Prevalence of Human Immunodeficiency Virus among Tuberculosis Patients Visiting Metehara Sugar Factory Hospital, Oromia Regional State: a Five-year Retrospective Study

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Abstract

Tuberculosis is the leading cause of death for HIV-infected patients, and HIV is the most important risk factor for developing active TB. The risk of death from TB is significantly higher in the HIV-infected population. The interaction between TB - HIV co-infected person is bidirectional and synergistic: HIV infection predisposes to the development of active TB, and the course of HIV-related immunodeficiency is worsened by active TB infection. The aim of this five-year retrospective study was to assess the prevalence of TB - HIV co-infections among patients who visited Metehara Sugar Factory Hospital (MSFH) from March 2012 to April 2017. In total 1165 TB patients visited MSFH from March 2012 to April 2017 and of these 1028 (88 %) who had a documented HIV test results were included in the study. Data were collected from medical records of all TB patients who were on anti-tuberculosis treatment during the aforementioned period. About 21 % of them were found HIV-positive. The percentage of TB/HIV co-infection was higher in females than males, single than married individuals, unemployed than employed and active working force than other age groups. The ART coverage of the TB/HIV co-infected patients was 78 % which was lower than WHO target of 100 %. Interventions to prevent HIV transmission among TB patients include counseling for patients and preventive intervention programs that attempt to change high-risk behavior.

Keywords*: Co-infection, HIV/AIDS, Metehara, prevalence, retrospective, Tuberculosis*

1. Introduction

Tuberculosis (TB) is a chronic infectious disease caused by *Mycobacterium tuberculosis* which is also known as Tubercle bacilli. Tuberculosis is one of the major global health problems, which ranked as the second leading cause of death from an infectious disease

worldwide next to human immunodeficiency virus (HIV) that causes ill health among millions of people each year (WHO, 2012). Human Immunodeficiency Virus (HIV) and Tuberculosis are closely associated where HIV promotes the progression from latent infection to active disease and TB is the leading infectious killer of people living with HIV (Lata *et al*., 2015). Infection with HIV is an established risk factor for acquiring and developing infection with tuberculosis, and the recent increase in the worldwide prevalence of HIV infection has contributed to the rising global incidence of TB (Abera *et al*., 2009). Tuberculosis is one of the most common infections that threaten people living with HIV (PLWHIV) in the developing world and together with HIV; TB is responsible for the deaths of over 4 million people annually (RESULTS Canada, 2010).

Globally the most TB cases are in Asia, the highest incidence rates are in sub-Saharan Africa where high rates of HIV and malnutrition weaken immune systems and accelerate the spread of the disease. Consequently, the number of new TB cases in most African countries has more than quadrupled since 1990, with 2.8 million new TB cases and roughly 735 thousand deaths annually (Fekadu *et al*., 2015). Tuberculosis is a common opportunistic infection in sub-Saharan Africa. Thus, the countries in the sub-region continue taking the leading position in HIV/TB morbidity and mortality rate, where the TB epidemic was primarily driven by HIV infection (Hailu and Eshetu, 2013).

Tuberculosis has been recognized as a major public health problem for more than five

decades in Ethiopia. Ethiopia is one of the 22 high burden countries (HBCs) and TB remains one of the leading causes of mortality. According to the WHO (2014), the prevalence and incidence of all forms of TB are 211 and 224 per 100,000 of the population, respectively. About 13% of all new TB cases are also HIV co-infected. Moreover, Ethiopia is one of the high TB/HIV and multidrug resistant TB (MDR TB) burden countries. Among TB patients with known HIV status, about 11% were HIV co-infected (Mulugeta and Alemu, 2016). According to the Ethiopian Ministry of Health hospital statistics data, tuberculosis is the leading cause of morbidity, the third cause of hospital admission (after deliveries and malaria) and the second cause of death in Ethiopia after malaria (EFMoH, 2008).

