# Journal of
# Medical Sciences

## Research Article
## Patterns of Tuberculosis Infection in El-Obeid City, North Kordofan State, Sudan

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## Abstract

**Background and Objective:** Tuberculosis is at the top of health problems in the various regions of Sudan, where this disease is associated with poverty and poor environmental and health conditions. Therefore, it spreads among poor communities as well as the displaced. The present study aimed to study patterns of tuberculosis infection. **Materials and Methods:** A retrospective cross-sectional descriptive hospital-based study of all tuberculosis patients (n = 1252) who had TB admitted to the department of respiratory tract diseases at the El-Obeid Teaching Hospital from 2015-2017. It was carried out from February to December, 2018. Data entered, processed and analyzed using the Statistical Package of Social Sciences (SPSS) version (16.0) and Microsoft Excel (2010) software. **Results:** The (31.2%) of tuberculosis patients had suffered from extra-pulmonary and (68.8%) of them had a pulmonary pattern. TB reached its peaked at the age 21-40 years with (44.3%), followed by 41-60 years with (22.5%). It responsible for the in-hospital mortality rate was (12.2%), (11%) and (15%) were responsible for pulmonary and extrapulmonary tuberculosis. There was a highly significant relationship between socio-demographic factors (age and gender) and the etiological diagnosis (p = 0.001 and p = 0.000). **Conclusion:** All data about patients admitted to the department of respiratory tract diseases should be listed in an accurate mode using uniform records. There is a need for early detection and treatment of TB cases so as become possible to provide optimal health care and decrease mortality rates.

## INTRODUCTION

Tuberculosis is a communicable disease that is a major cause of ill health[1]. A third of the world's population is infected with *Mycobacterium tuberculosis*[2]. Tuberculosis is still a global public health problem despite worldwide control effors[3]. it is a health, socioeconomic disaster of a huge magnitude that is occurring over the world. Tuberculosis can attack people of any sex, age, or socioeconomic class. In reality, it is likely to claim its greatest toll from certain strata of the population and it is important to identify these for planning and implementing TB control[4].

Tuberculosis is an infection caused by a group of organisms including *Mycobacterium tuberculosis*[5]. which typically affects the lungs called pulmonary TB but may affect other organs as well (extrapulmonary TB). The disease is spread through the air when people who are sick with pulmonary TB expel bacteria. TB is also more widespread among men than women and affects mostly adults in the economically productive age groups[6]. Principally from humans and M. bovis, primarily from cattle[5].

*Mycobacterium tuberculosis* and *M. africanum* are transmitted by exposure to the *bacilli* in airborne droplet nuclei produced by coughing, sneezing, talking, or singing[5]. People nearby may breathe in these bacteria and become infected. About 5% go from initial infection to pulmonary TB, such as meninges, lymph nodes, pleura, pericardium, bones, kidneys, or other organs, the infection develops as extra-pulmonary TB[5]. A single cough may bring out up to 4.000 droplets. Most infections do not have symptoms, known as latent TB. It is estimated that up to 10% of infected persons may gradually progress active TB in their lifetime and fatality may reach up to 50% of the patients if left untreated. TB causes ill-health among millions of people each year and ranks alongside HIV as a leading cause of death worldwide[6].

Globally there are 33 million cases of TB, 3 million yearly death and 8 million persons developed active TB every year ¾ of which are concentrated in productive age group[7]. One of the top 10 causes of death worldwide and the leading cause of death from a single infectious agent. Only in 2019, about 10.0 million people were infected with TB[1]. The disease features, risk factors, access to health care and outcomes vary from country to country and usually differ locally as well. Hence any control measures have to be designed to meet these needs in a culturally appropriate manner. The World Health Organization (WHO) has identified the movement of people from high prevalence to industrialized nations as one of the causes of the current worldwide increase in TB

prevalence[8]. Tuberculosis attacks persons in their adult working years, with 80-90% of cases in persons between the ages of 15 and 49 years[3].

Globally the incidence of all forms of TB is decreasing. However, the rate is not similar across all WHO regions. In the African region, it is decreasing slowly by 1.8% per year[9]. Tuberculosis (TB) is a major cause of illness and death in Asia and Africa. Twenty two high burden countries constitute 80% of all incident cases worldwide. India ranks first of them with two million estimated TB cases as against estimated global incidence of 9.4 million accounting for 21% of new cases[10].

Sudan is a large country with a diverse population and a history of civil conflict. Poverty levels are high with a gross national income per capita of fewer than two thousand dollars. The country has a high burden of Tuberculosis (TB) with an estimated 50,000 incident cases during 2009 when the estimated prevalence was 209 cases per 100,000 of the population[9,11].

