ORIGINAL ARTICLE

COMPARISON OF THE INCIDENCE OF TUBERCULOSIS IN DIFFERENT GEOGRAPHICAL ZONES IN THE STATE OF JAMMU AND KASHMIR.

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ABSTRACT:

I**ntroduction:** This study was conducted to see the disease pattern of tuberculosis in two different geographical and climate zones of the State of Azad Jammu and Kashmir (AJK).

Objectives: To study and compare the incidence of tuberculosis in northern and southern districts of State of AJK.

To identify vulnerable section of the population according to gender.

Methods: This descriptive study was conducted at Abbas Institute of Medical Sciences Muzaffarabad. The data was collected from 60 TB centers of AJK for three years from 2009 to 2011 and evaluated.

Results: Incidence of tuberculosis was higher in the northern districts of the State. The maximum disease burden was in northern districts of Hatian Bala (151/100,000), Muzaffarabad (147/100,000) and Neelum (136/100,000). In southern districts, in 2011 it was 107/100,000 in Kotli, 101/100,000 in Bhimber and 98/100,000 in Mirpur districts .The average incidence in the northern districts in 2011 was 144.6/100,000 as compared with 102/100,000 in the southern districts. There was a steady decline in the incidence of tuberculosis from northern to southern districts as terrain changes from high mountains to relatively plain areas.

Tuberculosis is a female predominant disease in the State of AJK. The maximum numbers of 2365 female patients were recorded in 2010 which accounted for 52 % of all tuberculous patients. The percentage of female patients from 2009 to 2011 was 50 %, 52%, and 51 % respectively. The maximum number of female patients in one district was 558 in 2009 in Muzaffarabad. The overall female predominance is due to more patients in northern districts of the State. In the most northern district of Neelum 71 % were female patients in 2010.

Conclusion: Tuberculosis is more common in the northern districts of State with cold climate. There is female predominance of disease in the State.

Key Words: Tuberculosis, Seasonality, Female predominance, AJK

INTRODUCTION:

Tuberculosis is a common infectious disease in the State of Jammu and Kashmir. It is associated with significant morbidity and mortality. It mostly affects younger people in the prime years of life[1]. Despite global decline in the incidence of tuberculosis it is among the top ten causes of deaths worldwide[2]. The State has unique geographic diversity (figure I). The southern low lying areas are at the height of 360 meters. Whereas the high hills in north are more than 6325 meters high above the sea level. The southern districts are warm, affluent with better socioeconomic and living standards. In the north high hills are covered with snow and weather is cold with prolong winter season. There is more poverty and living standards are poor in the

north. Generally, there are four seasons in state. The spring season begins in March, summer in June, autumn in September, and winter in December.

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There is long cold winter season in the north as compared with short spell of cool weather in the south. In this study we evaluated incidence and pattern of disease in these two geographically distinct zones with different climates. The better understanding of factors influencing trends and incidence of disease will be helpful in planning effective strategies for TB control programmes.

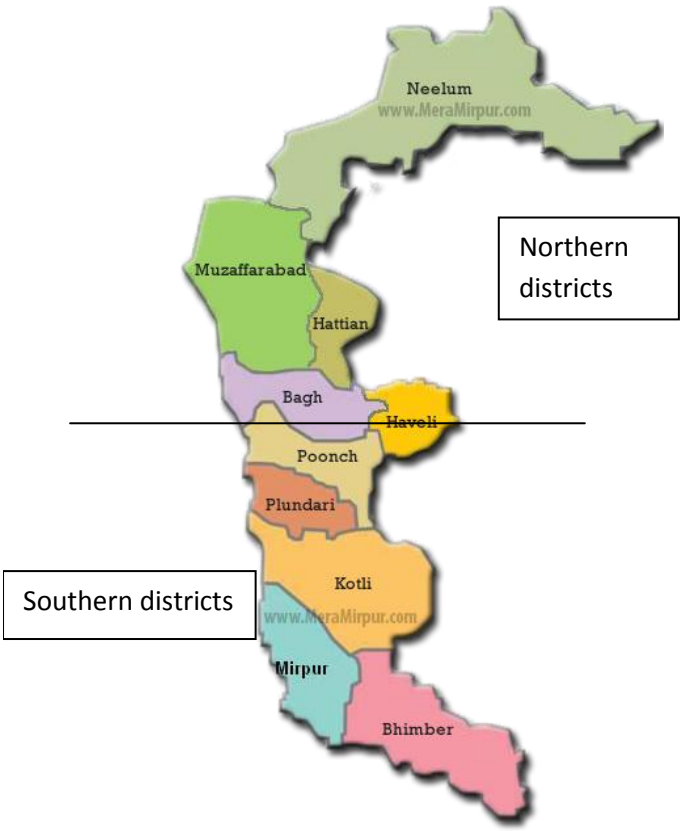


Figure I: Map of the State of Azad Jammu and Kashmir

Patients and Methods:

