

## Comparison Study on Tuberculosis Cases in Three Libyan Cities (Tripoli- Zawia- Zuwara)

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### Abstract

Tuberculosis is an infectious disease caused by the bacteria *Mycobacterium tuberculosis*, which is infected by about eight million people worldwide and leads to the death of approximately 1.8 million people annually. The current study aimed to estimate the number of tuberculosis cases in three Libyans (Tripoli. Zawia. and Zuwara) cities and estimate the most infected gender in the years 2008 to 2017. Data was taken from the National Centre for Disease Control (NCDC) register for the years 2008 to 2017. The cases were recorded in Tripoli with 73 cases, 50 males and 23 females. In Zawia, there were 39 cases, 25 males and 14 females. In Zuwara, 32 cases were recorded. The most cases in Tripoli were 20 in 2010 and 24 in 2011, followed by Zuwara with 15 in the same year and only 5 in the Zawia. In 2016-2017, cases were increasing. In Tripoli, 59 cases and 27 cases were recorded in Zuwara and a few in Zawia. 42 cases (33 males, 9 females ) of non-Libyans were recorded in Tripoli 2016-2017, and in Zawia, the same year it was 7 cases (5 males, 2 females ). Through the results, the number of cases has been increasing compared to previous years.

**Keywords:** Tuberculosis, Gender, Tripoli, Zuwara, and Zawia cities

### الملخص

السل مرض معدي تسببه البكتيريا *Mycobacterium tuberculosis* يصاب به حوالي ثمانية مليون شخص حول العالم ويؤدي إلى وفاة ما يقارب 1.8 مليون شخص سنويا. هدفت هذه الدراسة إلى تقدير عدد حالات السل في ثلاث مدن ليبية ( طرابلس، الزاوية،

وزارة ( وتقدير نوع الجنس الأكثر إصابة في السنوات من 2008 إلى 2017. تم أخذ البيانات من سجل المركز الوطني لمكافحة الامراض (NCDC) للسنوات من 2008 الى 2017، حيث سجلت الحالات في طرابلس بعدد 73 حالة كانت 50 من الذكور و 23 إناث وفي الزاوية 39 حالة 25 من الذكور و 14 من الاناث وسجلت في زوارة 32 حالة. كانت أكثر الحالات في مدينة طرابلس 20 حالة في عام 2010 و 24 حالة في 2011 وتليها مدينة زوارة 15 حالة في نفس السنة وكانت في الزاوية 5 حالات فقط. اما في سنة 2016-2017 كان عدد الحالات في تزايد وسُجلت في طرابلس 59 حالة و 27 حالة في زوارة وقليل في الزاوية. وقد بلغ عدد الحالات في سنة 2016-2017 لغير الليبيين في طرابلس 42 حالة وكان عدد الذكور 33 وعدد الاناث 9 حالات وفي مدينة الزاوية في نفس السنة كانت 7 حالات منها 5 ذكور وحالتين إناث. من خلال النتائج، فان عدد الحالات كانت في تزايد مقارنة بالسنوات السابقة.

**الكلمات المفتاحية:** السل، انتشار السل، الجنس، مدن طرابلس، زوارة و الزاوية.

### Introduction:

Tuberculosis (TB) is one of the top 10 causes of death in the world. Around one-third of the world's population is infected with the bacillus called *Mycobacterium Tuberculosis*, and eight million individuals get tuberculosis illness each year, killing 1.8 million people globally. (Kinsi and Nimao, 2019; Ahmed *et al.*, 2013). By applying a novel stain to the sputa of infected patients in 1882, Robert Koch, a Prussian physician, discovered the "tubercle bacillus," i.e., *M. tuberculosis* as the infectious agent of TB.

