

STUDENTS' CORNER ORIGINAL ARTICLE

DISTRIBUTION OF DRUG SENSITIVE TUBERCULOSIS BY SEX, AGE GROUPS AND TYPE OF DISEASE IN DS-TB POPULATION OF DISTRICT D.I.KHAN, PAKISTAN

 Abshar Khan,  Altaf Hussain,  Mubashir Wahab,  Abdur Rehman,  Shah Abdul Latif,  Syed Wasif Ali Naqvi,  Mamoon Farooq,  Muhammad Zubair

Students, Department of Community Medicine, Gomal Medical College, D.I.Khan, Pakistan

ABSTRACT

Background: Tuberculosis (TB) is the 10th leading cause of death globally and is leading cause of death from a single infectious disease. The objectives of our study were to determine the distribution of drug sensitive tuberculosis (DS-TB) by sex, age groups and type of disease in DS-TB population of District D.I.Khan, Pakistan.

Materials & Methods: This cross-sectional study was conducted in Department of Community Medicine, Gomal Medical College, D.I.Khan, Pakistan from January 5, 2021 to January 25, 2021. The data of 3,916 patients was retrieved from District Health Office, D.I.Khan for the period from January 1, 2019 to December 31, 2020. Sex, age groups and type of disease were categorical variables and analyzed by count and percentage with CI at 95%CL. Distribution of DR-TB by sex, age groups and type of disease was analyzed separately by chi-square goodness-of-fit test at alpha .05.

Results: Out of 3,916 patients with DS-TB, women 2,110 (53.88%, 95% CI 52.32-55.44) were more than men 1,806 (46.12%, 95%CI 44.55-47.67), with most common age group of 15-44 years 1,948 (49.74%, 95%CI 48.17-51.31), and with more pulmonary 2,877 (73.47%, 95%CI 72.08-74.85%) than extrapulmonary 1,039 (26.53%, 95%CI 25.14-27.91) cases. Our observed prevalence of DS-TB in men was lower 46.12% than expected 51.72% and in women it was higher 53.88% than expected 48.28% ($p < .00001$). Our observed distribution of DS-TB in different age groups was not similar to expected ($p < .00001$). Our observed prevalence of pulmonary TB was lower 73.47% than expected 80.35% and in extrapulmonary TB it was higher 26.53% than expected 19.65% ($p < .00001$).

Conclusions: Drug sensitive tuberculosis was more common in women than men in DS-TB population of District D.I.Khan, Pakistan. It was highest in age group 15-44 years and higher for pulmonary TB than extrapulmonary TB. Our observed prevalence in men was lower than expected and in women it was higher than expected. Our observed prevalence for drug sensitive TB in various age groups was different than expected. Our observed prevalence for pulmonary TB was lower than expected and for extrapulmonary TB it was higher than expected.

KEY WORDS: Tuberculosis; Pulmonary Tuberculosis; Extrapulmonary Tuberculosis; Sex; Men; Women; Age Groups; Adult; Prevalence; Incidence.

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1. INTRODUCTION

1.1 Background: Tuberculosis (TB) is the 10th commonest cause of death globally and is the top cause of death from a single communicable disease.

Corresponding Author:

Altaf Hussain
Student, Gomal Medical College
D.I.Khan, Pakistan
E-mail: altafagra6@gmail.com

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Worldwide in 2018, approximately 10 million people were involved in tuberculosis. It caused 1.2 million deaths in HIV non-infected persons and 251,000 deaths in HIV infected persons.¹

In 2018, TB was most prevalent in adult males 57%, then adult females 32% and then children 11%. The prevalence of TB in HIV patients was 8.6%. Eight countries contribute to its 2/3rd magnitude globally; India 27%, Indonesia 8%, China 9%, Philippines 6%, Pakistan 6%, Nigeria 4%, Bangladesh 4% and South Africa 3%.¹

Barreto, et al.² from Brazil reported 896,314 cases for the period from 2010-2019 in a nationwide study, out

of which 613,545 (68.45%) were men and 282,769 (31.55%) women, and 15,666 (1.74%) were in age group <10 years, 16,589 (18.14%) in 10-24 years, 632,211 (70.53%) in 25-64 years and 82,112 (9.16%) in > 65 years.