This descriptive study was conducted at Abbas Institute of Medical Sciences (AIMS) Muzaffarabad. AIMS is a referral center and teaching hospital affiliated with Azad Jummu and Kashmir medical college Muzaffarabad. The data was collected from sixty T.B centers of ten

districts of AJK. The study covered the period from 2009 to 2011. During this study period, the population of state increased from 3.85 to 4.03 million. T.B centers are established by the health department of Government of AJK in different facilities including Basic Health Units (BHUs), Rural Health Centers RHCs), TB Sanatorium, Tehseel Head Quarter Hospitals (THQs), District Head Quarter Hospitals(DHQs), two Combined Military Hospitals, and at Abbas Institute of Medical Sciences (AIMS). These centers provide free diagnostic and treatment facilities according to the guidelines of National TB program (NTB).

All patients who were seen in the TB centers and those referred from private set up with the provisional diagnosis of tuberculosis, the diagnosis was confirmed according to the WHO criteria for the diagnosis of tuberculosis. It included clinical, radiological and microbiological assessment. All these patients were included in our study. These patients were given free supply of anti tuberculous medicines and followed up regularly in medical department. Patients not fulfilling the criteria as laid down by WHO for diagnosis of tuberculosis were excluded from the study.

Statistical analysis was performed by using SPSS software version 20 (IBM SPSS Statistic data editor-20). Geographical information and population denominators used to calculate rates for the study area were obtained from department of planning and development of Government of AJK.

Results:

There is higher incidence of tuberculosis in the northern districts of the State. There is gradual decline from high incidence in north to low in south. The maximum disease burden is in northern districts of Hatian Bala (151/100,000), Muzaffarabad (147/100,000) and Neelum (136/100,000). There is low incidence in the central and southern districts of Rawalakot, Sudhanoti, Kotli, Mirpur and Bhimber (Table-IV). In southern districts, in 2011 it was 107/100,000 in Kotli, 101/100,000 in Bhimber, and 98/100,000 in Mirpur districts. The average incidence in the northern districts in 2011 was 144.6/100,000 as compared with 102/100,000 in the southern districts (Table III and Table IV).

The analysis of data showed that tuberculosis is a female predominant disease in the State of Jammu and Kashmir (Graph I). The maximum numbers of 2365 female patients were recorded in 2010 (Table II). In the same year the number of male patients was 2172. In 2010 female patients accounted for 52 % of all tuberculous patients. The percentage of female patients in 2009 and 2011 was 50 % and 51 % respectively. The maximum number of female patients in one district was 558 in 2009 seen in Muzaffarabad (Table I). The overall female predominance is due to more patients in northern districts of the State. In the most northern district of Neelum out of all patients suffering from tuberculosis 71 % were female in 2010. In the southern districts number of female patients is less than the male patients. It is 48% in Mirpur, 45% in Kotli, and 43 % in Bhimber.

Table I: Tuberculosis: Pattern of disease in the State of Azad Jammu and Kashmir

Year 2009 (Table-1)

Districts	population	Total Patients			Grand Total
		Male	Female	Female % age	
Neelum	1,73,106	91	128	58	219

Muzaffarabad/ Hatian Bala	8,41,080	501	558	53	1059
Bagh/Havaili	4,87,044	295	396	57	691
Rawalakot	5,23,230	204	276	57	480
Sudhanoti	2,76,774	171	132	44	303
Kotli	7,29,588	405	347	46	752
Mirpur	4,19,562	257	196	43	453
Bhimber	4,00,002	208	186	47	394
TOTAL	38,50,386	2132	2219		4351

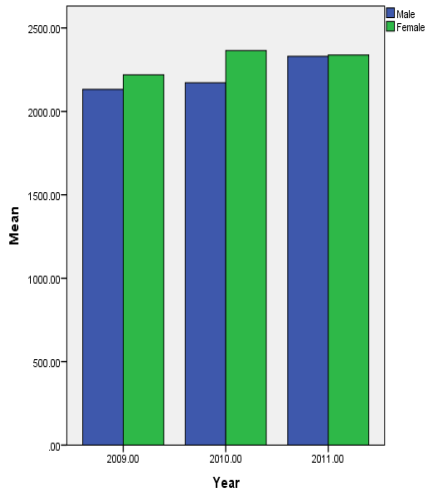
Year 2010 (Table-2)