*M. tuberculosis* is now recognized to be an aerobic, non-motile, slow-growing rod-shaped bacterium belonging to the Mycobacteriaceae family and genus Mycobacterium. Much of *M. tuberculosis*' pathogenic success is due to its unique cell wall, which consists of three types of macromolecules-peptidoglycan, arabinogalactan, and mycolic acids—as well as a capsule (Belard *et al.*, 2019; Kinsi and Nimao, 2019). *Mycobacterium Tuberculosis* typically affects the lungs in 80–90% of cases, with symptoms such as cough, hemoptysis, and difficulty breathing, as well as shortness

of breath, fever, weight loss, and heavy night sweats. Droplets in the air mostly transmit TB (**Kinsi and Nimao, 2019**). Patients with pulmonary TB, the most prevalent form of tuberculosis, may experience chronic cough, hemoptysis, or difficulty breathing. Although TB is most commonly associated with the lungs, it may infect any region of the human body. Furthermore, people infected with tuberculosis bacteria have a 5–10% lifetime risk of contracting the disease. Compromised immune systems, such as those living with HIV, malnutrition, or diabetes, or those who smoke, are more likely to become sick (**WHO, 2021**).

Infection with HIV is the most well known risk factor for TB disease. Diabetes mellitus, severe alcohol use and alcohol use disorders, cigarette smoking, social vulnerability, and environmental exposures are all known variables that raise the risk of TB. In addition, poverty indicators such as crowded living conditions, malnutrition, and exposure to air pollution have been linked to an increased risk of TB. Furthermore, the risk of tuberculosis disease increases with age (**Belard et al., 2019; Gelaw, 2020; Alashavi et al., 2021**). Further, in 2004, the World Health Organization (WHO) proposed integrated TB and HIV collaboration activities, which were updated in 2012 to include steps for combination intervention to reduce mortality from both diseases.

Moreover, population growth, age structure, and migration (internal or external migration), urbanization, education status, poverty, air pollution, and healthcare system characteristics have all been linked to regional variance in the prevalence of tuberculosis.

Globally, TB is one of the world's most deadly infectious diseases, having claimed more lives than any other infectious disease in the past. (**Belard et al., 2019; Hani et al., 2021**). According to the World Health Organization (WHO), about 10 million people fell ill with tuberculosis in 2010, and about 1.5 million individuals died from tuberculosis in 2020. In terms of geographical distribution, the WHO areas of South-East Asia (44%) had the largest proportion of TB patients in 2019, followed by Africa (25%) and the eastern

Pacific (12%). (18 percent). Whereas 8.2% of TB cases were discovered in the Eastern Mediterranean region (**Alashavi et al., 2021**).

The prevalence of tuberculosis is increasing in Libya. During the decade-long conflict, the country's health system has been severely impacted, and the country's National Tuberculosis Program is in critical need of trained people, specialized equipment, and medical supplies (**WHO, 2021**). In addition, according to WHO in 2020, the incidence of TB in Libya remained constant from the previous year, at 59 cases per 100,000 people.

In Libya, there were some studies on this disease. One study found that the incidence of tuberculosis infection in the year 1959 was about 1-2% in the eastern region of Libya. According to the National Center of Tuberculosis and Chest Diseases monitoring in Tripoli city during 2003, about 51% of the 1559 cases in North Western Libya were pulmonary TB cases and the rest were extra pulmonary TB cases. (**Melad et al., 2018**).

The objectives of this study are to estimate and compare the number of TB cases in three cities in Libya: Tripoli, Zuwara, and Zawia in the years from 2008 to 2011 and the years of 2016 and 2017 in the same three cities. Also, estimate which gender is more affected by tuberculosis.

### **Method:**

Data was collected from TB cases registered in the national center for disease control (NCDC) records of three different Libyan cities in the western region of Libya (Tripoli, Zuwara, and Zawia). The study included registered cases from 2008, 2009, 2010 and 2011 and from 2016 and 2017. Tripoli is the capital and largest city of Libya, with a population of three million people in 2019 (**Wikipedia, 2022**). Zuwara is a coastal city. It is situated 102 km (63 mi) west of Tripoli, with an estimated population of 55,893 people in 2021. Zawia is in northwest Libya. It is situated on the Libyan coastline of the Mediterranean Sea about 47 km west of Tripoli, with an

estimated population of 87.316 people in 2021. The TB cases were collected according to different variables such as gender and Libyans and non-Libyans in three different Libyan cities.

