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Age Variation of Tuberculosis Cases in North Darfur Province During 2020-2022(*)

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Abstract:

Tuberculosis, which is caused by Mycobacterium tuberculosis bacteria, is the second deadliest infectious disease (after HIV/AIDS, which causes a high mortality rate). It often infects the lungs and can spread when tuberculosis patients expel the bacteria into the air by coughing. This study aims at investigating the geographical distribution of tuberculosis cases in the province, and the discrepancy between age groups of tuberculosis patients in North Darfur State in Western Sudan in the years 2020, 2021 and 2022. The study covers 15 government hospitals in a number of governorates where the number of confirmed tuberculosis cases reached 680 cases, according to the reports of the Ministry of Health of North Darfur State. However, the study showed that tuberculosis spreads more among males than females aged 15-54 years than in women, as it spreads among the economically active groups. The study also showed that there are statistically significant differences between the cases of infection during the period of the study.

Keywords - disease - tuberculosis - contrast test – Darfur.

Introduction

According to Dorland's medical Dictionary, "disease is pathological process having a characteristic set of signs and symptoms". It may affect the whole body or any of its parts. Whereas classical medicine defines disease as the disturbance of the adaptation to the environment which gives the implicit apology of the given environment (Kovács, 1998, p. 34).

Tuberculosis (TB) is a disease caused by a bacterium called Mycobacterium tuberculosis. It affects almost all human body systems, particularly the lungs when inhaling the bacillus in enclosed spaces (Churchyard et al., 2017, p. 216) which leads to several symptoms, including:

- cough that lasts for more than four weeks and the sputum is accompanied by blood or has a yellowish or greenish color.
- a fever that increases in the evening, accompanied by a lot of sweating.
- chest pains.
- difficulty in breathing and peaking when most of the lung is destroyed, and weight loss and loss of appetite, and the patient often suffers from anemia (Schull, 2009, p. 60).

Tuberculosis may affect the digestive system by drinking raw milk.

Tuberculosis, therefore, is the second disease that causes high mortality rates after HIV/AIDS. The M. tuberculosis bacillus is a pathogen that can persist in the host's tissues for decades without causing disease. In case of infection, you must take medications for at least 6 to 9 months.

According to the historical extrapolation tuberculosis spread, the disease was widespread in the northern and the southern Nile Valley, especially among soldiers. In Sudan, Paleopathology studies have shown that the disease appeared during the Ancient Kerma 2500-2050 BC (Welsby, 2001, p. 494); during the Kingdom of Meroe 900 BC - 350 AD in Northern Sudan; and in the era of the Christian Mamluks (543 - 1504 AD) at the Faras area in the far north of Sudan (Bayoumi, 1979). Perhaps this attributed to the poor economic and deteriorated health conditions during those periods. TB is more prevalent in Northern Sudan, though before 1885 it was not reported as one of epidemics of the Sudan. South of Sudan remained untouched by TB until the 1930s (Zaki et al., 2009). Therefore, Tribes in northern Sudan were particularly vulnerable to TB in 1925-1932 and occurred frequently. The south and the Nuba Mountains were almost free of infection or disease.

The study area, North Darfur province, has witnessed in period 1970 - 2022 unstable climate conditions which affected the economic and nutritional aspects of the population. As a result, malnutrition diseases of all kinds emerged. Accordingly, Tuberculosis appeared for the appropriate

conditions coincide. The central provinces of the Sudan; Darfur, Kordofan, Blue Nile, Khartoum and Kassala are known as Epidemics belt of Africa (Zaki et al., 2009, p. 179). Thus, the area of the study is one of the areas that suffer from many natural and human crises that helped current prevalence of tuberculosis. Thus, this study investigates the geographical distribution of tuberculosis cases in northern Darfur and whether there are statistically significant differences between the cases of infection due to age. The following hypothesis, then, can be formulated: tuberculosis is not associated with a specific age group, but rather spreads among all age groups.