Districts	population	Total Patients			Grand Total
		Male	Female	Female % age	
Neelum	1,77,000	70	172	71	242
Muzaffarabad	6,42,000	440	463	51	903
Hatian Bala	2,18,000	131	194	60	325
Bagh	3,50,000	211	268	56	479
Havaili	1,48,000	79	117	60	196
Rawalakot	5,35,000	196	283	59	479
Sudhanoti	2,83,000	160	127	44	287
Kotli	7,46,000	404	369	48	773
Mirpur	4,29,000	270	185	41	455
Bhimber	4,09,000	211	187	47	398
TOTAL	39,37,000	2172	2365		4537

Year 2011(Table-3)

Districts	population	Total Patients			Grand Total
		Male	Female	Female % age	
Neelum	1,81,266	100	147	59	247
Muzaffarabad	6,57,472	447	491	51	968
Hatian Bala	2,23,254	160	177	52	337
Bagh	3,58,435	195	245	56	438
Havaili	1,51,567	100	123	55	223
Rawalakot	5,47,894	257	247	49	504
Sudhanoti	2,89,620	135	140	51	275
Kotli	7,63,979	448	373	45	821
Mirpur	4,39,339	221	212	48	433
Bhimber	4,18,857	237	185	43	422
TOTAL	40,31,883	2330	2338		4668

Incidence of Tuberculosis			
District	**2009**	**2010**	**2011**
Neelum	126	137	136
Muzaffarabad	126	141	147
Hatian Bala	-	149	151
Bagh	142	137	122
Havaili	-	132	147
Rawalakot	92	89	92
Sudhanoti	109	104	95
Kotli	103	104	107
Mirpur	108	106	98



Bhimber	73	97	101

Graph-1 (Table-4)

Discussion:

Azad Jammu and Kashmir lies between longitude 73^0 - 75^0 and latitude of 33^o - 36^o and comprises an area of 5134 Square Miles (13297 Square Kilometers) [3]. The topography of the area is mainly hilly and mountainous. The climate is sub-tropical to temperate highland type with an average yearly rainfall of 1300 mm. The elevation from sea level ranges from 360 meters in the south to 6325 meters in the north. There are two important differences in the weather conditions of the northern and southern districts. The weather is cool and prolong winter season extends up to five months in the north. The living standards are also poor in the north. It is opposite in the south with warm weather conditions and better living standards.

The most northern district is Neelum. It consists of hilly terrain and mountains covered with snow most of the year. Wood is used during the winter season for heating. It is arranged in one room and most of the family members spend their time in the heated room. This environment exposes every family member to the risk of infection from patient with open pulmonary tuberculosis. It is the norm in these families that females stay at home and take care of sick family member. They remain in close contact with the patient for prolong periods of time. The absence of adequate ventilation provides conductive conditions for propagation of infection. These weather conditions and family traditions have an important role in determining female vulnerability. It has impact on increased incidence of disease in the northern districts. These districts with cold climate and poor socio economic living standards bear the maximum disease burden.

The seasonality of tuberculosis has been reported in several studies. These studies have shown strong association between tuberculosis and seasonality in different climates[4]. It has been observed that the maximum cases of tuberculosis are reported at the end of winter season or in early spring[5]. The transmission of disease occurs in winter. Due to slow development of disease and diagnostic delays these cases are diagnosed and reported after the winter season[6].

The indoor crowding and vitamin D deficiency are two important factors implicated for increased winter transmission of disease[7]. There are more chances of disease transmission during prolong winter season. In our study we found maximum disease burden in northern districts with

cold climates. The incidence of tuberculosis in 2011 in Hatian Bala, Muzaffarabad, Neelum and districts was 151, 147, 136 respectively. The higher incidence of TB in these districts correlates with increased winter transmission of disease. There is transition from high to low incidence from north to south with change in climate. The State TB program needs to focus on this aspect of disease transmission and evolve better strategies to limit this increased transmission in winter.

Parrinello CM et al reported tuberculosis seasonality in New York with increased transmission in winter season[8]. Fares et al considered enhanced susceptibility of respiratory epithelium to infections during winter season responsible for increased rate of infection. Chung-Min Liao et al evaluated different individual and environmental factors while assessing trends and predictors of tuberculosis in Taiwan[9]. They also had same findings of increased winter transmission of disease as reported in other studies.

Winter season has been associated with increased morbidity and mortality of respiratory tract infections including tuberculosis[10]. Explanations for this include decreased exposure to sun light, changes in immune system of human body and increased indoor activity. The long sunny summer days provide adequate natural ultraviolet light with effective sterilizing activity against M.tuberculosis[11]. The minimum availability of sunlight in winter season is associated with increased survival and activity of mycobacterium. It also results in decreased production of natural vitamin-D associated with skin exposure to natural sun light[12]. The immune modulating and beneficial immune enhancing effects of vit-D has been shown in several studies[13]. Its relative deficiency in winter leads to increased susceptibility to infection.

