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**Tuberculosis treatment outcome: The case of women in Ethiopia and China, Ten-Years Retrospective Cohort study**

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23 Abstract

24 Every year tuberculosis kills above half million women all over the world. Nonetheless, the  
25 difference in the size of deaths among countries was not compared. Hence, this study is aimed to  
26 compare the death size of two countries. Socio demographic and clinical data of women treated  
27 for all form of tuberculosis in the past ten years 2007-2016 were collected from total of eight  
28 hospitals and six treatment centers of Tigray and Zigong respectively. Then, collected data were  
29 entered into SPSS version 21 then we estimated the magnitude of TB, level of treatment success  
30 and assessed factors associated with the unsuccessful TB outcome. In the past ten years, a total  
31 of 5603(41.5%) and 4527 (24.5%) tuberculosis cases were observed in Tigray and Zigong  
32 respectively. Of those with treatment outcome record a total of 2602(92%) in Tigray and  
33 3916(96.7%) in Zigong were successfully treated. Total of 170 (6%) cases in Tigray and  
34 36(0.8%) cases in Zigong were dead. In Tigray cases like retreatment (aOR, 0.29; 95% CI: 0.16-  
35 0.53) and multi drug resistant (aOR, 0.31; 95% CI: 0.003, 0.27) were less likely to show  
36 treatment success. But, HIV co-infected TB cases (aOR, 3.58; 95% CI: 2.47, 5.18) were more  
37 likely to show treatment success. In Zigong, women with MDR TB (Adjusted OR, 0.90; 95%CI:  
38 0.24, 0.34) were less likely to show treatment success. On the other hand women in the age  
39 category of 15-49 (adjusted OR, 1.55; 95% CI: 1.08, 2.206) showed treatment success. Big  
40 number of tuberculosis cases and death were observed in Tigray comparing with Zigong. Hence,  
41 a relevant measure should be considered to improve treatment outcome of women in Tigray.

42 **Key words:** Tuberculosis, women, MDR-TB.

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## 45 **Introduction**

46 Despite the discovery of effective and affordable chemotherapy (1) tuberculosis kills 1.5 million  
47 people every year the death toll for women was 41.3% of the total death (2). The gender  
48 difference in tuberculosis infection was not well understood. Nevertheless, TB kills more women  
49 annually than all the causes of maternal mortality combined (2). In recent times, every year, at  
50 least 3.5 million women and children develop active TB among these 1.2 million cases died and  
51 more were left severely disabled (3-5).

52 Globally implementation of Direct observed treatment [DOTs] were saved 2.2 million of women  
53 and children (6) however there are enormous difference on the number of life saved and its  
54 factors affecting among regions. Few reports and studies attempts to compare and display the  
55 regional difference but the majorities were crude. For instance, WHO categorize Ethiopia and  
56 China among high TB burden countries (7-9) but its prevalence and treatment success reports  
57 were not specific for this group it tells about general population. Thus, the prevalence for  
58 Ethiopia was 192/100,000 and 67/100,000 was for China (10, 11) and the treatment success rate  
59 was 89% for Ethiopia and 94 % for China (10). In 2010 there was a regional report from high  
60 TB burden countries and out of 22 countries only 10 country report contain specific data about  
61 women and children that time China notified a total of 869 092 TB cases out of this 17% were  
62 women and 0.8% were children (5) at the same year Ethiopia notified a total of 150, 221 TB  
63 cases yet the size for women and children were not specified (5, 12).

64 Tigray which found in Northern part of Ethiopia (13) in 2015 notified a total 9,594 TB cases of  
65 both sex to a national TB control program . Accordingly 2,043 (21%) were smear positive with  
66 the cure rate of 74% (1,235) and 344 (4.2%) TB cases were died (14). Zigong which is located in  
67 southeastern Sichuan and which is home of large number of TB cases (15, 16) in 2015 notified

68 1738 TB cases and among this 399(22%) were smear positive with the cure rate of 385 (96%)  
69 and among total 22(1.2%) cases were died.

