

Evaluating Predictive Factors Impacting Tuberculosis Treatment Outcomes

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ABSTRACT: Tuberculosis (TB) is an infectious disease that can cause infection in lungs or other tissues. It commonly affects lungs, but it can also affect other organs like spine, brain, or kidneys. TB is caused by the bacterium *Mycobacterium tuberculosis*. The germs are spread through the air and usually infect the lungs, but can also infect other parts of the body. This work aims to provide valuable insights into the factors influencing Tuberculosis treatment success and could help improve patient management strategies and treatment protocols. The source of the data used for the analysis is the University of Ilorin Teaching Hospital. The data on gender, age, length of stay in the hospital, year of admission, outcome of treatment, and diagnosis (type of Tuberculosis) of patient was obtained. The data is for the period of 12 years (2013-2024). In the attempt to carry out successful work on this study, Microsoft Excel and R-Programming were used to clean and analyze the data and to also plot some necessary graphs.

KEYWORDS: TB, Age group and gender, correlation and regression analysis

I. INTRODUCTION

The word health refers to a state of complete emotional, mental, and physical well-being. Healthcare exists to help people stay well in these key areas of life. Good health is central to handling stress and living a longer, more active life. Tuberculosis (TB) is an infectious disease that can cause infection in your lungs or other tissues. It commonly affects your lungs, but it can also affect other organs like your spine, brain, or kidneys. The word "tuberculosis" comes from a Latin word for "nodule" or something that sticks out. TB is caused by the bacterium *Mycobacterium tuberculosis*. The germs are spread through the air and usually infect

the lungs, but can also infect other parts of the body. Although TB is infectious, it doesn't spread easily. You usually have to spend a lot of time in contact with someone contagious to contract it (WHO Global TB Report 2021).

A lot of research has been undergone on Tuberculosis such as in Bodunwa et al.(2021) reported cases of Tuberculosis diseases and those that co-infected with HIV among different age groups and gender between 2016 and 2020 in Ondo State, Nigeria and the result showed that the proportions of gender is found to be significant meaning that TB infection rate is higher in males compared to female. This supports the fact that Pulmonary Tuberculosis which is contagious is expected to occur more frequently than extra pulmonary tuberculosis. Domingos et al. (2024) and Shital et al. (2023) used of data quality metrics such as: completeness, variance and temporality aligned with assistive tools for evaluating and monitoring data collected in TB research can positively impact strategies that make data discoverable, accessible, interoperable and reusable in other surveys. Despite all the valuable contributions to TB research over the years produced by the reference center in research for tuberculosis, the present case study can infer that the databases used in such Brazilian studies do not follow the quality criteria described in the literature. as described by the FAIR principles. One of the limitations of the research was the number of metrics used to determine data quality, there are several metrics described and well known in the literature that provide information about failures in data collection and maintenance [Bernardi, 2022 & Feder, 2017]. Olusoji et al. (2022) demonstrated the usefulness of the Bayesian modelling approach in the disease mapping of LGAs with the elevated

risk of TB in Nigeria and the analysis can complement routine surveillance and assist program managers and policymakers to make evidence based informed decisions to rationally allocate resources and plan targeted local interventions to the identified. Olanrewaju et al. (2020) clearly showed from the projection that the reported cases of tuberculosis reduce year by year by 7% over the period under consideration which could be as a result of intervention from government, health worker, and individuals. In line with these findings, we recommend that the management of general hospital to increase awareness campaign to the public on the causes and dangers of tuberculosis.

Lv et al. (2024) concluded that among the eight high-burden countries, the Philippines, India and Indonesia are diverging from the goals set by the WHO, and the risk of TB in the Philippines and the DRC shows a trend toward affecting. Others who worked on TB are Akande (2020); Behr et al. (2019); Fadare et al. (2020); Oga Omekunle et al. (2021); Ogbuabor (2020); Oladimeji et al. (2021); Tihamiyu et al. (2020); Ugwu et al. (2020); Umekunkwo et al. (2020). Even some explored the aspect of mathematical concepts which are Omoloye et al. (2021a); Omoloye et al. (2021b); Omoloye et al. (2021c); Omoloye et al. (2021d); Omoloye et al. (2021e); Afolabi et al. (2020); Afolabi et al. (2021); Omoloye and Adewale (2021); Afolabi et al. (2022); Yunus and Omoloye (2022); Musibau et al. (2022); Akeem et al. (2023); Emmanuel et al. (2023) to study TB and other infectious diseases. This work aims to provide valuable insights into the factors influencing Tuberculosis treatment success and could help improve patient management strategies and treatment protocols.