Pang, et al.³ from Beijing, China reported 20,534 hospitalized TB patients for the period from January 2008-December 2017, including 12,846 (62.56%) pulmonary TB (PTB), 6,433 (31.33%) extrapulmonary TB (EPTB) cases and 1,255 (6.11%) concurrent PTB & EPTB.

Alene, et al.⁴ from Hunan, China showed 481 patients of MDR & XDR TB for the period from 2011 to 2014, including 340 (70.7%) males and 141 (29.3%) females.

Aysel, et al.⁵ from Van city, Turkey retrospectively reviewed medical records of 411 TB patients for the period from January 2010-July 2014, including 221 (53.77%) men and 190 (46.23%) women, and 208 (50.6%) PTB and 203 (49.4%) EPTB cases.

Venkatesh, et al.⁶ from Gorakhpur, India reported 157 cases for the period from November 2015 to October 2016 as 108 (68.8%) males and 49 (31.2%) females, and 80 (51%) in age group 18-29 years, 45 (28.7%) in 30-40 and 32 (20.3%) in >40 years.

According to data for year 2018 from National TB Control Program (NTP) of Pakistan, 360,019 cases of TB were reported in Pakistan, including 186,195 (51.72%) men and 173,824 (48.28%) women, and 47,804 (13.28%) in age groups in 0-14 years, 180,303 (50.08%) in 15-44 years, 92,825 (25.78%) in 45-64 years and 39,087 (10.86%) in age group >65 years, and 289,265 (80.35%) PTB and 70,754 (19.65%) EPTB.⁷

Out of high prevalent countries, Pakistan is on 5th position for DS-TB and also on 5th for DR-TB. Incidence, prevalence and mortality were estimated as 267/100,000, 341/100,000 and 27/100,000 population respectively with approximately 525,000 new tuberculosis patients each year.⁸

Akhtar, et al.⁹ reported distribution of 1,250 TB cases from Lahore, Pakistan for the period from January 2010 to June 2014 as 664 (53.12%) men and 586 (46.88%) women, and 31 (2.48%) in age group 0-14 years, 996 (79.68%) in 15-45 years and 223 (17.84%) in >46 years, and 1,231 (98.48%) PTB & 19 (1.52%) EPTB.

Wahab, et al.¹⁰ from Peshawar, Pakistan for years 2006 to 2007 reported 30 TB cases, including 17 (56.7%) males and 13 (43.3%) females, and four (13.3%) in age group <20 years, 18 (60%) in 20-40 and 8 (26.7%) in >40 years.

Ashraf, et al.¹¹ from Bannu, Pakistan reported 133 TB cases for the period from January through December 2018 as 57 (42.86%) men and 76 (57.14%) women, and zero in <5, six (4.51%) in 5-14, 39 (29.32%) in

15-30, 16 (12.03%) in 31-45, 46 (34.59%) in 46-60 and 26 (19.55%) in >60 years age groups.

Zeeshan, et al.¹² from D.I.Khan, Pakistan reported 286 drug resistance TB cases for the period from September 2013 to December 2019. Out of which 123 (43%) were men and 163 (57%) women, and eight (2.80%) in age group 0-14 years, 172 (60.14%) in age group 15-44 years, 106 (37.06%) in > 45 years, and 282 (98.60%) as PTB and four (1.40%) as EPTB.

1.2 Research problems (RPs), Knowledge Gaps (KGs) & Rationale: Unawareness of distribution of drug sensitive tuberculosis (DS-TB) by sex, age groups and type of disease in DS-TB population of District D.I.Khan, Pakistan were our three RPs. We could not retrieve the relevant data from various databases/ search engines. Unawareness of these information were our three KGs. What is the distribution of drug sensitive tuberculosis by sex, age groups and type of disease in DS-TB population of District D.I.Khan were our three RQs?