70 There are factors which identified as causes of unsuccessful treatment outcome for general  
71 population among these Retreatment cases, HIV co-infection, TB type and age were mentioned  
72 repeatedly however, this factors may not be found equally in all regions (17).

73 Generally the information in the above did not indicate the burden of TB in women specifically  
74 this implies that the existing study results and reports were crude. Thus, globally this time we  
75 lack specific proof which shows level of treatment outcomes and its factor affecting in these  
76 vulnerable group.

77 Declaring the above reasons, re-examining and comparing age and sex-aggregate data  
78 maintained by TB programs of these countries will be worth enough to look the profile, burden,  
79 treatment success and its factors affecting with in women. Moreover, finding of this study will  
80 help in tackling the limitation, shearing experience between countries and devise strategy to  
81 improve TB prevention and treatment program.

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## 89 **Study settings and methods**

### 90 **Tigray region**

91 This study was conducted in Tigray (Ethiopia) and Zigong (China). Ethiopia is located in the  
92 Horn of Africa and is bordered by Kenya, Somalia, Sudan, Eritrea, and Djibouti.  
93 Administratively, Ethiopia is divided into nine regional states and two city administrative  
94 councils. The current population size was estimated 100 million(7, 18).Tigray is one of the nine  
95 national regional states of Ethiopia which is bordered by Eritrea in north and Sudan in the west.  
96 The region is administratively divided into seven Zones and 52 districts.

97 In 2010 among total population 2,441,158 (50.7%) were females with the total fertility rate of  
98 5.1, agriculture is the main means of subsistence in the region in which 85% of the population  
99 lives in rural area.

100 In this region health care services are delivered through 1 specialized hospital, 15 general  
101 hospitals, 20 primary hospitals, 204 health centers ,712 health posts [village clinic] and 500  
102 private health facilities. Then, in the region a total of 8,279 health professionals founds and  
103 226[2.7%] were doctors (14). In Ethiopia Directly Observed Treatment (DOTS) was started in  
104 1992 as a pilot and currently achieves 100 percent geographical coverage and recently 92% of  
105 public hospitals and health centers offer DOTS (19).The role of health facility in TB prevention  
106 and control was not centralized that means all hospitals and majority of health centers which  
107 have the diagnostic technology are allowed to diagnosis TB and providing DOTs service(17, 19,  
108 20). Though, the role of health posts (village clinics) was limited only they provide health  
109 education, refer TB suspects for investigation and collect sputum smears, retrieve

110 absentees/defaulters and in few place they can provide DOTs for case who is very far from  
111 health institution(21).

## 112 **Zigong region**

113 China's National TB control Program started to implement the international recommended  
114 directly observed treatment, short-course (DOTS) strategy in 1991, and expanded the DOTS  
115 program to the entire country by 2005 (8). Zigong is found in south-west China Sichuan province  
116 and currently this county has a total population 3.28 million. The existing health care system was  
117 organized into a three-tier health care delivery system and tuberculosis control program is  
118 centralized. Thus, the basic unit of TB health care is the specialized County TB dispensary (CTD)  
119 with the responsibilities of TB diagnosis, treatment and patient management guided by the  
120 National TB control program(11).Whereas, the non-CTD's role in TB control program is to refer  
121 suspected TB patients to CTDs (22) all patient took anti TB drug three times per week (8) and  
122 DOTs observers get paid 60 Yuan (US\$1  $\approx$  CNY7) per TB patient for the standardized treatment  
123 regimen of  $\geq 6$  months (23) The recommended treatment regimen for new TB case and retreated  
124 TB cases were the same 2HRZS/4HR and 2HRZSE/6HRE (16)

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## 132 **Study design, sampling technique and data collection**

133 Using retrospective cross-sectional study design we reviewed all form of TB cases of women and  
134 children (age greater than 15 years old) treated in the years of January 2007 to December 2016 in  
135 both countries. In Tigray DOTs is decentralized. So, all health facilities are allowed to provide  
136 DOTs but the data is not in digital form. Where as in Zigong DOTs services are not decentralized  
137 it is provided only in specific health facility but the data is available in digital form. Hence,  
138 considering the logistic constraint in Tigray among 16 hospitals eight hospitals that provide  
139 DOTs service for ten years and above were randomly selected then trained data collectors and  
140 supervisors were assigned to collect the information. Nevertheless, in Zigong there are only six  
141 TB treatment centers and all information about TB were found in CDC thus all data was  
142 extracted from Excel sheet.