The Objectives are to:

- Analyze how age and gender affect the success rates of tuberculosis treatments.
- Investigate the relationship between the length of hospital stay and age.
- Determine which factors are most strongly associated with poor treatment outcomes.
- Identify any significant patterns or trends in the data, such as seasonal variations or differences in outcomes by demographic subgroups.
- Use statistical methods to create models that predict the length of stay based on age.

In the attempt to carry out successful work on this study, Microsoft Excel and R-Programming were used to clean and analyze the data and to also plot some necessary graphs. R is a programming language for statistical computing and data visualization. It has been adopted in the fields of data mining, bioinformatics, and data analysis. The variables considered are gender, age, length of stay in the hospital, year of admission, outcome of treatment, and diagnosis (type of Tuberculosis). The data is for the period of 12 years (2013-2024). The study will limit its analysis to the University of Ilorin Teaching Hospital (UIH) based on the targeted objectives of tuberculosis. The data collected for this study may or may not indicate the total number of affected patients but the number of occurrences within the country on a specified period as they have been recorded in the hospitals' records.

II. MATERIALS AND METHODS

The data was collected from the University of Ilorin Teaching Hospital and it contains six (6) variables, namely; Year (the year the patient was admitted), Age (how old the patient was), Gender (male or female), Length of stay (how long the patient was admitted in the hospital), TB category (type of TB diagnosed) and Status (if the patient survived or not. i.e., alive or dead). The data was collected from 2013 to 2024 with six hundred and ninety-four (694) patients recorded and diagnosed with only Pulmonary Tuberculosis (PTB). Some programming and analysis software were used for the success and accomplishment of this project. The software used for the analysis are R-Programming, Microsoft Excel, and Power BI.

R is a programming language for statistical computing and data visualization. It has been adopted in the fields of data mining, bioinformatics, and data analysis.

Microsoft Excel is a spreadsheet editor developed by Microsoft for Windows, macOS, Android, iOS, and iPadOS. It features calculation or computation capabilities, graphing tools, pivot tables, and a macro programming language called Visual Basic for Applications (VBA). Microsoft Power BI is an interactive data visualization software product developed by Microsoft with a primary focus on business intelligence. It is part of the Microsoft Power Platform. Power BI is a collection of software services, apps, and connectors that work together to turn various sources of data into static and interactive data visualizations.

The data was loaded into Excel and two new columns were created: Age group (the age was grouped into 9) and weeks (the length of stay in days was converted to weeks). This was achieved by following the steps below;

For Age group;

1. Uploaded the data into Power Query in Excel
2. Click on Add Column (can be seen on the Ribbon) and then click on conditional column (a small window pops up)
3. Input a desired name for the new column (Age group)
4. If (select AGE), operator (is less or equal), value (9), output (0-9)
5. Click on Add Clause
6. If (select AGE), operator (is less or equal), value (19), output (10-19)
7. Repeat step 5 and step 6 until the output is 70-79
8. Else 80 and above
9. Click on OK

For Weeks;

1. Click on Add Column (can be seen on the Ribbon) and then click on conditional column (a small window pops up)
2. Input a desired name for the new column (Weeks)
3. If (select Length of stay), operator (is less or equal), value (7), output (Week 1)
4. Click on Add Clause
5. If (select Length of stay), operator (is less or equal), value (14), output (Week 2)
6. Repeat step 5 and step 6 until the output is Week 16
7. Else Week 17
8. Click on OK

After creating the two columns, click on Home and then click on Close & Load. The document was saved as an Excel Workbook and Comma Separated Value (CSV) file. The Comma separated value (CSV) file was uploaded into R-Programming and some analysis like correlation analysis, was done to check the relationship between length of stay and age. A regression model was also done between length of stay and age for prediction. Some tables and charts were also generated. All codes used for the analysis in R can be seen in the appendix.