The rationale of our study was to answer these three RQs, fill these three KGs and hence solve our three RPs. We have adopted "Marwat's Logical Trajectory of Research Process" in this project.¹³⁻¹⁸

1.3 Research objectives: To determine the;

RO 1: distribution of DS-TB by sex in DS-TB population of District D.I.Khan.

RO 2: distribution of DS-TB by age groups in DS-TB population of District D.I.Khan.

RO 3: distribution of DS-TB by type of disease in DS-TB population of District D.I.Khan.

1.5 Research Hypotheses

H₀₁: The sample and population distribution of DS-TB by sex is same in DS-TB population of District D.I.Khan.

H₀₂: The sample and population distribution of DS-TB by age groups is same in DS-TB population of District D.I.Khan.

H₀₃: The sample and population distribution of DS-TB by type of disease is same in DS-TB population of District D.I.Khan.

2. MATERIALS AND METHODS

2.1 Design, Setting and Duration: We carried out this cross-sectional study in the Department of Community Medicine, Gomal Medical College, D.I.Khan, Pakistan from January 5, 2021 to January 25, 2021. This was a project of fourth year MBBS students under supervision of Dr. Muhammad Marwat.

2.2 Population & sampling: District Health Office, D.I.Khan provides diagnostic and curative services for tuberculosis to population of District D.I.Khan. The population of District D.I.Khan was 1,627,132 in 2017 census. It was presumed to be 1.9 million for 2019. TB prevalence in Pakistan was estimated

for year 2019 as 341 per 100,000 (0.341%). With margin of error 0.1824%, 95%CL and assumed prevalence of 0.341% of DS-TB, a sample size of 3,916 was calculated.¹⁹

2.3 Procedure of conduct: The data of 3,916 patients was retrieved from computer record of DS-TB Center, District Health Office, D.I.Khan for duration from 01-01-2019 to 31-12-2020.

2.4 Data collection plan: Data was retrieved for these three variables (groups); sex (men and women), age groups (0-14, 15-44, 45-64, 65+ years) and types of disease (pulmonary and extrapulmonary). Sex and type of disease were nominal data, while age groups were ordinal data.

2.5 Data Analysis Plan

2.5.1 Descriptive analysis and estimation of parameters: These three variables were analyzed by count and percentage for the sample. The sample data was inferred on to the population as confidence intervals at 95%CL, using normal approximation method.²⁰

2.5.2 Testing of Hypotheses: The three null hy-

potheses (H_{01} - H_{03}) were verified by chi-square goodness-of-fit test each. Observed counts (O), expected counts (E), $O-E$, $O-E^2$, χ^2 , $\Sigma\chi^2$, degree of freedom and p-value are given at $\alpha .05$.²¹

3. RESULTS

3.1 Descriptive analysis and estimation of parameters

3.1.1 Distribution of DS-TB by Sex (RQ 1): Out of 3,916 cases having DS-TB, 1,806 (46.12%, 95%CI 44.55-47.67) were men and 2,110 (53.88%, 95% CI 52.32-55.44) women. The prevalence was higher in women than men. (Table 3.1.1)

3.1.2 Distribution of DS-TB by age groups (RQ 2): Maximum cases of DS-TB 1,948 (49.74%, 95%CI 48.17-51.31) were in age group 15-44 years. (Table 3.1.2)

3.1.3 Distribution of DS-TB by type of disease (RQ 3): We had 2,877 (73.47%, 95%CI 72.08-74.85%) patients of pulmonary and 1,039 (26.53%, 95%CI 25.14-27.91) patients of extrapulmonary tuberculosis. PTB was more common than extrapulmonary. (Table 3.1.3)

Table 3.1.1: Distribution of drug sensitive TB by sex in DS-TB population of District D.I.Khan (n=3,916)

Variable	Attributes	Sample analysis		95% CI for proportion	
		Count	Percentage	Lower	Upper
Sex	Men	1806	46.12	44.56	47.68
	Women	2110	53.88	52.32	55.44
Total		3,916	100%	Population parameters	