The promotion diagnosis of TB is essential for community public health infection control measures as well as for ensuring the appropriate therapy for infected patients unfortunately acid fast bacilli are found in the sputum in a limited number of patients with active Pul-TB. Therefore the imagined diagnosis would provide appropriate therapy for an infected patient before the definitive diagnosis by the bacteriology[7].

Tuberculosis care and treatment are provided by the Sudan National Tuberculosis Control Program under the auspices of the Ministry of Health and by several Non-Governmental Organizations (NGOs) who provide care to displaced persons, including those living in refugee camps[11]. Due to insufficient data on tuberculosis infection patterns in North Kordofan State, the current study was conducted to determine patterns of tuberculosis infection and their relationship to demographic factors.

## MATERIALS AND METHODS

**Study area:** A retrospective cross-sectional descriptive hospital-based study of all patients who had TB admitted to the department of respiratory tract diseases at the El-Obeid Teaching Hospital from 2015-2017. It was carried out from February-December, 2018, to study patterns of tuberculosis infection and age, gender, indication for admission, treatment discontinuity, relapse, utilized therapy and hospital mortality. El-Obeid Teaching Hospital was established in the forties of the last century and is one of the oldest hospitals in Sudan since the era of the first colonialism. It was established in the

year 1992. The area of the hospital is 66 thousand meters. The hospital has about 40 wards that differ in their clinical capacity. El-Obeid Teaching Hospital is the first public hospital located in the centre of El-Obeid city. It has a dedicated emergency room and receives referrals from all Kordofan States of Western Sudan.

**Sample techniques:** All tuberculosis patients attending during (2015-2017) were included. The sample size was covered (1252) patients, all patient charts were reviewed and checked to gather data relating to age, gender, indication for admission, treatment discontinuity, relapse, utilized therapy and hospital mortality. Data were obtained from the El-Obeid Teaching Hospital records through the period from February-December, 2018.

**Data collection:** This study was derived authoritatively from secondary data sources from already registered documents. A form was prepared by researchers and checked for consistency. The self-administrated form is used to collect data on basic information about tuberculosis disease from records of the department of respiratory tract diseases. The final form included information relating to tuberculosis disease, in addition to demographic characteristics of the patients, including age, gender. Also, the form included information about indications for admission, chemical treatment, full recovery, etiological diagnosis and in hospital mortality.

**Data processing and analysis:** After taking samples and filling the form and cleaning all data. Data were collected from hospital records and analyzed using the Statistical Package of Social Sciences (SPSS) version (16.0) and Microsoft Excel software (2010).

**RESULTS**

Total tuberculosis patients during the period from 2015-2017 were 1252, among the total patients there was more than third (44.3%) of patients fall in the 21- 40 years and (17.7%) of them in the 1-20 years, (22.5%) fall in 41-60 years, (14.7%) in 61-80 years and (0.7%) more than 80 years, as shown in Fig. 1. As illustrated in Table 1, the total tuberculosis patients admitted during the years 2015, 2016 and 2017 were 33.9, 34.2 and 31.9%, respectively. According to the pattern of TB, Fig. 2 indicates that (31.2%) of tuberculosis patients had suffered from extra-pulmonary and 68.8% of them had a pulmonary pattern. According to socio-demographic factors, Table 2 illustrates that the highest prevalence of TB was observed in the middle age (21-40 years) was (44.3%) and the adult age group of (41-60 years) was (22.5%). Also, males (70%) were more prone to have pulmonary tuberculosis than females (30%). There was a highly significant relationship between age and the etiological diagnosis (p = 0.001) and there was a highly significant relationship between gender and the etiological diagnosis (p = 0.000). The data in Table 3 indicated that the percentage of pulmonary TB
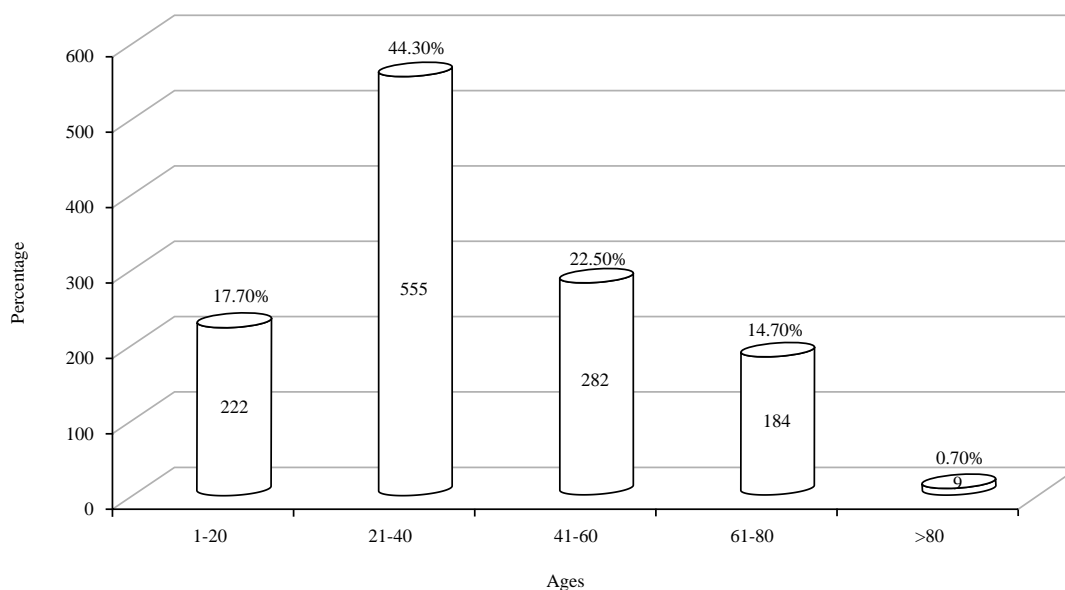