## 143 **Data analysis**

144 After checking the completeness, data was entered and analyzed using SPSS Version 21. Then,  
145 descriptive analysis such as frequency, mean and standard deviation were computed and  
146 compared. Additionally, binary logistic regression was executed to examine the association of  
147 independent variable with unsuccessful treatment outcomes. Hence, P-value less than of 0.05  
148 was used as significant value. Finally, variables significant in binary logistic regression were  
149 analyzed again using multiple logistic regressions to identify variables which augment  
150 unsuccessful treatment outcomes in women and children.

## 151 **Ethical clearance**

152 The study was passed through the ethical approval procedure of Sichuan University College of  
153 public health Chengdu, China and CHS/IRB of Mekelle University Ethiopia.

154 **Result**

155 **1. Socio demographic and clinical characteristic of women**

156 The past ten years (January 2007- December2016) in Tigray a total of 13,435 and in Zigong  
157 18,423 TB cases were identified. Among this 5603(41.7%) cases in Tigray and 4527(24.5%) in  
158 Zigong were women in the age category of 15-49. The mean age of case in Tigray was  $36 \pm 15$   
159 years and in Zigong was  $44 \pm 17$ years. Looking the age category in Tigray 4274 (76.3) and  
160 Zigong 2798(61.8) of women were in the age category of 15-49.

161 In addition among all TB cases 1175(21%) in Tigray and 2151(47.5%) in Zigong were  
162 pulmonary positive cases. Then, 21(0.4%) in Tigray and 16 (0.3%) in Zigong were MDR-TB.  
163 Also, 1048(18.7%) TB/HIV cases were identified in Tigray whereas no HIV documentations  
164 were found in Zigong. (table 1)

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174 **Table 1** General characteristic of women treated for tuberculosis in Tigray and Zigong January 2007-December  
 175 2016[N=5603 and N=4527].

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177 **Table 1**

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		Countries	
Characteristics	Category	Tigray N (%)	Zigong N (%)
179	Age category		
180			
	15-49	4274 (76.3)	2798(61.8)
	≥ 50	1329(23.7)	1729(38.2)
181	TB type		
	Smear Positive	1175(21)	2151(47.5)
	Smear Negative	2068(36.9)	2362(52.2)
	Extra Pulmonary	2360(42.1)	14(0.3)
183	Patient category		
	New	5265(94)	4260(94.1)
	Relapse	162(2.9)	266(5.9)
184			
	Defaulter/failure	12(0.2)	0
	Unrecorded	164(0.6)	2
	MDR-TB		
	MDR	21(0.4)	16(0.3)
	NMDR	5582(99.6)	4511(99.7)
	HIV Status		
	Positive	1048 (18.7)	NA
	Negative	3728(66.5)	NA
	Un known	827(14.8)	NA
	Year		
	2007-11	3339(60)	2432(53.7)
	2012-16	2264(40)	2095(46.3)
	Total	5603	4527

185           **3. Women clinical character and tuberculosis treatment in Tigray and Zigong**

186   Over the study period, total of 5603(41.7%) and 4527(24.5%) tuberculosis (TB) cases were  
187   registered in Tigray and Zigong respectively. Then, in Tigray among all cases 2728(48.7%) TB  
188   cases were transferred to their nearby health facilities, 71(1.3%) have no record of their treatment  
189   outcome and in Zigong 480 (10.6%) case their treatment outcome were not recorded. Therefore,  
190   transfer out and cases with unknown treatment outcome were not included in the analysis.  
191   So, a total of 2804(50%) cases from Tigray and 4047(89%) from Zigong were involved in the  
192   analysis. Accordingly, 2602(92%) in Tigray and 3916(96.7%) case in Zigong were successfully  
193   treated. The cure rate of pulmonary positive cases out of 528 cases 477[90%] in Tigray where as  
194   in Zigong among 1891cases 1801 [95%] were cured. (Table: 2)

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**Table 2** women clinical factors and level of unsuccessful treatment outcome in Tigray and Zigong from January 2007-December 2016[N=2804 and N=4047].