Since 2002, Ethiopia has been implementing the TB/HIV collaborative activities (EFMoH, 2009). However, only few studies reported that HIV co-infection has been a major public health challenge among TB patients of the country (Sebsibe and Takele, 2013). Assessment about HIV co-infection among TB patients might help to understand the spread of the co-infections and to monitor the performances of TB and HIV sustainable controlling and monitoring activities (WHO, 2012). Understanding the predictors of TB/HIV co-infections in the local context is critical for Ethiopia to improve co-management of TB/HIV co-infected patients (Mitiku *et al*., 2016). The prevalence of TB infection is significantly associated with the incidence of HIV and vice versa across the areas in Oromia region. Assessment of the prevalence of TB among HIV patients and vice

versa is increasingly seen as important, as the HIV epidemic has continued to fuel the TB disease (Abera *et al*., 2009).

Metahara Sugar Factory has a large number of workers and the workers have access to free treatment in the factory's hospital. The hospital provides services for over 2800 patients per year. The prevalence of HIV among TB positive individuals at Metehara Sugar Factory hospital has not been studied. Knowledge of the prevalence of HIV positive cases among TB patients is important for better program planning HIV testing for all TB patients in order to design HIV/AIDS management program in an effort to stop the continued transmission of HIV within the community. Therefore, this retrospective study was to investigate the prevalence and trends of HIV-positive individuals among TB patients (TB/HIV co-infections).

2. MATERIAL AND METHODS

2.1 Description of the Study Area

This study was carried out in Metehara Sugar Factory (MSF) in Fentalle district, East Shoa Zone of Oromia Regional State. The factory is bounded by escarpments from east, west and south. It is located at $8^{o}50'$N latitude and $39^{o}50'$E longitude and the elevation is 950 m above sea level (Fig. 1). It is found at a distance of 200 km southeast of Addis Ababa within upper Awash Valley, near the main road to Harar. The area is typically characterized by semi-arid climate with a mean relative humidity of 55.4 %, average annual rainfall of 543 mm, mean minimum and maximum temperatures of 17.2^{O}C and 32^{O}C, respectively (Metehara Sugar Research Metrological Center, unpublished data).

Metehara Sugar Factory Hospital provides services for over

2800 patients per year. There were 4 doctors, 3 health officers, 30 nurses, 8 health extension workers,5 laboratory technicians, 1 radiologist, 2 HIV and Anti HIV drug treatment nurses, 2 data encoders and case managers. The clinics provide basic health services entirely based on clinical symptoms within the respective villages and communities including from nearby Afar and Somali districts. However, laboratory based medical treatment for TB and HIV is provided only in the hospital.

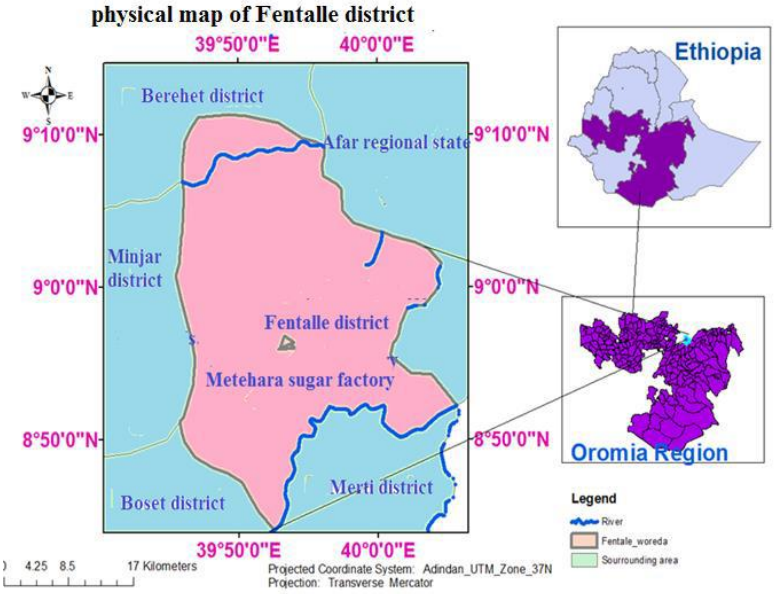

Figure 1: Map of the study area (Source: Ethio Arc GIS, 2017)

