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Prevalence of Multidrug Resistant Tuberculosis and its Associated Factors among Smear Positive TB Patients at Debre Markos Referral Hospital, Northwest Ethiopia

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Abstract- *Background:* The emergence of MDR-TB is a threat for the populations of resource limited countries. In Ethiopia multidrug resistant tuberculosis is becoming a challenge, because of poor adherence to treatment, TB/HIV co-infection, and a few diagnostic and treatment facilities.

Objective: The main aim of this study was to assess prevalence and associated factor for multidrug resistant tuberculosis among smear positive TB patients.

Methods: A retrospective cross-sectional study was conducted among TB patients treated at DOT's clinic at Debre Markos Referral Hospital from September 1, 2015 to March 10, 2017. Data was enteredand analyzed using SPSS version 20. Logistic regression was employed to assess associated factors with p-value <0.05 as significant.

Results: Of a total of 403 smear positive TB patients 248(61.2%), there was 48(11.9%)drug resistance TB cases.The prevalence of MDR-TB from both new and previously TB treated cases was found to be 1.5%. There was statically significant association between history of previous TB treatment and chance of developing MDR-TB. In this study previously treated patients have 34.26 timesmore likely to develop MDR-TB than treatment naïve patients [AOR= 34.26(95%CI: 4.89-24.11), p=002].

Conclusion: Previous history of TB treatment was found to be significantly associated with MDR-TB.

Keywords: *MDR-TB, prevalence, HIV, tuberculosis.*

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Prevalence of Multidrug Resistant Tuberculosis and its Associated Factors among Smear Positive TB Patients at Debre Markos Referral Hospital, Northwest Ethiopia

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I. Background

Tuberculosis (TB) is an infectious bacterial disease caused by *Mycobacterium tuberculosis*that most commonly affects the lungs. Despite the recent progress of global control efforts, TB remains a major public health burden [1]. In 2014, there were $9.6x10^6$cases and $1.5x10^6$ deaths of TB globally [2]. According to WHO Global TB report, Ethiopia is ranked as 15th among 27 high burden MDR-TB countriesand 3rd in Africa. The estimated MDR rate was (0.9%–2.8%) for new cases and (5.6%–21%) for retreatment cases [3]. The history of TB treatment has observed sequential development of resistance to anti- TB drugs. Para-amino-salicylic acid and isoniazid were introduced to reduce the development of streptomycin resistance, which heralded the era of combination treatment for TB[4].Treatment of MDR- TB using second line anti-TB drugs has more adverse events, since provided for an extended period of time (WHO recommendation at least 20 months) and is expensive [5].

Multidrug resistance TB (MDR-TB) is defined as tuberculosis caused by *Mycobacterium tuberculosis* resistant in vitro to the effects of Isoniazid and Rifampicin with or without resistance to any other drugs [6]. Primary resistance in TB refers to patients infected with *M. tuberculosis* that is resistant to anti-TB drugs from the outset, prior to anti-TB treatment. MDR-TB is essentially man made that emergence as result of poor TB control including poor supply of management and quality of anti-TB drugs, improper/inadequate treatment which is further fuelled by high prevalence of HIV [7].

MDR-TB is an emerging challenge for TB control programs globally. Emerging and spread of drug resistance TB has encountered as a great challenge in Africa region, Sub-Saharan Africa in particular. Information on the extent of MDR-TB from Africa region is very limited, probably due to poor laboratory facilities, poor surveillance mechanisms and reporting procedures, outdated databases and sub-optimal coverage of infrequent surveys. Sub-Saharan Africa stands the burden of both very high TB incidence and the highest HIV prevalence rates in the world, and represents 14% of the global burden of new MDR-TB cases [8].Knowledge of the magnitude of MDR-TB is so crucial to allocate resources, and to address prevention and control measures [9]. Therefore, the aim of this study was to assess the prevalence of MDR-TB and associated risk factors at DMRH, Northwest Ethiopia.