Fig. 1: Distribution of TB patients according to age, El-Obeid Teaching Hospital, (n = 1252)

Table 1: Distribution of TB patients during (2015–2017), El-Obeid Teaching Hospital, (n = 1252)

| Admission history | Frequency | Percentage |
|---|---|---|
| 2015 | 425 | 33.9 |
| 2016 | 428 | 34.2 |
| 2017 | 399 | 31.9 |
| Total | 1252 | 100 |

Table 2: Total number of pulmonary and extra-pulmonary according to socio-demographic factors, El-Obeid Teaching Hospital, (n = 1252)

| | Diagnosis | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pulmonary TB | | Extra-pulmonary | | Total | | | |
| Socio-demographic factors | | | | | | | $\chi^2$ | p-value |
| **Age (years)** | | | | | | | | |
| 1-20 | 129 | 14.99% | 93 | 23.85% | 222 | 17.7% | 1.233 | 0.001 |
| 21-40 | 410 | 47.56% | 145 | 37.18% | 555 | 44.3% | | |
| 41-60 | 206 | 23.89% | 76 | 19.48% | 282 | 22.5% | | |
| 61-80 | 114 | 13.22% | 70 | 17.95% | 184 | 14.7% | | |
| >80 | 3 | 0.34% | 6 | 1.54% | 9 | 0.7% | | |
| Total | 862 | 100% | 390 | 100% | 1252 | 100% | | |
| **Gender** | | | | | | | | |
| Male | 603 | 70% | 230 | 59% | 833 | 66.5% | 14.537 | 0.000 |
| Female | 259 | 30% | 160 | 41% | 419 | 33.5% | | |
| Total | 862 | 100% | 390 | 100% | 1252 | 100% | | |

Table 3: Total number of pulmonary and extra-pulmonary according to the history of admission, El-Obeid Teaching Hospital, (n = 1252)

| | Diagnosis | | | | |
|---|---|---|---|---|---|
| | Pulmonary TB | | Extra-pulmonary | | |
| Admission history | | | | | Total |
| 2015 | 301 | 34.9% | 124 | 31.8% | 425 |
| 2016 | 290 | 33.6% | 138 | 35.4% | 428 |
| 2017 | 271 | 31.4% | 128 | 32.8% | 399 |
| Total | 862 | 100% | 390 | 100% | 1252 |

Table 4: In-hospital mortality among TB patients, El-Obeid Teaching Hospital, (n = 1252)

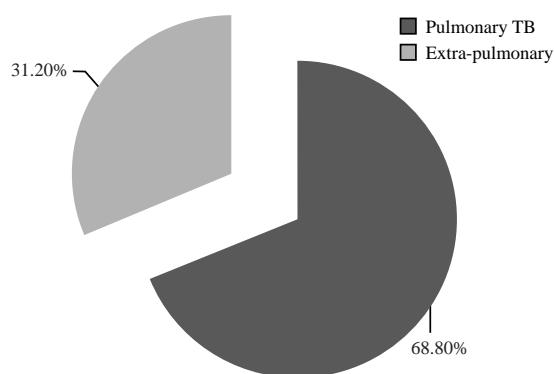| | Diagnosis | | | | | |
|---|---|---|---|---|---|---|
| | Pulmonary TB | | Extra-pulmonary | | Total | |
| In-hospital mortality | | | | | | |
| Yes | 95 | 11% | 58 | 15% | 153 | 12.2% |
| No | 767 | 89% | 332 | 85% | 1099 | 87.8% |
| Total | 862 | 100% | 390 | 100% | 1252 | 100% |
| | p = 0.054 | | df = 1 | | $\chi^2$ = 3.712 | |