2.2 Study population and study design

The design of this study was a five-year retrospective descriptive survey of the prevalence of TB and TB/HIV co-infections among patients who visited MSFH from March 2012 to April 2017. In total 1165 TB patients visited MSFH and of these 1028 (88.2 %) who were registered and treated according to the clinical guidelines of the National Tuberculosis and Leprosy Control Program

(NTLCP) (EFMoH, 2008) and had a documented HIV test results were included in the study.

2.3 Variables

The response variable for this study is the occurrence of TB/HIV co-infection. The predictor variables are socio-demographic characteristics (age, sex, occupation) and clinical related characteristics (ART status, TB type, and Treatment outcomes) of the patients.

2.4 Data Analysis

Collected data were checked for missing values, organized, coded, tabulated and then were analyzed using descriptive statistics with Excel Microsoft ware computer. Descriptive statistics (frequencies and summary statistics (percentage) were used to describe patients' characteristics.

2.5 Ethical Consideration

Ethical clearance was obtained from Health Research Ethical Review Committee of Oromia Regional Health Bureau. Before conducting the study, the purpose and importance of the study was explained to the MSF management, DOTS-HIV care unit officials and participants of the study. Confidentiality and anonymity of the data from the hospital's documents and interviewees were secured by using codes throughout the study.

3. RESULTS

3.1. Socio-demographic characteristics

Of the total (1028) TB patients attended the hospital, male patients account for 56 % of the study subjects. Most (60.4 %) of the patients were found in the age group 25 – 34 years and about 51 % (n = 521) were married, 32.5% were employed (Table 1).

3.2 Clinical characteristics of TB patients

Type of TB, HIV status, ART status, and treatment outcome of patients are depicted in Table 2. About 80 % (n = 817) of the TB patients had pulmonary TB type and of the total patients about 66 % had smear negative pulmonary TB type. About 21 % (n = 211) of the total TB patients visited the hospital were found to be HIV-positive, about 65 % completed treatment, 13.3 % (n = 137) were cured and 4.5 % (n = 46) of them died. About 79 % of the TB/HIV co-infected patients had been following anti-retroviral therapy (ART).

Table 1. Socio-demographic characteristics of TB patients at Metehara Sugar Factory Hospital from March 2012 to April 2017 (N =1028)

Variables	Number	Percentage (%)
Sex		
Male	575	55.9
Female	453	44.1
	Age (years)	
0-14	60	5.8
15 -24	152	11.0
25 - 34	628	60.4
35 - 44	99	14.0
45 - 54	76	7.5
>54	13	1.3
Residence		
Inside MSF	382	38.1
Outside MSF	646	61.9
Occupational status		
Employed	334	32.5
Housewife	166	16.1
Unemployed	156	15.2
Farmer/pastoralist	78	7.6
Others	294	28.6
	Marital status	

Married	521	50.7
Single	299	29.1
Widowed	39	3.8
Divorced	22	2.1
Children/undecided	147	14.3

Note: Others = students, merchants, preschool children, pensioners, commercial sex workers

Table 2: Clinical characteristics of TB patients visited Metehara Sugar Factory Hospital from March 2012 to April 2017 (N = 1028)

Characteristics		**Number**	**Percentage**
Type of TB	SPPTB	143	13.9
	SNPTB	674	65.6
	EPTB	211	20.5
HIV status	Positive	218	21.2
	Negative	810	78.8
ART status (N = 218)	Pre ART	48	22.0
	On ART	170	78.0
Treatment outcome	Completed	664	64.6
	Cured	137	13.3
	Transfer out	28	2.7
	Defaulter	109	10.6
	Failure	44	4.3
	Dead	46	4.5
	Treatment success	801	77.9