Table 3.1.2: Distribution of drug sensitive TB by age groups in DS-TB population of District D.I.Khan (n=3,916)

Variable	Attributes	Sample analysis		95% CI for proportion	
		Count	Percentage	Lower	Upper
Age groups (Years)	0-14	299	7.64	6.84	8.51
	15-44	1948	49.74	48.18	51.31
	45-64	1076	27.48	26.10	28.89
	65+	593	15.14	14.05	16.30
Total		3,916	100%	Population parameters	

Table 3.1.3: Distribution of drug sensitive TB by type of disease in DS-TB population of District D.I.Khan (n=3,916)

Variable	Attributes	Sample analysis		95% CI for proportion	
		Count	Percentage	Lower	Upper
Type of disease	Pulmonary	2877	73.47	72.06	74.83
	Extrapulmonary	1039	26.53	25.17	27.94
Total		3,916	100%	Population parameters	

3.2 Hypotheses Testing

3.2.1 Distribution of DS-TB by sex (RQ 1 & H₀₁):

Our observed counts for men versus women were 1,806:2,110 (n=3,916) against expected counts of 186,195:173,824 from 360,019 cases of TB from all over Pakistan for the year 2018.⁷ With difference in denominators, the comparison was not logical. Therefore expected counts and expected percentages were adjusted for our sample size of 3,916. The expected counts of 186,195:173,824 were replaced by 2,025.28:1,890.72 (adjusted expected). Adjusted expected percentages were same as expected percentages. (Table 3.2.1.1)

Test of significance gave us p-value <.00001, rejecting H₀₁, which shows that our observed prevalence of DS-TB 46.12% in men was lower than expected (adjusted) 51.72% & for women 53.88% it was higher than expected (adjusted) 48.28% from NTP Pakistan⁷

data for year 2018. (Table 3.2.1.2)

3.2.2 Distribution of DS-TB by age groups (RQ 2 & H₀₂):

Our observed counts for age groups (in years) of 0-14:15-44:45-64:≥65 were 299:1,948:1,076:593 (n=3,916) against expected counts of 47,804:180,303:92,825:39,087 from 360,019 cases of TB from all over Pakistan for year 2018.⁷ With different denominators, comparison was not logical. Therefore expected counts and expected percentages were adjusted for our sample size of 3,916. The expected counts of 47,804:180,303:92,825:39,087 were replaced by 519.97:1,961.20:1,009.68:425.16 (adjusted expected). Adjusted expected percentages were same as expected percentages. (Table 3.2.2.1)

Test of significance gave us p-value <.00001, rejecting H₀₂, which shows that our observed prevalence of DS-TB in different age groups was not similar to

Table 3.2.1.1: Observed, expected and adjusted expected counts and percentages for distribution of drug sensitive TB by sex in DS-TB population of District D.I.Khan (n=3,916)

Sex	Observed counts	Observed %ages	Expected counts	Expected %ages	Adjusted expected counts	Adjusted expected %ages
Men	1806	1806*100/3916 =46.12%	186195	186195*100/360019 =51.72%	186195*3916/360019 =2025.28	2025.28*100/3916 =51.72%
Women	2110	2110*100/3916 =53.88%	173824	173824*100/360019 =48.28%	173824*3916/360019 =1890.72	1890.72*100/3916 =48.28%
Total	3916	100%	360019	100%	3916	100%

Table 3.2.1.2: Observed vs. expected distribution of drug sensitive TB by sex in DS-TB population of District D.I.Khan (n=3,916)

Sex	Observed count	Expected count	O-E	(O-E) ²	χ ²	Σ χ ²	d.f.	p-value
Men	1806	2025.28	-219.28	48083.72	23.74	49.17	1	<.00001
Women	2110	1890.72	219.28	48083.72	25.43			
Total	3916	3916	00					

Table 3.2.2.1: Observed, expected and adjusted expected counts and percentages for distribution of drug sensitive TB by age groups in DS-TB population of District D.I.Khan (n=3,916)