The style of clothing is also associated with sun exposure and levels of vit-D[14]. The Kashmiri women generally wear a long woolen shirt called 'FAHRAN'. It covers body from shoulders to ankles. It provides effective insulation and is very useful during winter but also acts as an effective barrier to sun light. This style of dressing *i.e* covering almost the whole body leads to decreased levels of 25(OH) D and harms endogenous immunity.

Tuberculosis is the most prevalent disease in Asia and Africa. It is a male predominant disease and affects both genders[15]. In the state of Jammu and Kashmir it is more common in female population. This overall female predominance is due to significantly more number of patients in the northern districts of the state. One possible explanation for female predominance of disease in the northern districts is the social setup of this area.[16] Codlin AJ and Khawaja S in their short report in 2011 also pointed predominance of smear positive tuberculosis in females in Pakistan[17]. It is in contrast to neighboring India where disease is more common in males. There is no available large study to explain this important difference in the epidemiology of common disease. In our study we found higher ratio of tuberculosis in females especially in the northern districts during the last three years.

There is need for more studies for better understanding of these findings and to develop guidelines for State TB control program.

Conclusion: We observed two important findings in our study. We found that TB is more common in the northern districts of State with hilly terrains and cold climate. The other important finding was the female predominance of disease in the State.

References:

1. Fauci, Braunwald, Kasper, Hauser, Longo, Jamson, Loscalzo (2008).Harrison's principles of Internal Medicine (17 th ed.). McGraw-Hill companies, Inc. pp 1006-1020.
2- World Health Organization. Global Tuberculosis Control Report. Geneva, WHO Report 2011. (WHO/HTM/TB/2010.17).
3- AJK PND Book 2010. [Cited on 30th Nov 2012]. Available on URL: www.pndajk.gov.pk
4- Auda Fares. Seasonality of Tuberculosis. J Glob Infect Dis. 2011 Jan-Mar; 3(1): 46–55.
5- Janmeja AK, Mohapatra PR. Seasonality of tuberculosis. Int J Tuberc Lung Dis. 2005; 9: 704–5.
6- . Paynter S, Hayward A, Wilkinson P, et al. Patient and health service delays in initiating treatment for patients with pulmonary tuberculosis: Retrospective cohort study. Int J Tuberc Lung Dis. 2004; 8:180–5.
7- Nnoaham KE, Clarke A. Low serum vitamin D levels and tuberculosis: A systematic review and meta-analysis. Int J Epidemiol. 2008; 37:113–9.
8- Parrinello CM, Crossa A, Harris TG. Seasonality of tuberculosis in New York City, 1990-2007. Int J Tuberc Lung Dis. 2012 Jan; 16(1):32-7.
9- Liao CM, Lin YJ. Assessing the transmission risk of multidrug-resistant Mycobacterium tuberculosis epidemics in regions of Taiwan. Int J Infect Dis. 2012 Oct;16(10):e739-47.
10- Mourtzoukou EG, Falagas ME. Exposure to cold and respiratory tract infections. Int J Tuberc Lung Dis. 2007; 11:938–43.
11- Lee ES, Yoon TH, Lee MY, et al. Inactivation of environmental mycobacteria by free chlorine and UV. Water Res. 2010 Mar;44(5):1329-34.
12- Webb AR, Kline L, Holick MF. Influence of season and latitude on the cutaneous synthesis of vitamin D: Exposure to winter sunlight in Boston and Edmonton will not promote vitamin D synthesis in human skin. J Clin Endocrinol Metab. 1988; 67: 373–8.
13- Bikle DD. Vitamin D and the immune system: role in protection against bacterial infection. Curr Opin Nephrol Hypertens. 2008 Jul; 17(4):348-52.
14- Mishal AA. Effects of different dress styles on vitamin D levels in healthy young Jordanian women. Osteoporos Int. 2001;12(11):931-5.
15- Tuberculosis. In: Goldman L, Ausiello D, eds. *Cecil Medicine*. 23rd ed. Philadelphia, Pa: Saunders Elsevier; 2007: chap 345
16- Hudelson P. Gender differentials in tuberculosis: the role of socio-economic and cultural factors. Tuber Lung Dis. 1996 Oct; 77(5):391-400.
17- Codlin AJ, Khowaja S, Chen Z, et al. Short report: Gender differences in tuberculosis notification in Pakistan. Am J Trop Med Hyg. 2011 Sep; 85(3): 514-7.