those population?

1. What are the reasons that HIV/AIDS and TB are still problems in Ethiopia and in the world for more than three decades?
2. What are the current efforts to prevent HIV/AIDS and Tuberculosis among the adolescents?
3. What should be interventions to prevent HIV/AIDS and Tuberculosis among the adolescents?
4. What do you think the role of media is, in the control or prevention of TB HIV among the adolescents?
5. What do you recommend to health institutions and policy makers or to ministry of health for better prevention and control of those important public health problems?

Thank you very much for your time and participation!

APPENDIX E:
ETHICAL CLEARANCE CERTIFICATE

UNISA university of south africa

COLLEGE OF HUMAN SCIENCES RESEARCH ETHICS REVIEW COMMITTEE

11 November 2020

NHREC Registration # :
Rec-240816-052
CREC Reference # :
67128327_CREC_CHS_
2020

Dear Ahmed Yusuf Abdu

Decision:
Ethics Approval from 11 November 2020 to 31 October 2024

Principal Researcher(s): Ahmed Yusuf Abdu (email: 67128327@mylife.unisa.ac.za)

Supervisor: Prof RM Mmusi-Phetoe (email: emphetrm@unisa.ac.za)

Title: Prevention strategy of tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia

Degree Purpose: PhD Public Health

Thank you for the application for research ethics clearance by the Unisa College of Human Science Ethics Committee. Ethics approval is granted for three years.

The ***High-Risk application*** *was* ***reviewed*** by College of Human Sciences Research Ethics Committee, on **November 2020** in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the College Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

4. Any changes that can affect thestudy-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following SouthAfrican legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes infuture on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
7. No fieldwork activities may continue after the expiry date **(31 October 2024).** Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number ***67128327_CREC_CHS_ 2020*** *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Yours Sincerely,

Signature :

Dr. K.J. Malesa
CHS Ethics Chairperson
Email: maleskj@unisa.ac.za
Tel: (012) 429 4780

Signature : PP

Prof K. Masemola
Executive Dean : CHS
E-mail: masemk@unisa.ac.za
Tel: (012) 429 2298

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APPENDIX F:
SUPPORT LETTER REQUEST

UNISA university of south africa

26 April, 2021
UNISA-ET/KA/ST/29/26-04-2021

Sidama Regional State Health Bureau
Hawassa

Dear Madam/Sir,

The University of South Africa (UNISA) extends warm greetings. By this letter, we want to confirm that Mr. Yusuf Abdu Ahmed (student number 67128327) is a PhD student in the Department of Health Studies at UNISA. Currently, he is about to go out for data collection on his doctoral research entitled "***Prevention strategy of tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia***".

This is therefore to kindly request your cooperation in assisting the student in any way that you can. We would like to thank you in advance for all the assistance that you would provide him. Attached, please find the ethical clearance that the student has received from the Department.

Sincerely,

UNISA REGIONAL LEARNING CENTRE
PO BOX 13836 ADDIS ABABA ETHIOPIA
TEL +251-114-350141
FAX +251-114-350078
MOBILE +251-114-351243
+251-912-191483

Dr. Tsige GebreMeskel Abera
Director

University of South Africa
Regional Learning Center
P.O. Box: 13836, Addis Ababa, Ethiopia
Telephone: +251 11 435 2244 / +251 11 435 0078
Facsimile: +251 11 435 1242/ 43/ 44
Mobile: +251 912 19 1483
www.unisa.ac.za

APPENDIX G:

PERMISSION LETTERS FOR DATA COLLECTION

Sidaamu Dagoomi Qoqqowi Mootimma
Hawaasi Quchumi Gashshoote
Fayyimmate Biddishsha

በሲዳማ ብሔራዊ ክልላዊ መንግስት
የሀዋሳ ከተማ አስተዳደር
ጤና መምሪያ

Kiiro/ቁጥር/Ref.№ ሰሄ/ሀጠ/5176/70
Barra/ቀን/Date 26/09/13

To Adare General Hosptal
To Millenum Health Center
To Alamura Health Center
Hawassa

Subject : Giving support letter to MR Yusuf Abdu

Sidama Regional Health Bureau on 28/8/2013 E.C.Ref No.Fayy/9/359/1 sent to us a letter which inquire to support Ato Yusuf Abdu who is studing in Universty of South Africa (UNISA) perusing doctoral degree program,is seeking to conduct a research entitled Prevention Strategy of Tuber Culosis among HIV positive Adolescents in Hawassa City.

1.In Adare General Hosptal
2.In Millnum Health Center
3.In Alamura Health Center

So,we Inquire You to support Ato Yusuf Abdu in his research.

LET US FIGHT CORONA VIRUS TOGETHER !