Note: SPPTB = Smear Positive Pulmonary TB; SNPTB = Smear Negative Pulmonary TB; EPTB = Extra Pulmonary TB; ART = Anti Retroviral Therapy

3.3. Prevalence of TB-HIV co-infection by age group of the study participants

Prevalence of TB/HIV co-infection of patients by age group and sex is shown in (Table 3). About 21 % (n = 218) of the total TB patients visited the hospital were found to be HIV positive (TB/HIV co-infection). The percentage of female TB/HIV co-infected female patients was generally higher than that of males and the highest percentage (28.3 %) of HIV positive TB patients were in the age group 15 - 24 years both sexes considered together.

3.4 Prevalence of TB/HIV co-infection by marital status and sex

The percentage of HIV status of TB patients of unmarried males was about two-fold (26.0 %) than married ones (13.4 %) while that of single females was about 3.4 times than HIV positive married females. When HIV status of single and married TB patients of both sexes is seen, 35 % of single TB patients were HIV positive while only 15 % of the married TB patients were HIV positive (Table 4).

3.5 Prevalence of TB/HIV co-infection by occupational status of the patients

Most (51.3 %) of the 218 TB/HIV co-infected patients were unemployed and the percentage of females was higher than that of the males (Table 5).

3.6 Trend of TB/HIV co-infection among TB Patients

There was a slight decrease of TB/HIV trend from 2012 to 2015 but it increased from 2015 to 2017 Fig. 2).

Table 3: Prevalence of TB/HIV co-infection of patients by age group and sex visited Meteha Sugar Factory Hospital from March 2012 to April 2017 (N = 1028)

	Male		Female		Both sexes	
Age (years)	Number examined	Number positive (%)	Number examined	Number positive (%)	Number examined	Number positive (%)
0 -14	31	3 (10)	29	6 (21)	60	9 (15)
15 - 24	93	19 (20.4)	59	24 (41)	152	43 (28.3)
25 - 34	354	68 (19.2)	274	69 (25.2)	628	137 (21.8)
35 - 44	53	5 (9.4)	46	15 (33)	99	20 (20.2)
45 – 54	36	2 (5.6)	40	6 (15)	76	8 (11)
> 54	8	1(13)	5	0 (0)	13	1 (8)
Total	**575**	**98 (17)**	**453**	**120 (26.5)**	**1028**	**218 (21.2)**

Table 4: Prevalence of HIV infection among TB patients by their marital status and sex at Metehara Sugar Factory Hospital from March 2012 to April 2017 (N = 218)

	Male		Female		Both sexes	
Marital status	Number examined	Number positive (%)	Number examined	Number positive (%)	Number examined	Number positive (%)
Married	262	35 (13.4)	259	43 (16.6)	521	78 (15.0)
Single	208	54 (26.0)	91	51 (56.0)	299	105 (35.1)
Widowed	8	0 (0)	31	6 (19.4)	39	6 (15.4)
Divorced	10	1 (10)	12	5 (41.7)	22	6 (27.3)
Children	87	8 (9.2)	60	15 (25)	147	23 (15.6)
Total	**575**	**98 (17)**	**453**	**120 (26.5)**	**1028**	**218 (21.2)**

Table 5: Prevalence of HIV infection among TB patients by occupational status and sex at Metehara Sugar Factory Hospital from March 2012 to April 2017 (N = 1028)

Occupational status	Male		Female		Both sexes	
Occupational status	Number examined	Number positive (%)	Number examined	Number Positive (%)	Number examined	Number Positive (%)
Employed	234	28 (12.0)	100	31 (31.0)	334	59 (18.0)
House wife	-	-	166	21 (15.0)	166	24 (14.5)
Unemployed	96	46 (48.0)	60	34 (57.0)	156	80 (51.3)
Farmer/pastoralist	71	14 (20.0)	7	0 (0.0)	78	14 (18.0)
Others	174	10 (6.0)	120	31 (26.0)	294	41 (14.0)
Total	575	98 (17)	453	120 (26.5)	1028	218 (21.2)

Note: Others = students, merchants, preschool children, pensioners, commercial sex workers.