Characteristic	Country					
	Total	Tigray Unsuccessful N (%)	Death	Total	Zigong Unsuccessful N (%)	Death
<b>Type TB</b>						
P-Positive	528	51(9.6)	35(6.6)	1889	60(3.2)	22(1.2)
P-Negative	1062	83(7.8)	73(6.8)	2156	70(3.2)	13(0.6)
E- pulmonary	1214	71(5.8)	62(5.1)	2	1(50)	1(50)
<b>Treatment</b>						
New	2709	178(6.5)	158(5.8)	3822	122(1.7)	32(0.83)
Re treatment	95	24(25.2)	12(12.6)	225	9(4.0)	4(1.7)
<b>Age</b>						
15-49	2155	156(7.2)	134(6.1)	2494	69(2.8)	11(0.4)
≥50	649	46(6.9)	36(5.4)	1553	62(4.1)	25(1.6)
<b>Drug resistance</b>						
MDR	7	6(75)	3(42.8)	13	3(31.2)	0
NMDR	2797	196(7.0)	167(5.9)	4034	128(3.2)	36(0.9]
<b>HIV status</b>						
Positive	596	60(10)	56(9.3)	0	NA	NA
Negative	1838	88(4.7)	70(3.8)	4047	NA	NA
Not tested	370	54(14.5)	49(13.2)	0	NA	NA
<b>Total</b>	<b>2804</b>	<b>202</b>	<b>170</b>	<b>4049</b>	<b>137</b>	<b>36</b>

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#### 211 **4. The trend of treatment success in women**

212 The past ten years trend of treatment success was assessed the percentage of treatment success in  
213 Tigray was between 86%-98% and for Zigong was between 94%-98%. In Tigray the lowest  
214 treatment success was seen in the year 2007 which is 81% and in Zigong the lowest treatment  
215 success was seen in 2013 and its percentage was 94%. The overall treatment success in Tigray  
216 was 92% were as in Zigong it was 96.6%.

217 The graph for treatment success indicates in Tigray the past ten years there was constant  
218 increment then sharp decrease in the year 2016. But in Zigong it was a constant increment. (Fig:  
219 1)

220 Figure 1 Trend of women treatment success in Tigray and Zigong January 2007-December 2016  
221 N= 2084 and N=4047  
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#### 223 **5. Trend of tuberculosis death in Tigray and Zigong**

224 In the past ten years a total of 170 [6%] case in Tigray and 36 [0.9%] cases in Zigong were  
225 reported died which is 6:1 ratio. Besides, in Tigray the peak death was seen in the year 2007  
226 [12%] and in Zigong were in 2011 (0.57%). looking the trend of death in Zigong it was constant  
227 with the average death of 0.8 per year where as in Tigray it was a decreasing pattern and the  
228 average death per year was 5.8 per year of 100 cases. (Fig:2)

229 **Figure 2** Trend of tuberculosis death in the past ten years (January 2007- December 2016) in  
230 women, Tigray N= 2084 and Zigong N= 4047

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236        **6. BLR: Sociodemographic and clinical Factors associated with unsuccessful treatment**  
237        **outcomes in women.**

238        In this study, we did bivariate logistic regression to identified factors that have association with  
239        unsuccessful treatment outcomes for both countries.

240        Accordingly, in Tigray those TB cases in retreatment category MDR cases , pulmonary positive  
241        and negative were more likely to show unsuccessful treatment outcome comparing with their  
242        counter parts. But variable labeled as HIV positive cases and HIV negative comparing with  
243        those unknown HIV status have less likely to have unsuccessful treatment outcome.