Previous studies

Several studies have investigated pulmonary tuberculosis spreads among certain age groups tuberculosis in certain geographical areas. Results from many researchers have proven that poverty, malnutrition and unhealthy housing conditions were the main reasons for the spread of the disease (Park et al., 1989), particularly among hard workers and young economically active ages (Hetherington et al., 1959).

Chan-Yeung et al. (2005) investigated the socio-demographic and geographic indicators responsible for the distribution and transmission of tuberculosis in Hong Kong. The results showed significant correlations were between the rate of TB and low educational attainment. Results also revealed correlation between elderly population and low-income household.

Another study, conducted by Wu et al. (2015) Compared the factors related to tuberculosis-specific and non-tuberculosis-specific mortalities in different age groups among tuberculosis patients in Taiwan. Results showed that Elderly age who were tuberculosis positive and comorbidity with chronic kidney and heart diseases or chronic hepatitis were most likely susceptible to tuberculosis death.

Alavi-Naini et al. (2013, p. 200) conducted a study to investigate common risk factors associated with death in patients' diagnosis positive TB, in a Iranian highest prevalence city incidence of TB in Iran. They found that TB death could be attributable to co-morbid conditions like anemia and diabetes mellitus; tobacco smokers and drug abusers.

Zelner et al. (2014) conducted a prospective cohort study of household contacts of TB patients in Lima, Peru. They analyzed data from a large population to investigate the importance of within-household transmission relative to community-based transmission. They found that the risk of TB infection from household and community sources increased from 0-20 years of age. Thus, exposure to public determines the risk of infection with Mycobacteria TB (Dowdy & Behr, 2022).

Zhu et al. (2018) investigated the local dynamics of tuberculosis epidemiology in China. They analyzed the age-specific incidence and number of TB cases in the Nanshan District of Shenzhen from 2011 to 2016. The results disclosed that the incidence of tuberculosis infection decreases in the age group 0-14 and the young aged 15-24 years, while the incidence of infection increased in the age groups 45-54 and 55-64, particularly in the elderly age group 65-65. Results also showed infection increases in cases related to the migration factor during the year. Similarly, Dong et al. (2022), who evaluated the effects of age, period, and birth cohort on reported positive incidence trends of TB based on population, concluded that the young (20-24) and the elderly (70-74) were equally at high risk of infection. Korzeniewska-Kosela et al. (1994) comparative study of pulmonary and pleural tuberculosis symptoms also showed no difference in the duration of symptoms between the two groups.

Research Methodology and data analysis

This research is a retrospective cohort study for the period from 2020 to 2022. Demographic regional surveillance data was used is this study. The data was obtained from Ministry of Infrastructure and Urban Development, Northern Darfur Province, Sudan. The province consisted of 17 localities with the total population of 830332 according to the last national census conducted on 2020.

The province under study; North Darfur, western Sudan; is geographically located between the longitudes 22.8 and 27.5 degrees east, and the latitudes 9.8 and 18 degrees north. It occupies an area of 296,420 square kilometers. Therefore, it represents the largest part of the Darfur region, with an area estimated at 57% of the total area of Darfur region and 12% of the area of Sudan.

Demographic data and tuberculosis cases were collected and analyzed using Statistical Package for Social Science software (SPSS). The data obtained for this study were 680 confirmed positive tuberculosis cases in North Darfur province hospitals. The Analysis of Variance (ANOVA) is used to compare the means values of the data, and visualize whether there exists any significant difference in Tuberculosis infection between gender and age.