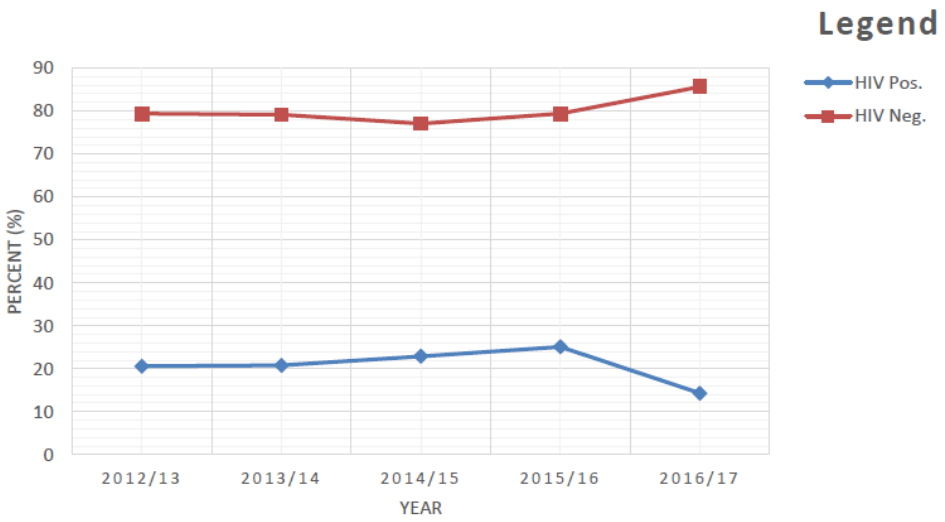

Fig. 2: Trend of TB and TB-HIV co-infection at Metehara Sugar Factory Hospital from March 2012 to April 2017

3. Discussion

This study showed that TB occurs in all age groups. Of the total (N = 1028) TB patients attended the hospital, male patients account for 56 % of the study subjects and this in line with Derek *et al*. (2015) who reported that tuberculosis cases are more prevalent among men than women, and TB mainly affects adults in their productive years. Of the different factors, gender difference is one of the risk factors which may indirectly influence the male-to-female ratio of tuberculosis. In high-burden countries, smoking is much more frequent in men than in women, and a correlative analysis of cigarette smoking, sex, and tuberculosis suggests that smoking might explain up to one-third of the gender bias observed in this setting. Alcohol consumption is also a risk factor for tuberculosis, and the prevalence in low-income countries among men is much higher than that among women (Watkins and Plant, 2006).

Of the total TB patients, about 21 % (n = 218) of them were found HIV-positive. Results of similar studies conducted on the HIV prevalence rate among TB patients show variations. The HIV prevalence rate in the present study is similar to some of these studies. In Amhara Regional State, Tarekegn Daniel *et al*. (2016) recorded about 20 % TB/HIV co-infection at Metema Hospital from 2009-2012 and Amare (2015) reported about 22 % in a study conducted from 2009-2014 at Fenote Selam District Hospital. However, Adisu *et al*. (2016) reported a lower percentage of about 13 % in a study conducted from 2008 to 2013 at Debretabor Hospital, while a higher percentage (31 %) was reported by Lengisa *et al.* (2015) and 44.8 % at Debre Markos Referral Hospital,

Amhara Regional State (Ahmed *et al*., 2013).