244        In Zigong MDR cases and age between 15-49 TB have more likely to have unsuccessful  
245        treatment outcome compared with others. (Table:3)

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250 **Table 3 MLR Factors associated with treatment outcome of women in Tigray and Zigong January 2007 December 2016 N=2084 and N= 4047**  
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Characteristic	Tigray					Zigong				
	Total	Unsuccessful N%	$\beta$	COR(95%CI)	P value	Total	Unsuccessful N%	$\beta$	COR(95%CI)	P value
<b>Type of TB</b>										
<b>P-Positive</b>	528	51(9.6)	-0.59	0.55(0.38,0.81)	0.002*	1889	60(3.2)	0.23	1.023(0.72,1.45)	0.899
<b>P-Negative</b>	1062	83(7.8)	-0.36	0.7(0.50,0.97)	0.035*	2156	70(3.2)	-3.34	0.03(0.002,0.54)	0.017*
<b>E. pulmonary</b>	1214	71(5.8)		1	1	2	1(50)		1	1
<b>Treatment</b>										
<b>Re-treatment</b>	95	24(25.2)	-1.57	0.28(0.13,0.34)	0.0001*	3822	122(1.7)	0.23	0.82(0.41,1.62)	0.561
<b>New</b>	2709	178(6.5)		1	1	225	9(4.0)		1	1
<b>Age</b>										
<b>15-49</b>	2155	156(7.2)	-0.23	0.98(0.69,1.37)	0.89	2494	69(2.8)	0.37	1.46(1.03,2.07)	0.033*
<b>≥ 50</b>	649	46(6.9)		1	1	1553	62(4.1)		1	1
<b>Drug resistance</b>										
<b>MDR</b>	7	6(75)	-4.37	0.013(0.002,0.1 1)	0.001*	13	3(31.2)	-2.214	0.109(0.03, 0.42)	0.001*
<b>NMDR</b>	2797	196(7.0)		1	1	4034	128(3.2)		1	1
<b>HIV status</b>										
<b>Negative</b>	1838	88(4.7)	1.223	3.39(2.37,4.87)	0.001*	ND	ND		ND	ND
<b>Positive</b>	596	60(10)	0.423	1.53(1.03,2.26)	0.035*	ND	ND		ND	ND
<b>Not tested</b>	370	54(14.5)		1	1	ND	ND		ND	ND
<b>Total</b>	2804	202				4047	131			

253 **7. MLR: factors associated with treatment outcome of women in Tigray and Zigong**

254 Factors significant at P-value < 0.05 in the bivariate logistic regression were taken and analyzed  
255 again in multivariate regression to identify the predictor variables. Then, in Tigray treatment  
256 success was less likely for women who were categorized as retreatment (adjusted OR, 0.29;  
257 95% CI: 0.16-0.53) compared to new cases, women with multi drug resistant (adjusted OR, 0.31;  
258 95% CI: 0.003, 0.27) compared with non-drug resistant. But, HIV co infected TB cases were  
259 3.58 times more likely to have treatment success (95% CI: 2.47, 5.18) compared with Unknown  
260 HIV status. On the other hand variables like Age and type of tuberculosis were not found as  
261 predictor factors.

262 In Zigong, women in the age category of 15-49 years have 1.55 more likely to show treatment  
263 success (95% CI: 1.08, 2.206) compared with older age. But, women with MDR TB were less  
264 likely to show treatment success (Adjusted OR, 0.90; 95%CI: 0.24, 0.34) compared with non-  
265 drug resistance cases. (Table: 4)