II. Materials and Methods

a) Study Area and Setting

A facility based cross sectional study was conducted among403 TB patients who treated and

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registered from September 1, 2015 to March 10, 2017 at Debre Markos Referral Hospital TB clinic. The hospital is a tertiary level hospital that provides health service for inhabitants in East Gojjam Zone and surrounding areas. It provides health service to more than 3.5 million populations in its catchments [10]. In the hospital, DOTS clinic was opened in 2012 under the National Tuberculosis and Leprosy Program of Ethiopia and it gives MDR-TB treatment services.

b) Sample Size and Sampling Technique

Allsmear positive TB patients registered and treated from September 1, 2015 to March 10, 2017 have been taken as a sample size. The study included 403 smear positive TB patients with full socio-demographic characteristics registered in the TB unit of Debre Markos Referral Hospital. The sample was taken orderly all patients' recorded and started TB treatment from September 1, 12015- March 10, 2017. Each individual TB patient's record had been selected from all tuberculosis patients' records using TB treatment card, TB register form, quarterly report on MDR-TB and case finding format at DMRH.

III. Data Collection and Analysis

Data was extracted by reviewing all the necessary registration formats from medical records and treatment charts in TB results at DMRH. The socio-demographic factors together with the clinical profile of the patient were extracted from medical records and treatment charts from the hospital TB database. The collected data were checked manually for the completeness and consistency and the data was cleaned, coded and analyzed using SPSS version 20. Logistic regression wasused to determine the association between independent variables and the outcome variable. Odds ratio and 95% confidence intervals were calculated and the result was considered statistically significant at $p < 0.05$.

a) Ethical Consideration

The study was conducted after it is ethically reviewed by Department of Research and Ethical Review Committee of Debre Markos University. Then supporting letter was written to Debre Markos Referral Hospital. All information during data collection had been confidential; there were no any personal identification which was left on the check list.

b) Operational Definitions

- *MDR-TB:* Is defined as an MDR-TB suspect who is sputum culture positive and whose TB is due to Mycobacterium TB that are resistant in-vitro to at least isoniazid and rifampicin
- *New Cases of TB:* Is defined as a newly registered episode of TB or TB treatment for < 1 month
- *Re-treated cases of TB:* A previously treated case is defined as a newly registered episode of TB in a patient with treatment history for TB for 1or more month
- *Primary Resistance:* Patients with TB resistant to one or more anti-TB drugs, but who have never been previously treated for TB
- *Acquired Resistance:* Patients diagnosed with TB who start anti-TB treatment and subsequently acquire resistance to one or more of the drugs used during the treatment
- *Extensive Drug-resistance (XDR):* Resistance to any fluoroquinolone and at least one of the three inject able second line drugs (capreomycin, kanamycin, amikacin)
- *Mono Resistance:* Resistance to only one first line anti TB drug.

IV. Results

a) The Socio-demographic characteristics of smear positive TB patients

A total of 403 smear positive TB patients were enrolled. Of these, 248(61.2%) were males and 155(38.8%) females (Table 1). The prevalence of drug resistance (both RR and MDR)-TB patients in this study was 48(11.9%) of which 29(60.4%) were males and 19(39.6%) females. Of all drug resistant TB cases only 6(12.5%) were MDR-TB and the remaining 42(87.5%) were mono-resistance (all rifampicin resistance). From all MDR-TB patients, 4(66.7%) were males and 2(33.3%) were females. Among403 smear positive TB patients, 6(1.5%) were MDR-TB cases. Of all drug resistance TB cases, 43(89%) of them were rural dwellers and 5(11%) were urban dwellers. On the other hand all patients who were MDR-TB cases were rural dwellers (Table 3).

The highest number of drug resistance TB patients in this study were seen in 2016, 23(47.9%) followed by 22(45.8%) in 2015 and the least observed in 2017, 3(6.3%)(Table 3). Of all drug resistance TB patients across the study period, the age group 16-30 were the most affected which accounts 28(53.2%) followed by age group 31-45, 7(14.6%).The lowest number was observed in the age group 46-60, 3(6.3%). In contrast to this, the majority of MDR-TB patients, 4(66.7%) were in the age group of 0-15 and 16-30 each account 2 and the least were seen in the age group 31-45 and>60 which account 1(16.6%) in each group of the total 6 MDR-TB patients. The majority of smear positive TB patients, 355(88.08%) of them were susceptible for rifampicin AFB smear positive TB patients (pulmonary and extra-pulmonary) (Table 4).

b) Prevalence of smear positive TB among patients with age groups in different years

From a total of 25(6.2%) smear positive TB patients found in 0-15 age group, 13(52%) of them were males and the remained, 12(48%) were females. There was an increase amongst males in 2016, 6(46.2%) from the total 25 and amongst females in 2015, 6(46.2%). The

prevalence of smear positive TB patient with the age group of 0-15 was the same in 2015 and 2016, 8 in each year, but there was slightly increasing in 2017, 9 of the total 25 (Table 2).