Infection by *M. tuberculosis* exacerbates HIV infection. The incidence and mortality rates for new AIDS-defining opportunistic infections have been shown to be higher if individuals with HIV are co-infected with TB (Pawlowski *et al*., 2012). Generally, a relatively small proportion of people infected with *M. tuberculosis* will develop active TB disease. However, those with HIV have a much higher chance of developing the active disease. The burden of TB continues to increase due to poverty, population growth, and HIV/AIDS (Derek *et al*., 2015).

The results of this study showed that the proportion of TB/HIV co-infection was higher in females (26.5 %) than in males (17 %). Some similar studies conducted in Ethiopia showed even very high TB/HIV co-infection in females than in males. Damtew *et al*. (2013) reported 37 % in Bishoftu Hospital and Jemberu *et al*. (2017) reported 76.3 % of TB/HIV co-infection in females in Gambella Regional State Hospital. Higher infection in females is attributed to permanent immune suppression associated with pregnancy and more likely lowered immunity due to the stress as a result of their biological, economic and cultural roles as household care-givers (Ahmed *et al*., 2013). Women are more affected by HIV/AIDS than males because of their difference in their socio-economic, political, legal and cultural status, as well as biology (Jackson, 2002). The higher prevalence of TB/HIV co-infection in female than males is expected due to the fact that HIV has more chance of transmission from males to females than from females to males. In line with this Georgina *et al*. (2013) reported that the penile-vaginal

transmission by an infected individual in a single sexual exposure is as low as one in 1000 from female to male and as high as one in 300 from male to female (Georgina *et al*., 2013).

Over 60 % (n = 628) of the TB patients were found within age group of 25 – 34 years and they constitute the highest (28 %) HIV positive, followed by 25 - 34 (21.8 %) and 35 - 44 (20.2 %) age groups in order. People in these age groups are more active for sexual activity and they are vulnerable to TB and HIV risk behaviors such as substance use and unprotected sexual practices than any other part of the population. The high co-infection prevalence among these age groups which comprises a large part of workforce and productive section of the society might face grave consequences of poverty that aggravate in acquiring the infections. These age groups, being parents of young children, could also be heavily contributing to spread of TB in the household (EHNRI, 2011). Similar studies at Bishoftu Hospital (Damtew *et al*., 2013), Metema Hospital (Tarekegn Daniel *et al*., 2016) and Debre Markos referral Hospital (Amare, 2015) also reported highest HIV infected TB patients within age group of 25 - 34 years.

The current study indicated that higher percentage (35 %) of unmarried TB patients was co-infected with HIV than married (15 %) TB patients. The percentage of single female (56 %) HIV-positive was over two-folds HIV- positive single males (26 %). This may indicate that the single individuals practiced multiple sexual partners than the married ones which is one of the risk factors for contracting HIV.

There was also variation in the prevalence of TB/HIV co-infection in relation to

occupational status. The rate of TB/HIV co-infection was higher among unemployed (51%) than employed (18 %) ones. High rates of unemployment lead to behaviors that increase the risks of tuberculosis and HIV infections such as alcohol consumption, smoking, intravenous drug use and unprotected sex (Azukie *et al*., 2014; Przybylski *et al*., 2014). Sharma *et al.* (2005) also reported that TB/HIV co-infection is intricately linked to unemployment that resulted in poverty and homelessness which may result in malnutrition, drug side effect and low stamina among patients and may possibly lead to poor adherence, death or discontinuation of anti TB chemotherapy.

Mycobacterium tuberculosis–HIV co-infections pose particular diagnostic and therapeutic challenges and exert immense pressure on health care systems in African and Asian countries with large populations of co-infected individuals (Pawlowski *et al*., 2012). Tuberculosis is the leading cause of death for HIV-infected patients, and HIV is the most important risk factor for developing active TB. The risk of death from TB is significantly higher in the HIV-infected population. The interaction between TB - HIV co-infection is bidirectional and synergistic: HIV infection predisposes to the development of active TB, and the course of HIV-related immunodeficiency is worsened by active TB infection (Amare, 2015). Both TB and HIV have profound effects on the immune system, as they are capable of disarming the host's immune responses. HIV co-infection is the most powerful known risk factor for progression of *M. tuberculosis* infection to activate the disease, increasing the risk of latent TB reactivation 20-fold. Likewise, TB

has been reported to exacerbate HIV infection (Pawlowski *et al*., 2012).