Age groups	Observed counts	Observed %ages	Expected counts	Expected %ages	Adjusted expected counts	Adjusted expected %ages
0-14	299	7.64%	47804	47804*100/360019 =13.28%	47804*3916/360019 =519.97	519.97*100/3916 =13.28%
15-44	1948	49.74%	180303	180303*100/360019 =50.08%	180303*3916/360019 =1961.20	1961.20*100/3916 =50.08%
45-64	1076	27.48%	92825	92825*100/360019 =25.78%	92825*3916/360019 =1009.68	1009.68*100/3916 =25.78%
65+	593	15.14%	39087	39087*100/360019 =10.86%	39087*3916/360019 =425.16	425.16*100/3916 =10.86%
Total	3916	100%	360019	100%	3916	100%

Table 3.2.2.2: Observed vs. expected distribution of drug sensitive TB by age groups in DS-TB population of District D.I.Khan (n=3,916)

Age groups	Observed count	Expected count	O-E	(O-E) ²	χ^2	$\Sigma \chi^2$	d.f.	p-value
0-14	299	519.97	-220.97	48827.74	93.90	164.61	3	<.00001
15-44	1948	1961.20	-13.19	173.98	0.09			
45-64	1076	1009.68	63.32	4398.34	4.36			
65 +	593	425.16	167.84	28170.27	66.26			
Total	3916	3916	00					

Table 3.2.3.1: Observed, expected and adjusted expected counts and percentages for distribution of drug sensitive TB by type of disease in DS-TB population of District D.I.Khan (n=3,916)

Type of disease	Observed counts	Observed %ages	Expected counts	Expected %ages	Adjusted expected counts	Adjusted expected %ages
Pulmonary	2877	2877*100/3916=73.47%	289265	289265*100/360019=80.35%	289265*3916/360019=3146.39	3146.39*100/3916=80.35%
Extrapulmonary	1039	1039*100/3916=26.53%	70754	70754*100/360019=19.65%	70754*3916/360019=769.61	769.61*100/3916=19.65%
Total	3,916	100%	360019	100%	3916	100%

Table 3.2.3.2: Observed vs. expected distribution of drug sensitive TB by type of disease in DS-TB population of District D.I.Khan (n=3,916)

Type of disease	Observed count	Expected count	O-E	(O-E) ²	χ^2	$\Sigma \chi^2$	d.f.	p-value
Pulmonary	2877	3146.39	-269.39	72570.97	23.06	117.361	1	<.00001
Extrapulmonary	1039	769.61	269.39	72570.97	94.30			
Total	3916	3916	00					

what we expected from NTP Pakistan⁷ data for year 2018. (Table 3.2.2.2)

3.2.3 Distribution of DS-TB by type of disease (RQ 3 & H₀₃): Our observed counts for PTB versus EPTB were 2,877:1,039 (n=3,916) against expected counts of 289,265:70,754 from 360,019 cases of TB from all over Pakistan for year 2018.⁷ With difference in denominators, comparison was not logical. Therefore expected counts and expected percentages were adjusted for our sample size of 3,916. The expected counts were replaced by 3,146.39:769.61 (adjusted expected). Adjusted expected percentages were same as expected percentages. (Table 3.2.3.1)

Test of significance gave us p-value <.00001, rejecting H₀₃, which shows that our observed prevalence 73.47% for PTB was lower than we expected (adjusted) 80.35% and our observed prevalence 26.53% for EPTB was higher than we expected (adjusted) 19.65% from NTP Pakistan⁷ data for year 2018. (Table 3.2.3.2)

4. DISCUSSION

4.1 Distribution of DS-TB by sex (RQ 1 & H₀₁): Our data (n=3,916) showed that DS-TB was more

common in women 53.88% (95% CI 52.32-55.44) than men 46.12% (95% CI 44.56-47.68).

Similar to our data, two studies showed DS-TB to be more common in women than men; Ashraf, et al.¹¹ from Bannu, Pakistan reported distribution of 133 TB patients with 42.86% men and 57.14% women, and Zeeshan, et al.¹² from D.I.Khan reported distribution of 286 drug resistant TB cases as 43% men and 57% women.