Only one diagnosis of TB was available for this work. The total number of cases considered for this analysis is 694 and the age range of the patient is 0-93, the range of length of stay is 1-119. The Summary of the data is given in the Table below; where SD is the Standard Deviation

III. RESULTS AND DISCUSSION

Table 4.1. Summary

	Mean	Median	SD	Min	Max	Range
Age	50.72	55	21.99	1	93	92
Length of Stay	15.48	11	16.43	1	119	118

The age was grouped into nine (9) (i.e., 0-9, 10-19, ..., 80 and above) and the length of stay was grouped into weeks (i.e., week 1, week 2, ..., week 17).

Table 4.2. Total cases by Age group and gender

Row Labels	FEMALE	MALE	Grand Total
0-9	10	15	25
10-19	16	17	33
20-29	44	41	85
30-39	44	45	89
40-49	23	45	68
50-59	23	67	90
60-69	11	110	121
70-79	21	107	128
80 and above	3	52	55
Grand Total	195	499	694

4.1.2 Trend of Tuberculosis cases per Year



Figure 4.7. Trend of tuberculosis cases in the Year 2013

Table 4.3. Trend of tuberculosis cases per week in the Year 2013

Row Labels	ALIVE FEMALE	ALIVE MALE	DEAD FEMALE	DEAD MALE	Grand Total
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Week 1	3	5	8	1	6	7	15
Week 2	3	6	9		10	10	19
Week 3		5	5		2	2	7
Week 4					1	1	1
Week 5		2	2		1	1	3
Week 8		1	1				1
Week 7		1	1				1
Week 6					1	1	1
Grand Total	6	20	26	1	21	22	48

The total number of cases had this year is 48 (7%) of which 41 (85%) are male and 7(15%) are female and 26 (54%) survived while 22 (46%) died. The highest number of cases by age group is 14 (3 females and 11 males) cases (50-59 age group) with 4 deaths recorded within this age group (all male). The second highest age group is 60-69 with 12 cases (3 females and 9 males), and 6 deaths recorded (1 female and 5 males). The least age group is 40-49 with only 4 cases (all male) and out of these 4 cases, only one survived. In this year, no female was admitted in the 40-49 and 70-79 age groups and nobody was admitted for 0-39 years. Nobody was admitted for more than 8 weeks and years out of the 22 deaths week 2 has the highest record of 10 (all male) out of 3 females and 16 males admitted. For the two patients admitted for 7 and 8 weeks (1 each), no death was recorded. No female was admitted for more than 2 weeks and out of the 7 females admitted only one death was recorded (the first week) out of the 41 males, 21 deaths were recorded from week 1 to week 6.



Figure 4.8. Trend of tuberculosis cases in the year 2014

Table 4.4. Trend of tuberculosis cases per week in the year 2014

Row Labels	ALIVE	ALIVE Total	DEAD	DEAD Total	Grand Total
	MALE		MALE		
Week 1	4	4	3	3	7
Week 2	4	4	2	2	6
Week 3	1	1	2	2	3
Week 4	2	2			2
Week 5	1	1	1	1	2
Week 6			1	1	1
Week 17			1	1	1
Grand Total	12	12	10	10	22

The total number of cases had this year is 22 (3%) of which are all male and 12 (55%) survived while 10 (45%) died. The highest age group admitted is the 70-79 age group with 9 cases followed by 50-59 and 60-69 with 5 cases each. Out of the 9 admitted for the 70-79 age group, 5 deaths were recorded one (1) death for the 50-59 age group and 2 deaths for the 60-69 age group. The least age group admitted for this year is 80 and above with only one case. In this year, 1 patient was admitted for up to 17 weeks and this patient did not survive (aged 70). No case was recorded between the ages of 0-19 and 30-49.

Table 4.5. Trend of tuberculosis cases per week in the Year 2015

Row Labels	ALIVE		ALIVE Total	DEAD		DEAD Total	Grand Total
	FEMALE	MALE		FEMALE	MALE		
Week 1	1	8	9		3	3	12
Week 2	4	14	18	1	4	5	23
Week 3		3	3		3	3	6
Week 5		1	1		1	1	2
Week 8					1	1	1
Week 7					1	1	1
Week 6		2	2				2
Grand Total	5	28	33	1	13	14	47