Most of the (79 %) TB/HIV co-infected patients had followed ART. The ART level shows variation in the country that 76.3 % was reported in Northern Amhara (Daniel *et al.*, 2015), 79.2 % in southwestern Ethiopia (EPHI, 2015), 54.6 % in Addis Ababa (Mesfin, 2011), and 89.8 % in Oromia (Oromia Region Health Bureau, 2015). In its National TB/HIV Sentinel Surveillance, the Ethiopian Public Health Institute (EPHI) (2015) reported that at national level 70 % of TB/HIV co-infected patients have started or continued previously initiated ART during the course of their TB treatment. According to the recent report ART improves treatment outcome of TB/HIV co-infected individuals reduce early mortality from HIV/TB co-infection, and reduce TB transmission when ART is initiated earlier in all individuals with TB and improved management of TB. Hence programs need to provide due attention to the quality of TB/HIV care and put all TB/HIV co-infected patients on ART treatment as part of the TB/HIV co-management and as per the 100 % recommendation in the national guideline (EPHI, 2015).

About 65 % of the TB patients completed treatment, 13 % cured and 4.5 % (n = 46) of the total patients died. Treatment success defined as 'treatment completed and cured' after completion of dose regimen was 80 % and it is lower than the target set in Ethiopia to achieve overall treatment success rate of 89 % (EFMoH, 2013). The treatment success recorded in the current study shows variation from other similar studies conducted in different hospitals in the country. For instance, Tigist and Mulugeta

(2015) recorded 86 % treatment success at Jimma University Specialized Hospital and Omonada training health center, 87 % at Debretabor Hospital (Adisu *et al.*, 2016), 64 % at Adama Hospital, 29 % (Fiseha *et al.*, 2015), and 63.4 % at Gambella Regional hospital (Getahun et al., 2015).

This study revealed a constant trend in the percentage of TB/HIV co-infection from 2012 to 2014 but an increased trend from 2014 to 2016. Earlier there was an increased awareness creation about HIV through health education and mass media on prevention and its control. However, currently less attention is given to the disease and thus it has been reviving.

The present study found that treatment success (defined as treatment completed and cured) after completion of dose regimen was 80 % and it less than the target set in Ethiopia to achieve overall treatment success rate of 89 % (EFMoH, 2013). Tigist and Mulugeta (2015) reported 86 % treatment success at Jimma University Specialized Hospital and Omonada training health center, while Adisu *et al.* (2016) reported 87.1 % at Debretabor Hospital. At Adama Hospital (64 %) (Lenjisa *et al.*, 2015) and Mizan Aman General Hospital (29 %) (Fiseha *et al.*, 2015) reported lower rate of treatment success.

6. Cnclusion

The prevalence of TB/HIV co-infection in this study was high (21 %) and the percentage of co-infection is higher in females than males, single than married individuals, unemployed than employed and active working force than other age groups. The ART coverage of the TB/HIV co-infected patients was 78 % which was lower than WHO target of 100

%. The present study showed that there was an increase TB/HIV co-infection trend from 2014 to 2016. Economic empowerment of females, awareness creation about prevention of TB and HIV/AIDS and job creation for jobless citizens, especially for those in the active working age can be used as intervention mechanisms of the diseases.

Acknowledgements

The authors wish to thank the management and staff of HIV care units of Metehara Sugar Factory Hospital for providing necessary facilities used in carrying out this study. Special thanks also go to Oromia Education Bureau and Adama Science and Technology University for funding the study.

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