Opposing our data, seven studies showed DS-TB to be more common in men than women; Barreto, et al.² from Brazil reported distribution of 8,896,314 cases of TB as 68.45% men and 31.55% women, Alene, et al.⁴ from China reported distribution of 471 TB patients, including 70.7% males and 29.3% females, Aysel, et al.⁵ from Van city, Turkey showed 411 TB cases as 53.77% men and 46.23% women, Venkatesh, et al.⁶ from Gorakhpur, India showed 157 TB cases as 68.8% men and 31.2% women, National TB Control Program Pakistan⁷ reported 360,019 TB cases all over Pakistan for year 2018 as 51.72% men and 48.28% women, Akhtar, et al.⁹ from Lahore showed 1,250 TB cases with men 53.12% and women 46.88% and Wahab, et al.¹⁰ from Peshawar showed 30 TB

cases with 56.7% men and 43.3% women.

No study could be obtained from literature showing equivalent distribution of DS-TB in males and females.

Our observed prevalence for DS-TB in men 46.12% was lower than expected (adjusted) 51.72% and our observed prevalence in women 53.88% was higher than expected (adjusted) 48.28% from NTP Pakistan⁷ data for year 2018. (Table 3.2.1.2)

4.2 Distribution of DS-TB by age groups (RQ 2 & H₀₂): Our data showed DS-TB to be most common in age group 15-44 years 49.74% (95% CI 48.18-51.31).

Similar to our study, it was reported to be most common in age group 15-44 years by the following studies; Venkatesh, et al.⁶ (n=157) 79.7% in 18-40 years, NTP Pakistan⁷ (n=360,019) 50.08% in 15-44 years, Akhtar, et al.⁹ (n= 1,250) 79.68% in 15-45 years, Wahab, et al.¹⁰ (n=30) 60% in 20-40 years, Ashraf, et al.¹¹ (n=133) 41.35% in 15-45 years and Zeeshan, et al.¹² (n=286) 60.14% in 15-44 years.

Our observed prevalence of DS-TB for various age groups was different than we expected from NTP Pakistan data.⁷ (Table 3.2.2.2)

4.3 Distribution of DS-TB by type of disease (RQ 3 & H₀₃): Our data revealed that pulmonary TB (PTB) 73.47% (95% CI 72.06-74.83) was more common than extrapulmonary TB (EPTB) 26.53% (95% CI 25.17-27.94).

Similar to our study, higher prevalence of PTB than EPTB was reported by the following four studies; Pang, et al.³ from Beijing, China reported 66.6% pulmonary and 33.4% extrapulmonary, National TB Control Program Pakistan⁷ reported 80.35% pulmonary and 19.65% extrapulmonary, Akhtar, et al.⁹ from Lahore, Pakistan showed 98.48% pulmonary and 1.52% extrapulmonary and Zeeshan, et al.¹² from D.I.Khan, Pakistan reported 98.60% pulmonary and 1.40% extrapulmonary DR-TB.

In contrast to our study, similar prevalence of pulmonary 50.6% and extrapulmonary TB 49.4% was reported by Aysel, et al.⁵ from Van city, Turkey.

Our observed prevalence for PTB 73.47% was lower than expected (adjusted) 80.35% and our observed prevalence of EPTB 26.53% was higher than expected (adjusted) 19.65% from NTP Pakistan⁷ data for year 2018. (Table 3.2.3.2)

5. CONCLUSIONS

Drug sensitive tuberculosis was more common in women than men in DS-TB population of District D.I.Khan, Pakistan. It was highest in age group 15-44 years and higher for pulmonary TB than extrapulmonary TB. Our observed prevalence in men was lower than expected and in women it was higher than expected. Our observed prevalence of drug sensitive TB in various age groups was different than

expected. Our observed prevalence for pulmonary TB was lower than expected and for extrapulmonary TB it was higher than expected.

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CONFLICT OF INTEREST
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All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.



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