The highest prevalence of smear positive TB patients in both male and female were observed in the age group 16-30 in 2015 and 2016.Fromthe total number of 236(58.6%) smear positive TB patients in this age group, 142 (60.1%) males and 94(49.9%)females. Of these 72(30.5%) males and 48(20.3%) females were observed in 2015 followed by 52(22.0%) males and 33(24.3%) females in 2016. The least prevalence of smear positive TB patients were seen in 2017, 19(8.05%) males and 13(5.5%) females. In addition to this, the prevalence of male patients was relatively higher than that of females across the year 2015-2017 in this age group as indicated in Table 2.

In the age group 31-45, the percentage of smear positive TB patients increased from 2015-2016 and the highest was observed in 2016, 41(51.3%). The prevalence decreased from 41(51.3 %) in 2016 to 6(7.5%)in 2017. In addition to this, the percentages of males were relatively higher than that of females across the year from 2015 to 2017. The number of smear positive TB patients registered in this age group across the study period was 80(19.9%). Fifty one (63.8%) males and 29(36.2%) females were seen. The second highest prevalence 236(58.6%) was observed in age group 16-30 (Table 2).

The highest percentage of smear positive TB patients in the age group 46-60 was 23(50%) registered in 2015 followed by 17(36.9%) in 2016 and the lowest 6(13%) registered in 2017. The percentage of patients was decreasing from 2015, 23(50%) to 2016, 17(36.9%). The percentage of male patients was higher than that of female patients across the year from 2015-2016, but they are equal in 2017. The total percentage of smear positive TB patients among the age group >60 was 18(4.5%) registered from 2015-2017. Of these, 13(72.2%) were males and 5(27.8%) were females. The highest percentage was registered in 2015, 9(55.5%) and the lowest was 3(16.7%) observed in 2017. The percentage of male patients were relatively higher than that of females across the years from 2015-2017 (Table 2).

c) Drug Resistance Pattern of TB and its Associated Factors

Of all drug resistance TB patients, 39(81.3%) of them were pulmonary in site and from these 24(50%) of them were male and 15(31.3%) of them were females. The rest 9(19.7%) were extra pulmonary in site, of these 5(10.4%) were males and 4(8.3%) females. Of all MDR-TB patients, 4(66.7%) were belongs to pulmonary in origin and the remaining 2(33.3%) were extra-pulmonary TB (Figure 1). No statistically significant association was seen between site of TB infection and MDR-TB [COR=0.8(95%CI 0.74-4.24, p=0.864].Forty threewere rural dwellers and 5 were urban dwellers among 48 drug resistant TB cases. Therefore, significant association was observed between MDR-TB and residence [AOR=8.2 (95%CI 2.72-14.8), p=0.04] (Table 3).

Of all smear positive TB patients 292(71.2%), 163(56.7%) males and 129(43.3%) females have no previous history of TB treatment. The rest 111(29.8%), 76(65.5%) males and 35(34.5%) females were previously treated for TB. Among drug resistance TB patients the majority of them, 31(64.6%) were previously treated for TB, of these 18(58%) were males and 13(42%) females. Of 48 of drug resistance TB patients 17(45.4%) were new patients. Eleven (64.7%) were males and 6(33.4%) females. The highest number of previously treated drug resistance TB patients were seen in 2015, 17(35.4%) of these 9(52.9%) were males and 8(47.1%) females. All MDR-TB patients were previously treated for TB. Of these the majority, 4(66.7%) of them were under category 4 (failure of new regimen) and the remaining 1(16.6%) was under category 5(after failure of retreatment) and the rest 1(16.6%) was under category 2(relapse). There was statically significant association between history of previous TB treatment and the chance of developing MDR-TB [AOR= 34.26(95%CI: 4.89-24.11), p=002] (Table 3).

d) Prevalence of Drug Resistance TB in HIV positive patients

The prevalence of TB/HIV co-infection was 29(7.2%). Of these, 17(4.16%) were males and 12(2.9%) females. The majority of patients, 374(92.8%) were HIV negative. Age group 16-30 years, 19(4.67%) took the major share followed by 31-45 years, 9(2.19%) and the least affected age group was 46-60 and >60 each account 0% in retroviral infection among smear positive TB patients. Males were the most affected group in TB/HIV co-infection (Table 2).