Woynshet Gebe Lediso
H/R/D/Office

Co.
To H/C/A/H/D/HEAD
To H/C/A/H/D/H/S/C/PROCESS
To Mr YUSUF ABDU

HAWASSA

0462129046 0462214761 ✉ 2 www.hawassacityadmin.info
[Type here]

UNISA university of south africa

26 April, 2021
UNISA-ET/KA/ST/29/26-04-2021

Hawassa University
College of Medicine and Health Science
Hawassa

Dear Madam/Sir,

The University of South Africa (UNISA) extends warm greetings. By this letter, we want to confirm that Mr. Yusuf Abdu Ahmed (student number 67128327) is a PhD student in the Department of Health Studies at UNISA. Currently, he is about to go out for data collection on his doctoral research entitled ***"Prevention strategy of tuberculosis among HIV positive adolescents in Hawassa, Southern Ethiopia"***.

This is therefore to kindly request your cooperation in assisting the student in any way that you can. We would like to thank you in advance for all the assistance that you would provide him. Attached, please find the ethical clearance that the student has received from the Department.

Sincerely,

Dr. Tsige GebreMeskel Aberra
Director

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FAX +251-114-350078
MOBILE +251-114-351243
+251-912-191463

Sidaamu Dagoomu Qoqqowu Mootimma
Fayyimmate Biiro

በሲዳማ ብሔራዊ ክልላዊ መንግስት
ጤና ቢሮ

ቁጥር fxxx/9/359/1
Ref.No
ቀን 28/8/2013

To: Hawassa Town Health Department
Hawassa

SUBJECT: INTRODUCTORY LETTER: MR. YUSUF ABDU

Dear Sir/Madam

The above mentioned student of The University of South Africa (UNISA), who is perusing doctoral "degree program, is seeking to conduct a research entitled "prevention strategy of tuberculosis among HIV positive adolescents in Hawassa town" in three health institutions of Hawassa town:

1. Adare General Hospital
2. Millennium Health Center
3. Alamura Health Center

Kindest regards,

Belayineh Beqqele Qarre
በላይነህ በቀለ ቃሬ
Bl/Zkl/Sore/Fayyi/Programme
Handaari Sooreessa
ጭ/ቢሮ ጉለፋና ጤና ፕሮ/ዘርፍ ኃላፊ

Sidaamu Dagoomu Qoqqowu Mootimma Fayyimmate Biiro
የሲዳማ ብሔራዊ ክልላዊ መንግስት ጤና ቢሮ

የስልክ ቁጥር/ Telephone 0462206337/ 0462200268/ 0462212946/ 0462212945/ 0462125163 ፋክስ2510462204723 መ.ሣ.ቁ
ሀዋሳ Hawaassa, Ethiopia

APPENDIX H:
DECLARATION: LANGUAGE AND TECHNICAL EDITING

15 December 2022

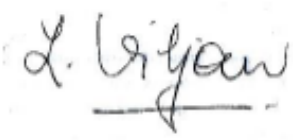
To Whom It May Concern

This is to certify that I have edited the language of the dissertation of **Yusuf Abdu Ahmed**, submitted in accordance with the requirements for the degree of Doctor of Philosophy (PhD) in the subject Public Health at the University of South Africa.

Title: *Prevention Strategy of Tuberculosis Among HIV Positive Adolescents in Hawassa Town, Southern Ethiopia*

Supervisor: Professor RM Mmusi-Phetoe

Feedback about the work has been provided to the author and, to my knowledge, after corrections the text is free of language errors.



Leonie Viljoen, PhD (UCT)
Formerly Associate Professor and Research Fellow
Department of English Studies
UNISA
Cell: 082 9244 733

Technical Editing

I, Ronèl Gallie, acknowledge that I did the technical formatting, checking of the reference list, and cross-referencing of the dissertation of **Yusuf Abdu Ahmed**. Feedback about the work has been provided to the candidate.

Ronèl Gallie
Technical Editor
Cell: 084 7780 292

APPENDIX I:

TURNITIN REPORT

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PREVENTION STRATEGY OF TUBERCULOSIS AMONG HIV POSITIVE ADOLESCENTS IN HAWASSA TOWN, SOUTHERN ETHIOPIA

by

YUSUF ABDU AHMED

submitted in accordance with the requirements for the degree of

DOCTOR OF PHILOSOPHY

in the subject

PUBLIC HEALTH

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: PROFESSOR RM MMUSI-PHETOE

DECEMBER 2022

PREVENTION STRATEGY OF TUBERCULOSIS AMONG HIV POSITIVE ADOLESCENTS IN HAWASSA TOWN, SOUTHERN ETHIOPIA

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