### Results:

Table 1 shows the incidence rate of TB. The total number of TB cases was 73 in Tripoli city (50 Libyan males (68.4%) and 23 Libyan females (31.5%)), 39 in Zawia city (25 Libyan males (64.1%) and 14 Libyan females (35.8%)), and 49 in Zuwara (37 Libyan males (75.5%) and 12 Libyan females (24.4%)). The most reported Libyan cases were in Tripoli city; 20 cases (27.3%) in 2010 and 24 cases (32.8%) in 2011, followed by cases in Zuwara city during 2010 and 2011; 15 cases (30.6%) each. In contrast, a lower number of TB cases were in Zawia city in 2010 and 2011; 5 cases (12.8%) each.

From tables 2 and 3, the total number of TB cases (Libyan and non-Libyan) increased in the three cities during 2016 and 2017 compared to previous years. The total number of TB Libyan cases recorded was high in Tripoli city (81 cases), followed by Zuwara city (57 cases), and a low number of cases recorded in Zawia city (40) in 2016 and 2017 respectively. In addition, the total number of TB cases in non-Libyan areas was high compared to previous years too, where there were 59 in Tripoli city and 27 in Zuwara city, followed by a low number of cases in Zawia city (7 cases).

In addition, the total number of TB cases was 59 in Tripoli city (35 non-Libyan males (59.4%) and 24 non-Libyan females (40.6%)), 7 in Zawia city (5 non-Libyan males (71.5%) and 2 non-Libyan female (28.5%)) and 27 in Zuwara city (19 non-Libyan males (70.4%) and 8 non-Libyan females (29.6%)).

**Table 1 shows the number and percentage of TB Libyan and non-Libyan cases among Tripoli, Zawia, and Zuwara's populations from 2008 to 2011**

Libyan cases									
Year	Tripoli			Zawia			Zuwara		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
2008	7 (14%)	5 (21.7%)	12 (16.4%)	9 (36%)	2 (14.2%)	11 (28.2%)	6 (16.2%)	1 (8.3%)	7 (14.2%)
2009	9 (18%)	8 (34.7%)	17 (23.2%)	12 (48%)	6 (42.8%)	18 (46.1%)	8 (21.6%)	4 (33.3%)	12 (24.4%)
2010	16 (32%)	4 (17.3%)	20 (27.3%)	1 (4%)	4 (28.5%)	5 (12.8%)	9 (24.3%)	6 (50%)	15 (30.6%)
2011	18 (36%)	6 (26.08%)	24 (32.8%)	3 (12%)	2 (14.2%)	5 (12.8%)	14 (37.8%)	1 (8.3%)	15 (30.6%)
Total	50 (68.4%)	23 (31.5%)	73	25 (64.1%)	14 (35.8%)	39	37 (75.5%)	12 (24.4%)	49
Non-Libyan cases									
Year	Tripoli			Zawia			Zuwara		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
2008	11 (33.3%)	3 (0.33%)	14 (33.3%)	1 (16.6%)	0 (0%)	1 (14.2%)	3 (50%)	2 (28.5%)	5 (38.4%)
2009	5 (15.1%)	0 (0%)	5 (11.9%)	1 (16.6%)	0 (0%)	1 (14.2%)	3 (50%)	1 (14.2%)	4 (30.7%)
2010	10 (30.3%)	1 (11.1%)	11 (26.1%)	0 (0%)	1 (100%)	1 (14.2%)	0 (0%)	4 (57.1%)	4 (30.7%)
2011	7 (21.2%)	5 (55.5%)	12 (28.5%)	4 (66.6%)	0 (0%)	4 (57.1%)	0 (0%)	0 (0%)	0 (0%)
Total	33 (78.5%)	9 (21.4%)	42	6 (85.4%)	1 (14.2%)	7	6 (46.1%)	7 (53.8%)	13