The prevalence of drug resistance TB and HIV co-infection in this study was 12(24.9%). Among these 9(18.6%) were males and 3(6.3%) females. Across the study period males were predominate over females in drug resistance TB and HIV co-infection except in 2015, in this case both sexes were equal in number. On the contrary, none of MDR-TB patients were HIV positive. The highest number of drug resistance TB and HIV co-infection were seen in 2016, 8(12.5%) and the least (0%) were seen in 2017. There was no statistical significant association between drug resistant TB and HIV status [COR=22.5(95%CI=0.35-98.5, p=0.998)] (Table 3).

e) Trends of MDR- TB across the study period

From the total of 48 drug resistance TB patients, 42(87%) of them were RR (rifampicin resistance), of these 25(59.5%) were males and 17(40.5 %) females. Of all drug resistant, 6(12.5%) of them were MDR-TB patients, 4(66.7%) males and 2(33.3%) females. When observing the trends of MDR-TB across the study period

among smear positive TB patients, the number of MDR-TB patients were 3(0.74%), 2(0.49) and 1(0.24%) in 2015, 2016 and 2017 respectively. So the trends of MDR-TB was decreasing from 3(0.74%) in 2015 to 1(0.24%) in 2017 (Table 3).

V. Discussion

The prevalence of MDR-TB from both new and previously TB treated cases in this study was found to be 1.5%.The finding in this study was lower than previous study in the same study area [11]. Multidrug resistance TB is estimated to be 3.7% of newly diagnosed patients with TB and 20% of previously treated patients around the world as shown by WHO 2012 report[8]. On the other hand, in the fourth WHO global report on anti-TB drug resistance in the world, data are reported from eight countries of the Region, and MDR-TB rate in this Region were 2% among new cases, 35.3% among previously treated cases and 5.4% from all or combined cases [6].In a previously study conducted from January 2011 to December 2013 stated that from a total of 2149 TB patients received in-patient treatment at St. Peter TB specialized referral hospital, 780(38%) patients were MDR-TB (culture positive) which is much higher than the result of this study [12].

A study finding in Northeastern China showed the prevalence of MDR-TB of 8.7% [13]. Similar study findings in New Delhi, India, shows from sputum positive pulmonary TB clients enrolled, the prevalence of MDR-TB among newly diagnosed pulmonary TB patients was 1.1% [14]. Another study in India on the pulmonary TB drug resistant shows 8% MDR-TB [15]. In contrast, all the above mentioned results were higher than the result found in this study and all MDR-TB patients were previously treated for tuberculosis, but there were MDR-TB cases in treatment naïve patients.

A research conducted in Dessie town, among 434 TB cases of TB treatment, 9(2.1%) were found to be MDR-TB cases which is a bit higher than this study finding [16]. On the other hand, a study which was conducted in Addis Ababa, at St .TB Specialized hospital from January 2011 to December 2013, a total of 2149 TB patients were received in-patient TB treatment in this hospital, of which 780(38%) patients were MDR-TB [12]. This higher prevalence of MDR-TB might be due to most of the patients were referral cases. Other studies conducted in the same study area at Debre Markos referral hospital showed, the prevalence of MDR-TB was 2.3% and 3% which is higher than the current study [11, 17]. But most MDR-TB cases were observed in males, 16-30 age groups and rural dwellers in agreement to the current study.