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270 **Table 4 Multiple Logistic regression factors affecting treatment outcome of women in Tigray and Zigong January 2007 December 2016 N=2084 and N=**  
 271 **4047**  
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Characteristic	Tigray					Zigong				
	Total	Un success N%	COR(95%CI	AOR(95% CI)	P-value	Total	Un success N%	COR(95%CI)	AOR(95% CI)	P-value
<b>Type of TB</b>										
P-Positive	528	51(9.6)	0.55(0.38,0.81)*	0.89(0.58,1.37)	0.61	1889	60(3.2)	1.023(0.72,1.45)	0.91(0.63,1.31)	0.614
P-Negative	1062	83(7.8)	0.7(0.50,0.97)*	0.78(0.56,1.09)	0.15	2156	70(3.2)	0.03(0.002,0.54)	0.025(0.002,0.41)	0.01
E. pulmonary	1214	71(5.8)	1	1		2	1(50)	1	1	
<b>T. Category</b>										
Re-treatment	95	24(25.2)	0.28(0.13,0.34)*	0.29(0.16-0.53)	0.0001	3822	122(1.7)	0.82(0.41,1.62)	1.12(0.53,2.35)	0.76
New	2709	178(6.5)	1	1		225	9(4.0)	1	1	
<b>Age</b>										
15-49	2155	156(7.2)	0.98(0.69,1.37)	1.17(0.81,1.69)	0.378	2494	69(2.8)	1.46(1.03,2.07)	1.55(1.08,2.206)	0.016
≥ 50	649	46(6.9)	1	1		1553	62(4.1)	1	1	
<b>Drug resistance</b>										
MDR	7	6(75)	0.013(0.002,0.11)	0.31(0.003,0.27)	0.002	13	3(31.2)	0.109(0.03, 0.42)	0.090 (0.024,0.34)	0.0001
NMDR	2797	196(7.0)	1	1		4034	128(3.2)	1	1	
<b>HIV status</b>										
Negative	1838	88(4.7)	3.39(2.37,4.87)*	3.58(2.47,5.18)	0.0001	ND	ND	ND	ND	
Positive	596	60(10)	1.53(1.03,2.26)*	1.59(1.07,2.38)	0.022	ND	ND	ND	ND	
Not tested	370	54(14.5)	1	1		ND	ND	ND	ND	
<b>Total</b>	2804	202				4047	131			



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## 275 **Findings and Discussion**

276 Tuberculosis is exacerbated by malnutrition and frequently affects economically  
277 active young adults (24, 25). Thus, women of reproductive age are more likely to  
278 develop active TB if they encounter TB bacteria and they are less likely to seek help  
279 for TB symptoms than men (4). In this study the mean age of TB case in Tigray was  
280 36 years with  $SD\pm 15$  and in Zigong was 44 years with  $SD\pm 17$ . Tigray finding was  
281 similar with study done in sidama and Gojjam for general population (17, 20). And  
282 comparing with Zigong, younger women get infected in Tigray than Zigong and this  
283 could be the age distributions tuberculosis in Africa has been severely skewed by the  
284 human immunodeficiency virus epidemic (26). Besides, under nutrition was a major  
285 public health problems in Tigray and it has considerable effect in provoking  
286 tuberculosis infection (27, 28). The demographic structural difference may be other  
287 cause large number of old peoples were found in Zigong than Tigray this all reasons  
288 may be factors to have more young age TB cases in Tigray than Zigong.

289 In 2014, globally TB killed 480,000 women and 140,000 children (2).  
290 Correspondingly, in this retrospective study the death of women and children in the  
291 past ten years were 170 [6 %] in Tigray and 36 [0.8%] in Zigong. The death toll in  
292 Tigray was higher than the annual report of the Regional Health Bureau for both sex  
293 3.6% (33), retrospective study done in Gojjam for both sex 3.7% and global report of  
294 TB death for women and children 4.2% (10, 14, 17). In cases of Zigong it is similar  
295 with the global report for general population (10). Comparing with Zigong, more

296 death occurred in Tigray. This could be the prevalence of TB/HIV co morbidity was  
297 high in sub-Saharan country(34) or poor women health care seeking behavior and  
298 diagnostic delay (35) Poor quality of treatment in High TB burden countries(36) are  
299 in favor of bad treatment outcome.

300 Treatment success is sum of patients cured and those who have completed treatment.  
301 Hence, patient compliance is a key factor in treatment success (10). In this study, the  
302 overall treatment success rate of all TB cases was 92% in Tigray and 96.6% in  
303 Zigong. The finding of Tigray was similar with studies done in west Gojjam, Sidama  
304 and Addis Ababa 91.5% (17, 20, 37) the success rate for both sex. But, higher than  
305 the WHO report 89% for both sex (10) and the success of Zigong is higher than (10,  
306 38, 39). Thus, the better treatment success in both countries could be since these  
307 studies assess only women and this group have good treatment adherence as a result  
308 the percentage of treatment success was better comparing with general population.