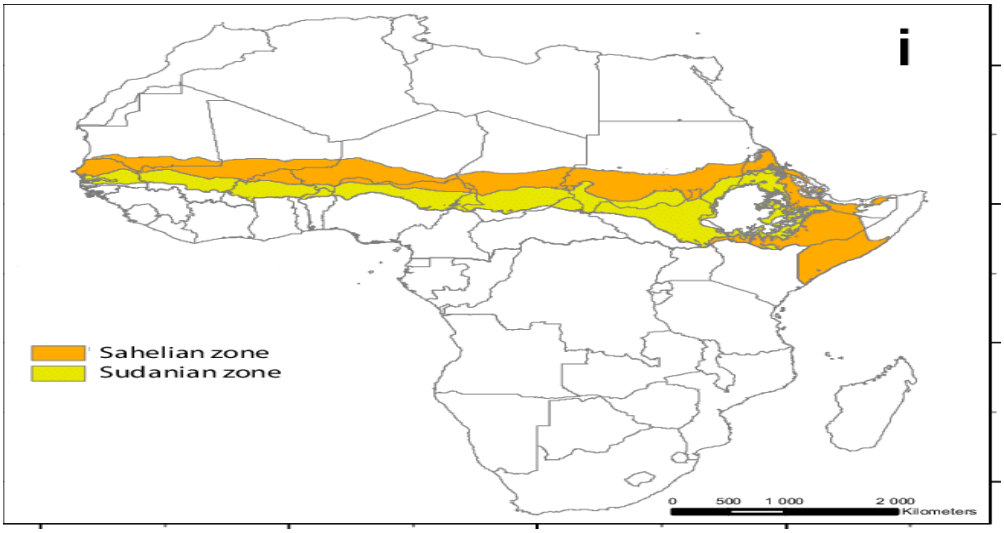
Results

Pulmonary Tuberculosis in the Study Area

Northern Darfur is located in the epidemics belt of Africa. Moreover, this area has witnessed many natural crises in the past such as draughts and famines because it is located in the range of the African Plain. Dry periods have become longer and annual precipitation has become more erratic

across most of the area. As a result, the area has been affected by malnutrition and infectious diseases appeared. Thus, Tuberculosis, one of the diseases prevalent diseases, accordingly. The Pulmonary Tuberculosis cases has increased during 2020,2021 and 2022 reaching the peak in 2020 and coincided with Covid 19 pandemic in the last two years. The percentage of people with these genes is 66.5% (Ministry of Health, North Darfur State: 2020-2022) see Fig.1.