The result is slightly higher than the result of this study. But gender distributions of MDR-TB patients were almost similar to the previous studies. Regarding the trends of MDR-TB in the study area, previous study shows an increasing trend of MDR-TB patients across the study period which was in contrast to this study. The trend of MDR-TB was 0%, 0.3%, 0.6%, 0.5% and 0.9% for 2011, 2012, 2013, 2014, and 2015 respectively. The trend of MDR was increasing in the study area from 0.0% in 2011 to 0.9% in 2015[18-22]. The decrease in the prevalence of MDR TB in the current study area may be due to better information of the community about the cause, transmission, prevention and treatment of tuberculosis. And commitment of the health professionals to strictly follow TB patients during the intensive and continuation phase of TB treatment. The new cases MDR-TB prevalence of this study was found to be null (0%) from all smear positive TB cases, which was extremely lower compared to other studies mentioned above. The possible reason for this low figure finding could it be low MDR-TB detection status of the hospital. On the other hand, the higher prevalence of MDR-TB in previously TB treated patients may be due to a poor adherence of patients to anti TB drugs by different reason.

There was no statistically significant association between age groups and MDR-TB occurrence from this study, which is similar in a study finding in Dessie administration[16]. In contrast to this, age was considered a risk factor for MDR TB as it was explained in a previous study, Ethiopia[23].Age group at 25-44 years in Bangladesh was a risks factor of MDR-TB. Sex was not significantly associated with MDR-TB according to this study finding. Similarly, there was no statistically significant association between sex and MDR-TB occurrence in a study conducted Dessie city administration in Ethiopia[16]. In contrast to this a nationwide survey conducted in China showed that, female gender were a risk factors for MDR-TB [13]. But a study in Nigeria showed gender was not significantly associated with MDR-TB [24]. Another study finding in Thailand also showed male gender as risk factors for MDR-TB [25]. In Ethiopia, male gender was a risk factor for MDR-TB in previous study [26] which is in contrast to current study.

Regarding treatment status of MDR-TB patients, all 6(100%) of them were previously treated for TB. And there was statically significant association between history of previous TB treatment and the chance of developing MDR-TB. In this study previously treated for TB patients have 34.26 times more risk to develop MDR-TB than treatment naïve patients. This result is similar to the report in a previously conducted study in Dessie City administration, Ethiopia stated that prevalence rate of MDR-TB from new TB cases, retreated cases and combined of all were found to be 0.3/100, 21.6/100 and 2.1/100respectively from all forms of TB cases. The prevalence rate of acquired MDR-TB was similar to the combined prevalence rate above since all MDR-TB

cases were acquired whereas, primary MDR-TB rate was null [16].

The prevalence of MDR-TB in previous study was 2.3% of which 0.2% new cases and 2.1%previously treated cases. Drug resistance was strongly associated with previous treatment [27, 28]. This is comparable with the result of this study. In this study, there was no statically significant association between occurrences of MDR-TB and HIV status of patients. This result is similar to the fining in Kenya, Malawi, Tanzania, Cote d'Ivoire and France [29-32].The Global Project of MDR-TB, which has been gathering data since 1994 from 7 countries, none of which have a high prevalence of HIV infection and there was no association between HIV infection and MDR-TB in 5 of these countries, where as a significant association was observed between MDR-TB and HIV infection in 2 countries Latvia and Ukraine [33,34].HIV was a risk factor for TB/MDR-TB accordingly to, WHO report at California; US during 2011which shows HIV contribute 4.5% MDR-TB cases [8].

With respect to the contribution of site of TB to multidrug resistant in the current showed that from all MDR-TB cases 4(4/6) of them were from pulmonary TB type and the rest 2 (2/6) were extra-pulmonary. A comparable result was noted in another study in Ethiopia which showed pulmonary TB type was a risk factor for MDR-TB [26].In contrast to the result of this study,a study in southern Ethiopia showed that HIV have statistically significant association for both acquired MDR-TB and primary MDR-TB [27].

VI. Conclusion

Prevalence of MDR-TB for both new and retreated TB cases from all smears positive TB patients at DMRH were found to be 1.5%. Previous history of TB treatment was found to be significantly associated with MDR-TB. In this study, age, sex and HIV status were not associated with MDR-TB. Counseling related to anti-TB drugs adherence during intensive and continuation phase of TB treatment is mandatory to decrease MDR-TB.Further prospective study is necessary to have more information about MDR-TB in the country in general and in study area in particular.

a) Limitation of the Study

The data was collected by using secondary data source from already recorded documents, so there were some difficulties in getting all the necessary information regarding the study across the study period. Even thought, the hospital started to give MDR TB diagnosis and treatment in February, 2014, the study included data only for 3 years (2015-2017) due to time constraint.