Figure 4.9. Trend of tuberculosis cases in the Year 2015

The total number of cases this year is 47 (7%) of which 41 (87%) are male and 6 (13%) are female and 33 (70%) survived while 14 (30%) died. The highest age group admitted for this year is 70-79 with 14 cases (4 females and 10 males) out of these, 3 deaths were recorded (all male). The next highest age group is 50-59 with 11 cases (2 females and 9 males), 5 deaths were recorded for this age group (1 female and 4 males). The least age group admitted is 40-49 with 5 cases (all males) with no death recorded. No case was admitted between the age of 0 and 39 and no female within 40-49, 60-69, 80 and above was admitted. The week with the highest admission is 2 weeks with 23 cases (18 males and 5 females) out of which 5 deaths were recorded (1 female and 4 males). No female was admitted for more than two weeks and no case for more than 8 weeks. In this year, only one female died (week 2).

Table 4.6. Trend of tuberculosis cases per week in the year 2016

Row Labels	ALIVE		ALIVE Total	DEAD		DEAD Total	Grand Total
	FEMALE	MALE		FEMALE	MALE		
Week 1	2	2	4	1	4	5	9
Week 2	2	4	6	2	3	5	11
Week 3		3	3		1	1	4
Week 5					1	1	1
Week 6					1	1	1
Week 16					1	1	1
Week 10					1	1	1
Grand	4	9	13	3	12	15	28

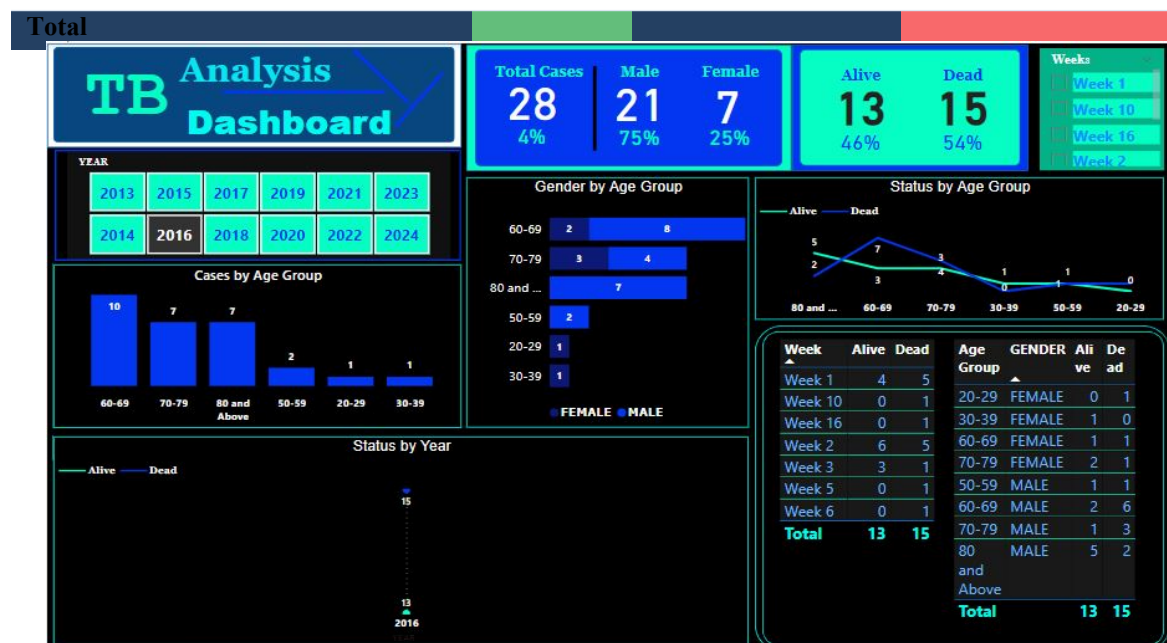


Figure 4.10. Trend of tuberculosis cases in the year 2016

The total number of cases had this year is 28 (4%) of which 21 (75%) are male and 7 (25%) are female and 13 (46%) survived while 15 (54%) died. The age group with the highest cases is 60-69 with 10 cases (2 females and 8 males). This age group also has the highest number of deaths which is 7 (1 female and 6 males). The next highest age groups are 70-79 & 80 and above with 7 cases each. For the 70-79 age group we have (3 females and 4 males) with 4 deaths (1 female and 3 males) recorded. For the 80 and above age group, all cases are male with 2 deaths recorded. The lowest age group is 30-39 with only one case and no death recorded. No male was admitted from the age of 0 to 49 this year and no female was admitted in the age groups 50-59 & 80 and above. The week with the highest admission is week 2 with 11 cases (7 males and 4 females) followed by week 1 with 9 cases (3 females and 6 males). These two weeks (week 1 and week 2) have the highest number of deaths with 5 cases each. For week 1 (1 female and 4 males) while for week 2 (2 females and 3 males). No female was admitted for more than 2 weeks and 2 cases were admitted for up to 10 and 16 weeks (1 each) both male.