Fig.1 Location of study area within Sudano-Sahelain Zone

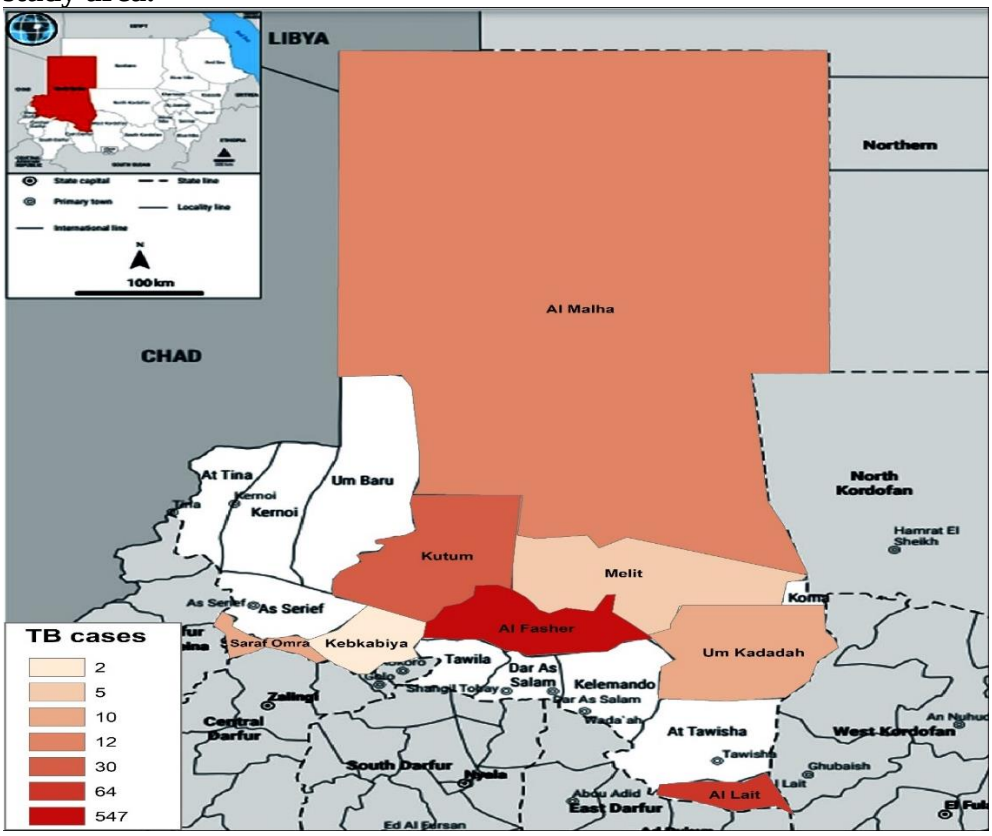


Source:Bargués Tobella, A. (2016:p:22).

Geographical distribution of pulmonary tuberculosis cases in the study area.

The map in Fig.2 shows that the infection cases of Pulmonary Tuberculosis are almost concentrated in the city of El Fasher. The percentage of infected people reached 80%. The infected cases come from various regions of North Darfur Province, as El Fasher is the capital of the state and has three state hospitals. In addition to the high number of residents in the city. Despite it is small residential city, Al-Lait is the second highly infected area in the province. The percentage of confirmed infected cases reached 9.4%. This could be referred to the poor living conditions due to the long droughts periods that hit the area in recent years. Kutum region is the third infected area with a rate of 4.4% positively confirmed TB incidences. Residency and economic conditions in Kutum are similar to that of Al-Lait region though the percentage of TB cases is lower, see Fig.2.

Fig.2 Geographical distribution of pulmonary tuberculosis cases in the study area.



Source: The researcher worked based on the data of the Ministry of Health, North Darfur State :2022.

Table.2 Cases of tuberculosis infection in North Darfur State during the 2020-2021-2022.

Yearly infection	males	%	Female	%	Total
2020	194	63.8	110	36.2	304
2021	127	65.8	66	34.1	193
2022	128	69.9	55	30.1	183
Total					680

Source: Ministry of Health, North Darfur State :2022.

Age and Gender Pulmonary Tuberculosis

The rate disease prevalence among the population during years under study was 36.6, 23.2, and 22 per 100,000. Table (1) shows that the incidence in infection is high in 2020. Perhaps the reason is due to coincide of Corona virus spread. Table (2) shows the discrepancy in cases of infection according to age groups.

Table.2 Tuberculosis cases in North Darfur State during the 2020, 2021 and 2022.

Age groups		TB cases in 2020			TB cases in 2021			TB cases in 2022		
		M	F	Total	M	F	Total	M	F	Total
0-4	No	4	1	5	2	0	2	4	7	11
	%	1.3	0.3	1.6	1	0	1	2.2	3.8	6
5 −14	No	6	2	8	3	4	7	4	1	5
	%	1.9	0.7	2.6	1.5	2.1	3.6	2.2	0.5	2.7
15-24	No	35	20	55	24	12	36	24	10	34
	%	11.5	6.6	18.1	12.4	6.2	18.6	13.1	5.4	18.6
	No	62	27	89	39	11	50	37	13	50
	%	20.4	8.9	29.3	20.2	5.6	25.9	20.2	7.1	27.3
35−44	No	32	23	55	25	11	36	23	6	29
	%	10.5	7.6	18.1	13	5.7	18.6	12.5	3.2	15.8
45 −54	No	22	18	40	16	11	27	13	6	19
	%	7.2	5.9	13.2	8.3	5.7	13.9	7.15	3.2	10.4
55 −64	No	14	13	27	4	7	11	17	6	23
	%	4.6	4.3	8.9	7.3	3.6	5.6	9.2	3.2	12.7
≥65	N	19	6	25	14	10	24	6	6	12
	%	6.3	2	8.2	7.3	5.2	12.4	3.3	3.2	6.6
Total cases	No	194	110	304	127	66	193	128	55	183
	%	63.8	36.2	100	65.8	34.1	100	69.9	30.1	100
New cases	No	226			140			162		
	%	74.6			72.5			88.5		
Deaths	No	12			1			2		
	%	4			0,5			1.2		
AIDS	No	2			1			2		
		0.7			0.5			1.2		