b) Abbreviations

DMRH: Debre Markos Referral Hospital, DMU: Debre Markos University, DOTs: Directly Observed Therapy's, DST: Drug Susceptibility Test, EMB: Ethambutol, EFMOH: Ethiopian Federal Ministry of Health, HIV: Human Immunodeficiency Virus, INH: Isoniazid, MDR-TB: Multi Drug Resistant Tuberculosis, OR: Oddis Ratio, PAS: Para Amino Salicylic Acid, RMP: Rifampicin, STM: Streptomycin, TB: Tuberculosis

c) Ethical approval and consent to participate

The study was approved by research and ethical review committee of Debre Markos University. All information during data collection was confidential; there was not any personal identification which was left on the check list.

d) Consent for Publication

Not Applicable.

e) Availability of data and materials

All data generated and analyzed during this study were included in the manuscript.

f) Competing Interests

Authors declare that they have no competing interests.

g) Funding

No funding source.

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Table 1: The socio-demographic characteristics of smear positive TB patients by age group, sex and retrovirus infection status at DMRH, Northwest Ethiopia, March 2017, (N=403)

Age group	Sex			HIV Status					
	M	F	Total	Positive			Negative		
				M	F	Total	M	F	Total
0-15	13	11	24	1	0	1	12	11	23
16-30	142	92	234	12	7	19	130	85	215
31-45	51	29	80	4	5	9	47	24	71
46-60	29	17	46	0	0	0	29	17	46
>60	13	6	19	0	0	0	13	6	19
Total	248	155	403	17	12	29	231	143	374

Table 2: The prevalence of smear positive TB patients among age groups and HIV status in different years at DMRH, Northwest Ethiopia

Year	Age group	Sex					HIV Status							
		M	%	F	%	Total	Positive					Negative		
							M	%	F	%	Total	M	F	Total
2015	0-15	2	25	6	75	8	1	100	0	0	1	1	6	7
	16-30	71	59.7	48	40.3	119	6	60	4	40	10	65	44	109
	31-45	19	57.6	14	42.4	33	5	71.4	2	29.6	7	14	12	26
	46-60	14	60.9	9	39.1	23	1	100	0	0	1	13	9	22
	>60	8	80	2	20	10	0	0	0	0	0	8	2	10
	Total	114	59.1	79	40.9	193	13	68.4	6	31.6	19	101	73	174
2016	0-15	6	75	2	25	8	0	0	0	0	0	6	2	8
	16-30	52	61.2	33	38.86	85	2	66.7	1	33.3	3	50	32	82
	31-45	28	62.3	13	37.7	41	2	40	3	60	5	26	10	36
	46-60	12	70.6	5	29.4	17	0	0	0	0	0	12	5	17
	>60	3	60	2	40	5	0	0	0	0	0	3	2	5
	Total	101	64.7	55	34.3	156	4	50	4	50	8	97	51	148
2017	0-15	5	55.6	4	44.4s	9	0	0	0	0	0	5	4	9
	16-30	19	59.4	13	40.6	32	2	100	0	0	2	15	11	26
	31-45	4	66.7	2	33.3	6	0	0	0	0	0	2	1	3
	46-60	3	50	3	50	6	0	0	0	0	0	3	3	6
	>60	2	75	1	25	3	0	0	0	0	0	2	1	3
	Total	33	58.9	23	41.1	56	2	100	0	0	2	27	20	47

Table 3: Resistance pattern and treatment categories of MDR-TB patients at DMRH Northwest Ethiopia from September 2015-March 10, 2017

Year	Treatment Status								Resistance Type									
	New				Previously Treated				RR					MDR				
									M		F		Total	M		F		Total
	M	%	F	%	M	%	F	%	N	%	N	%	N	N	%	N	%	N
2015	4	80	1	20	9	52.9	8	47.1	11	57.9	8	42.1	19	2	66.7	1	33.3	3
2016	6	60	4	40	8	61.5	5	39.5	13	61.9	8	38	21	1	50	1	50	2
2017	1	50	1	50	1	100	0	0	1	2.1	1	2.1	2	1	100	0	0	1
Total	11	64.7	6	35.3	18	58	13	42	25	59.5	17	40.5	42	4	66.7	2	33.3	6