309 A patient is considered “cured” when sputum smear examination is bacteriologically  
310 negative in the last month of treatment and on at least one previous occasion(17).The  
311 cure rate for pulmonary positive cases was 90% in Tigray and 95% in Zigong. So, the  
312 finding of Tigray was slightly higher than 2015/16 annual report of the region and  
313 study done in west Gojjam (14, 17, 33) for general population. But, in case of Zigong  
314 it is similar with the WHO global report for Chinese population (10). Therefore, the  
315 reason of higher cure rate in Zigong could be the less number of HIV co infected

316 women and/or the early initiation of drug resistance test program in the region were  
317 made Zigong to have higher cure rate than Tigray.

318 Retreatment case is patient who has been treated for one month or more with anti-TB  
319 drugs in the past(2) and many studies indicate that re treatment case have high chance  
320 of poor treatment outcome or failure rate. Similarly, in our study re-treatment cases  
321 were 79% less likely (adjusted OR, 0.29; 95% CI: 0.16-0.53) to have treatment  
322 success compared to new cases and this finding was parallel with the study done in  
323 Gojjam, Sidama ,Tigray and Uganda (13, 17, 20, 40). Yet, in Zigong it was not  
324 significant this may be the number of re treatment cases were few Zigong compared  
325 with Tigray. Besides, drug sensitivity test is done in Zigong before providing anti-TB  
326 drug to a patient and better follow up.

327 Globally, an estimated 3.3% of new TB cases and 20% of previously treated cases  
328 have MDR-TB (2). In Ethiopia 2.7% of the new and 14% of the previously treated TB  
329 cases expected to have had rifampicin or multi drug resistant TB (10). Report about  
330 MDR-TB started in 2011 in both countries. Then in Tigray total of 28(0.4%) MDR-  
331 TB cases were reported and majorities were identified in 2016 which is 16(3.7%)  
332 cases. Where as in Zigong 16 (0.3%) MDR-TB cases were identified. According to  
333 global TB report only 50% of MDR-TB patients were successfully treated(10). But in  
334 this study 6 women out of 7 MDR TB cases in Tigray and 3 women out of 13 MDR  
335 TB cases in Zigong were not successfully treated. this is consistent with study done  
336 in India China and Ethiopia (41, 42). In both study area patients with drug resistant  
337 tuberculosis were less likely to have treatment success. In Tigray 69% less-likely

338 (Adjusted OR, 0.31; 95% CI: 0.003, 0.27 and in Zigong 9% less likely (adjusted OR,  
339 0.09; 95% CI: 0.024, 0.34 successful treatment outcome compared with non-drug  
340 resistant. It is obvious that the nature of the bacteria, the long-term treatment and its  
341 adverse effect made the outcome poor and many studies support this finding (25, 43).

## 342 **Conclusions**

343 Evidence presented in this study shows tuberculosis is one of the major public health  
344 concerns for women in both countries. However, poor level of treatment success and  
345 mortality were seen in Tigray compared with Zigong. Besides, factors boost  
346 unsuccessful treatment outcome were many in case of Tigray than in Zigong. Hence,  
347 national policy makers of Ethiopia and region Tigray should give due attention to this  
348 specific group.

## 349 **Abbreviation**

350 TB: Tuberculosis; HIV: Human immune deficiency Virus; MDR/TB: Multi drug  
351 resistance tuberculosis; CDC: The Centers for Disease Control and Prevention; WHO:  
352 The World Health Organization

## 353 **Competing interests**

354 All authors declare they have no competing interests. The findings and conclusions of  
355 this paper are those of the authors and do not necessarily represent the views of the  
356 funder of this work.