Source: Ministry of Health, North Darfur State :2022

Pulmonary tuberculosis Infection in 2020 reached 304 confirmed positive cases. The percentage of infected people increased among males more than females; 63.8% males compared to 36.2% females. Infection increased among age groups (15-54), 49.6% males 29% females. In age category, the infection was less among the young (0-14) and the elderly (55

- 70), while the new cases were 74.4% of the total cases. 0.7% were cases of tuberculosis coincided AIDS. The death rate reached 4% of the infected cases in 2020.

In 2021, the total number of infections is less than in 2020, but the cases remained high in the same age groups. The percentage of infected people increased among males more than females, 65.8% males and 34.1% females. Infection in the age groups (15-45) reached 49.6% for males and 29% females of the total infections followed by the elderly (55 -70), and decreased in the age groups (0-14). Newly infected cases were 72.5% of the total cases; while cases of tuberculosis coincide with AIDS was 0.5. %. Deaths percentage was 0.5% of the total infected cases.

Discussion

Result show that high incidences of positive confirmed TB cases were reported in relatively high populated areas and within certain socio-economic conditions. The finding also shows that TB incidences coincide with other infectious diseases such as Covid 19 an Aids. These findings of the current support the previous studies of Park et al. (1989) and Hetherington et al. (1959). Statistics revealed in Table.2 shows that TB spread among all age groups and within both sexes as well. To test research hypothesis: "there are no statistically significant differences between the incidence cases due to the age factor, the researcher used Kolmogorov-Smirnov Normality test, Levane Test of Homogeneity of Variances and One-way analysis of variance to see if there is any variation between age group infections**.**

Table.3 Normal distribution of tuberculosis cases in North Darfur-2020-2021-2022.

Age group		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Infected cases	1	.153	8	.200*	.941	8	.618
	2	.161	8	.200*	.955	8	.761
	3	.147	8	.200*	.954	8	.747
*. This is a lower bound of the true significance.							
a. Lilliefors Significance Correction							

Kolmogorov-Smirnov Normality test shown in Table.3 reveals that the value of Sig, which is equal to (0.200), is greater than 0.5, and this indicates that the incidence of infection according to the three-year age groups follows a normal distribution.

Table4: Test of Homogeneity of Variances of Infected cases			
Levane Statistic	df1	df2	Sig.
1.973	2	21	.164

Table .5 One-way analysis of variance results

Groups	N age groups	Mean	Std. Deviation	F	sig
(1)2020	8	38.00	27.934		
(2)2021	8	24.13	16.539		
(3)2022	8	22.88	14.594		
Total	**24**	**28.33**	**20.847**	**1.335**	**.285**

Table.5 compares number of cases for each year. From this table it can be determined the arithmetic mean of infection cases for the year 2020, which was higher than the general average of cases over the three years, is 38 cases. Also, the standard deviation in 2020 is 27.934, which is greater than the standard deviation in 2021 and in 2022. This indicates the dispersion of cases incidence in the last two years.

Table.5 shows one-way analysis of variance. The sum of squares between groups is 1127,583 with a degree of freedom 2. The mean of squares within groups is 563,792. The sum of squares between groups is 8867,750 with a degree of freedom 21, and the mean of squares between groups is 422,274. The value of the F test statistic is 1,335, and the significance value is (Sig = .285), which is greater than the values of (a = .05). Accordingly, we accept the null hypothesis of a saying and reject the alternative hypothesis. There are no statistically significant differences between the cases of infection due to the age factor, despite its prevalence between groups Perhaps this is related to other factors that should be studied.

Conclusion

By analyzing the previous data, the study concluded that tuberculosis of all its kinds affects all ages as mentioned by medical sources. This result confirms the hypothesis of the study which says tuberculosis is not associated with a specific age group, but rather spreads among all age groups.(Workicho et al., 2017).

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