Fig. 2: Total number of pulmonary and extra-pulmonary, El-Obeid Teaching Hospital, (n = 1252)

cases to the total number of TB cases per year was as follows: In 2015 it was 34.9%, in 2016 it was 33.6%, in 2017 it was 31.4%, while extra-pulmonary TB cases were 31.8, 35.4 and 32.8% in 2015, 2016 and 2017, respectively. Figure 3 illustrated that (82.7%) of tuberculosis patients fully recovered. The (95%) of patients who completed the treatment and (5%) of tuberculosis patients lost during follow up, given in Fig. 4. As illustrated in Table 4, the in-hospital mortality rate was (12.2%), whereas pulmonary TB was responsible for (11%) of in-hospital death and extra-pulmonary was responsible for (15%). There was a significant relationship between in-hospital mortality and the etiological diagnosis (p = 0.054). There was a highly significant relationship between relapse

Table 5: Total number of pulmonary and extra-pulmonary according to relapse cases, El-Obeid Teaching Hospital, (n = 1252)

| Relapse | Diagnosis | | | | | |
|---|---|---|---|---|---|---|
| | Pulmonary TB | | Extra-pulmonary | | Total | |
| Yes | 48 | 6% | 4 | 1% | 52 | 4.2% |
| No | 814 | 94% | 386 | 99% | 1200 | 95.8% |
| Total | 862 | 100% | 390 | 100% | 1252 | 100% |
| | p = 0.000 | | df = 1 | | $\chi^2$ = 13.920 | |

Table 6: Relapse cases among TB patients according to gender, El-Obeid Teaching Hospital, (n = 1252)

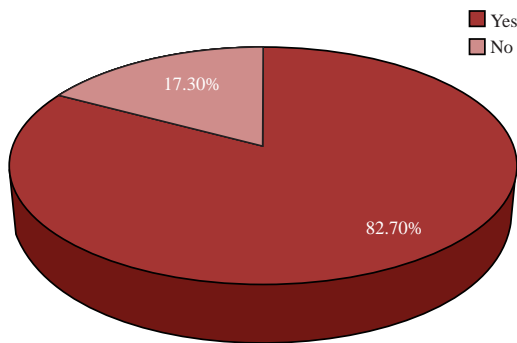| Gender | Relapse cases | | | | | |
|---|---|---|---|---|---|---|
| | Yes | | No | | Total | |
| Male | 39 | 75% | 794 | 66% | 833 | 66.5% |
| Female | 13 | 25% | 406 | 34% | 419 | 33.5% |
| Total | 52 | 100% | 1200 | 100% | 1252 | 100% |
| | p = 0.186 | | df = 1 | | $\chi^2$ = 1.747 | |



Fig. 3: Distribution of TB patients according to completed recovery, El-Obeid Teaching Hospital, (n = 1252)
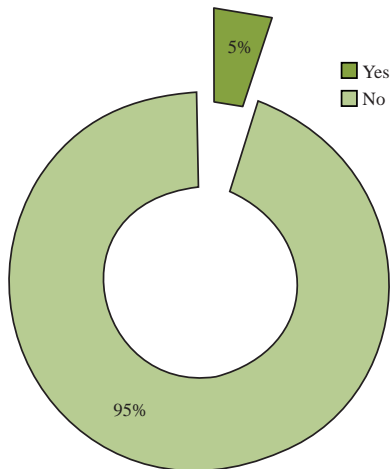


Fig. 4: Distribution of TB patients according to adherence of treatment, El-Obeid Teaching Hospital, (n = 1252)

infection and the etiological diagnosis (p = 0.000), given in Table 5. According to relapse cases among males and females were 75 and 25%, respectively, given in Table 6.

In Table 1, the total tuberculosis patients admitted during the years 2015, 2016 and 2017 were 33.9, 34.2 and 31.9%, respectively.

Table 2 shows that the prevalence of pulmonary TB was beheld in the adult age group of (41-60 years) was (47.56%) while among middle age (21-40 years) was (23.89%). The prevalence of extra-pulmonary TB was beheld in the adult age group of (41-60 years) was (37.18%) while among middle age (21-40 years) was (19.48%).