RR- Rifampicin resistance, MDR- Multidrug resistance

Table 4: Analysis of socio-demographic and clinical factors for MDR-TBpatients atDMRH, Northwest, Ethiopia, March 2017

Variables		Resistant Pattern		COR (95% CI)	P-value	AOR (95% CI)	P-value
		R	S				
Sex	M	29	219	1.6(0.06-9.11)	0.574	-	
	F	19	136	1			
Age	0-15	6	28	1			
	16-30	28	206	0.73(0.02-0.86)	0.340	-	
	31-45	7	73	0.33(0.21-5.3)	0.997	-	
	46-60	3	43	0.86(0.81-7.2)	0.997	-	
	>60	4	15	0.41(0.24-10.29)	0.768	-	
Previous history of TB treatment	Yes	31	80	31.0(9.78-74.44)	0.001	34.26(4.89-24.11)	0.002
	No	17	275	1		1	
HIV status	Positive	12	17	22.5(0.35-98.5)	0.998	-	
	Negative	36	338	1			
Residence	Rural	43	200	5.4(1.64-10.63)	0.025	8.2(2.72-14.8)	0.04
	Urban	5	108	1		1	
Site of TB	PTB	39	238	0.8(0.74-4.24)	0.864	-	
	EPTB	9	70	1			

R=Resistant, S= Sensitive, PTB=Pulmonary Tuberculosis, EPTB=Extra-pulmonary Tuberculosis

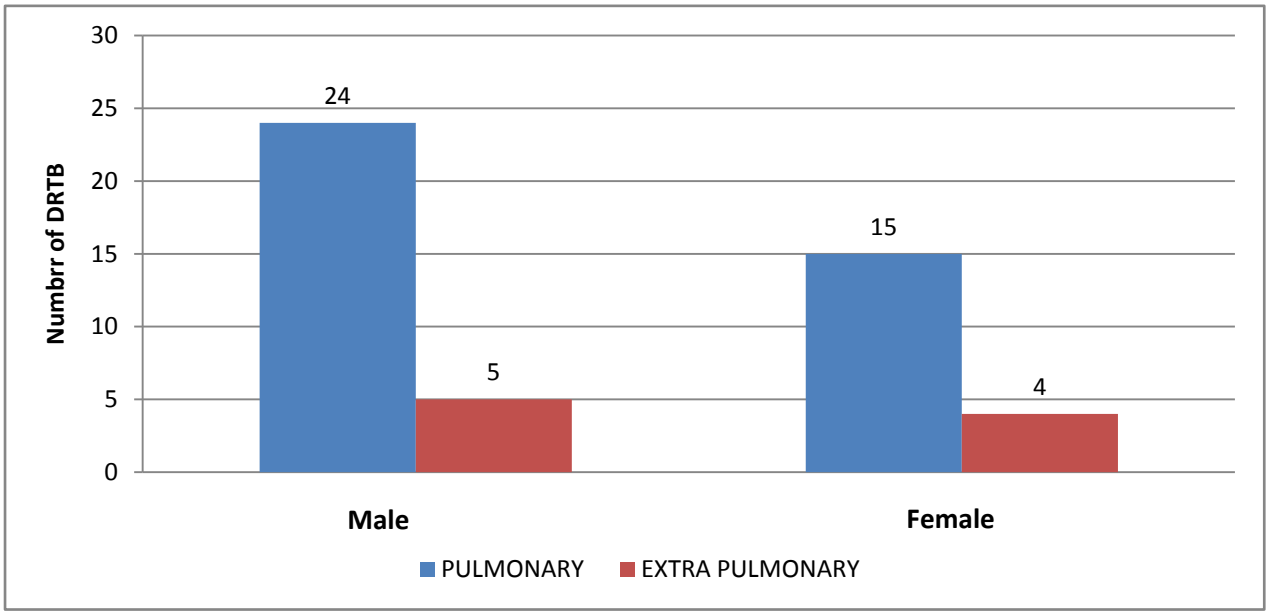

Figure 1: Site of drug resistance TB among patientsat Debre Markos Referral Hospital, Northwest Ethiopia, March 2017