**Table 2 shows the number and percentage of TB Libyan cases among Tripoli, Zawia, and Zuwara populations from 2016 and 2017.**

TB Libyan cases									
Year	Tripoli			Zawia			Zuwara		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
2016	20	25	45	11	6	17	12	10	22
2017	26	10	36	15	8	23	20	15	35
Total	46 (56.7%)	35 (43.3%)	81 (100%)	26 (65%)	14 (35%)	40 (100%)	32 (56.2%)	25 (43.8%)	57 (100%)

**Table 3 shows the number and percentage of TB non-Libyan cases among Tripoli, Zawia, and Zuwara populations from 2016 and 2017.**

TB non-Libyan cases									
	Tripoli			Zawia			Zuwara		
Year	Male	Female	Total	Male	Female	Total	Male	Female	Total
2016	15	10	25	2	0	2	7	4	11
2017	20	14	34	3	2	5	12	4	16
Total	35 (59.4%)	24 (40.6%)	59 (100%)	5 (71.5%)	2 (28.5%)	7 (100%)	19 (70.4%)	8 (29.6%)	27 (100%)

### Discussion:

This study was conducted to determine whether there has been an increase in the number of tuberculosis cases in three Libyan cities (Tripoli, Zawia, and Zuwara) when compared to instances in 2016 and 2017. Another aim of this investigation was to determine which gender is most affected by TB. What we found in this study is that the incidence rate of Libyan cases was higher in Tripoli and Zuwara than in Zawia. This may be related to the fact that these cities are industrial cities compared to Zawia (**Pathak et al., 2020; Ginafon et al., 2011**). A power plant system emits gases that can cause a variety of respiratory conditions and may increase the chance of developing TB. However, gas emissions from a power station and a petroleum industry have also been linked to TB cases in Zawia, which indicates that this is the major cause of the disease.

Regarding patient gender, the results of this research are consistent with those of previous studies (**Awatef et al., 2011; Melad et al., 2018; Raja et al., 2018**). Males rather than females are more frequently diagnosed with new cases of TB. This could be because males often work and engage in more social interaction than females. As a result, there would be a higher chance of contracting infections from infected people.

The high incidence of TB cases in 2016 and 2017, which is related to a severe shortage of TB medications provided by WHO in the nation, was another significant result in this study. Also, recent rates

of illegal migration have increased beyond borders without proper health surveillance, accompanying malnutrition and other factors that increase prevalence and infection rates in the population. Among the more than 1500 new cases of tuberculosis reported during this time were more than 80 children. In addition, in Libya, TB is becoming more common. The ten-year conflict has had a significant impact on the nation's health system (WHO, 2018; WHO, 2021).

Infection disorders in children and adults with TB infection are significantly influenced by environmental variables. According to a study by Lestari *et al*, 2011 living with TB patients might influence children in the same house because of the high humidity, which is a key factor in the transmission of the disease. The coastal cities in Libya that are part of our study have high humidity levels.

This study has significant limitations, including the inability to obtain some important information, such as age, and the insufficient information on the age group most affected by TB. However, several studies have shown that TB mostly affects people between the ages of 25 and 34, followed by people between the ages of 15 and 25. (Awatef *et al.*, 2011; Raja *et al.*, 2018)

### Conclusion:

It can be concluded that the incidence of TB among males was more than in females in the three cities. The most reported Libyan cases were in Tripoli city in 2011, followed by cases in Zuwara city during 2010 and 2011. The number of TB Libyan cases recorded was high in Tripoli city, followed by Zuwara and Zawia cities, ,respectively in 2016 and 2017.

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