Table 3 indicated that the percentage of pulmonary TB cases to the total number of TB cases per year was as follows: In 2015 it was 34.9%, in 2016 it was 33.6%, in 2017 it was 31.4%, while extra-pulmonary TB cases were 31.8, 35.4 and 32.8% in 2015, 2016 and 2017, respectively.

**DISCUSSION**

A total of 1252 tuberculosis patients during the period from 2015-2017 were 1252 among the total patients there was (66.5%) male and (33.5%) female.

The present study showed that the tuberculosis cases were highly peaked among males which were (66.5%) than females (33.5%). A study conducted in Bab El Sharia University Hospital showed that (46.4%) of males have prone to TB, while (53.6%) of females[4]. This finding is in disagreement with studies conducted in different parts of the world such as Eritrea, where females (8.2%) were more prone to have a positive tuberculosis smear than males (7.4%)[12].

The high prevalence of TB cases was observed in the age group of (21-40) which was (44.3%) followed by (41-60 years) which was (22.5%). Tuberculosis affects people in their adult

working years, with 80-90% of cases in persons between the ages of 15 and 49[3]. This finding is in disagreement with a previous study conducted in Babol, Iran, where age groups of 18-40 and over 60 years old comprised the majority of patients with TB 39 and 31.5%, respectively[13].

According to the pattern of tuberculosis (68.8%) of tuberculosis patients have suffered from pulmonary TB while (31.2%) of them have suffered from extra-pulmonary. This result is in line with the studies conducted in a different area, in Eastern Sudan, where pulmonary TB accounted for (73.4%) while extra-pulmonary TB was reported in 26.6% of all TB patients[14]. A similar study conducted in Bab El Sharia University hospital showed that there were (54.4%) of patients with pulmonary TB and (45.6%) of them with extra-pulmonary TB[4]. Our findings are in line with a previous study conducted in Egypt, where 81.2% of patients had pulmonary TB and 18.8% had extrapulmonary TB[15].

The prevalence of pulmonary TB was beheld in the adult age group of (41-60 years) was (47.56%) while among middle age (21-40 years) was (23.89%), this finding is in agreement with a previous study conducted in Eritrea, where the highest prevalence of pulmonary TB was observed in the adult age group of 41-60 years (11%)[12].

The study discovered that tuberculosis was responsible for (12.2%) in-hospital mortality rate. This finding is higher than that found in a different area, in Babol, Iran, where (6.5%) died as a result of TB and other causes[13]. A similar study was conducted in Eastern Sudan, (2.8%) of TB patients died[14].

The present study showed that (82.7%) of tuberculosis patients fully recovered. Our finding is consistent with the study by Abdallah and Ali, which showed that (82.1%) of TB patients completely recovered[14]. Our study showed that (5%) of tuberculosis patients lost during follow up. This finding was lower than the study conducted in Eastern Sudan, where (13.6%) of TB patients lost during follow up[14]. The current study revealed that (95%) of patients completed the treatment. This result is in line with the study conducted in Babol, Iran, where (90.5%) were completed the treatment and improved[13]. The present study showed that (4.2%) of tuberculosis patients relapsed. which is comparable to the study conducted in Eastern Sudan, where (1.5%) of TB patients relapsed[14].

The current study has many limitations, such as the short time to conduct the research, lack of some information about the patient and the research is limited to secondary data. Therefore, we recommend that all information about patients and the treatment plan should be recorded and that further studies should be conducted on the factors associated with tuberculosis. This study is of paramount importance as it provides data and results to decision-makers and local health planners that help in developing strategies for the prevention and control of tuberculosis.

## CONCLUSION

This study showed that the highest prevalence of TB was observed in the adult age group of (41-60 years) and among middle age (21-40 years). About two-thirds of tuberculosis patients had suffered from pulmonary TB. Also, about two-thirds of males were found to be more suffered from tuberculosis. There was a highly significant relationship between socio-demographic factors (age and gender) and the etiological diagnosis. There was a significant relationship between in-hospital mortality and the etiological diagnosis. All data about patients admitted to the department of respiratory tract diseases should be listed in an accurate mode using uniform records. There is a need for early detection and treatment of TB cases so as become possible to provide optimal health care and decrease mortality rates.

## SIGNIFICANCE STATEMENT

The study discovered rates of tuberculosis, patterns of tuberculosis infection and relapse cases among tuberculosis patients. This study will help the researcher to uncover the information and evidence about sociodemographic and physical factors associated with tuberculosis. Thus, it will help decision-makers and local health planners to develop strategies and plans for the prevention and control of the disease, according to the database provided by the study.

## ACKNOWLEDGMENTS

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