357

358 **Authors' contributions**

359 The authors' contribution was as described below. XM and MG conceived and  
360 designed the study. MG and BA performed the study. MG, XM, and BA analyzed the  
361 data. MG XM and MF wrote the manuscript. All authors read and approved the final  
362 manuscript.

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Figure: 1

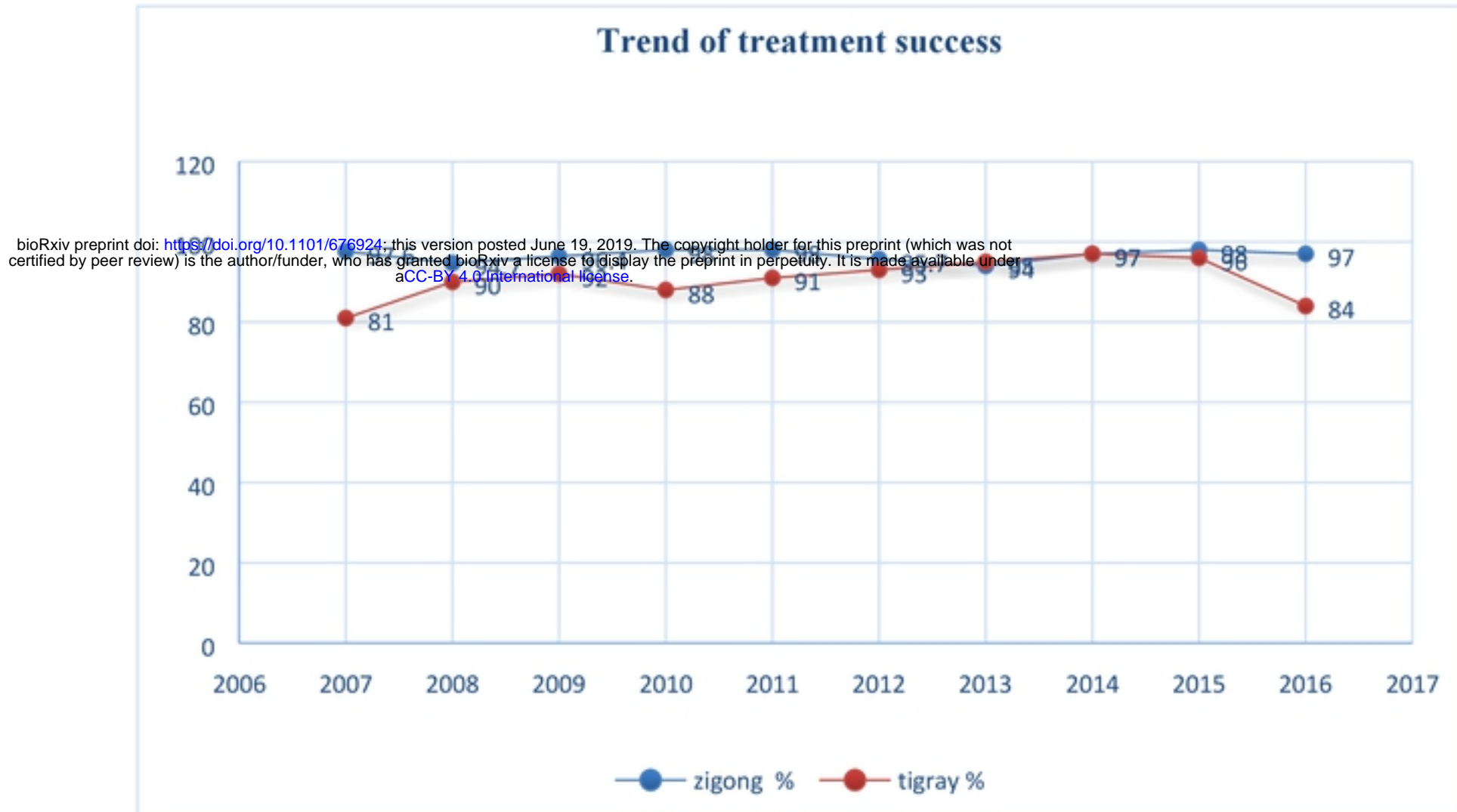


Figure: 2