Table 4.7. Trend of tuberculosis cases per week in the year 2017

Row Labels	ALIVE		DEAD		Grand Total
	FEMALE	MALE	FEMALE	MALE	

Week 1	9	7	16	3	8	11	27
Week 2	11	6	17	5	6	11	28
Week 3	4	5	9		1	1	10
Week 4		2	2	1	2	3	5
Week 5		2	2				2
Week 9	1		1				1
Week 8		1	1				1
Week 7	1		1				1
Week 11		1	1				1
Week 6	1		1				1
Grand Total	27	24	51	9	17	26	77



Figure 4.11. Trend of tuberculosis cases in the year 2017

The total number of cases this year is 77 (11%) of which 41 (53%) are male and 36 (47%) are female and 51 (66%) survived while 26 (34%) died. The age group with the highest number of cases is 20-29 with 20 cases (12 females and 8 males); this age group also has the highest number of deaths with 7 cases (4 females and 3 males). The second highest age group is 30-39 with 18 cases (10 females and 8 males), and 5 cases reported dead (1 female and 4 males). The least age group admitted in this year is the 80 and above age group, no females admitted in 60-69 and 80 and above age groups. 6 cases were recorded for the 0-9 age group (2 females and 4 males) with 3 deaths (1 female and 2 males). Week 2 has the highest number of cases with 28 cases (12 males and 16 females). The next highest is week 1 with 27 cases (15 males and 12 females). These two weeks (week 1 and week 2) have the highest number of deaths recorded, which is 11 each for week 1 (3 females and 8 males)

while week 2 (5 females and 6 males). One case (male) was admitted for up to 11 weeks and survived.

Table 4.8. The Trend of Tuberculosis Cases by Week in the Year 2018

Row Labels	ALIVE		ALIVE Total	DEAD		DEAD Total	Grand Total
	FEMALE	MALE		FEMALE	MALE		
Week 1	2	17	19	8	7	15	34
Week 2	9	8	17	4	5	9	26
Week 3	7	6	13		5	5	18
Week 4	2	7	9	3	1	4	13
Week 5	2	2	4	4	2	6	10
Week 15		2	2				2
Week 9		1	1				1
Week 8	1		1		1	1	2
Week 7	2		2				2
Week 11		1	1				1
Week 6	1	2	3	2		2	5
Week 12		1	1				1
Week 14		1	1				1
Grand Total	26	48	74	21	21	42	116



Figure 4.12. Trend of tuberculosis cases in the year 2018

The total number of cases this year is 116 (17%) of which 69 (59%) are male and 47 (41%) are female and 74 (64%) survived while 42 (36%) died. The age group with the highest cases is 30-39 with 25 cases (12 females and 13 males) for this age group 10 deaths (7 females and 3 males) were recorded. The second highest age group is 20-29 with 24 cases (10 females and 14 males), 10 deaths (7 females and 3 males) were also recorded. The

age group with the least cases is 80 and above with only one case (female) and the patient survived after staying for about 4 weeks. Two cases (males) within the 30-39 age group were admitted for about 15 weeks and they both survived. The week with the highest number of admissions is week 1 with 34 cases (10 females and 24 males), week one also has the highest number of deaths with 15 deaths (8 females and 7 males) recorded. The week with the

second highest admission is week 2 with 26 cases (13 females and 13 males) and also has the second highest number of deaths with 9 deaths (4 females and 5 males) recorded. No female was admitted for more than 8 weeks. In this year, cases lasted up to 15 weeks but no death was recorded from week 9.

Table 4.9. The Trend of Tuberculosis Cases by Week in the Year 2019

Row Labels	ALIVE		ALIVE Total	DEAD		DEAD Total	Grand Total
	FEMALE	MALE		FEMALE	MALE		
Week 1	7	8	15	4	6	10	25
Week 2	11	7	18	2	4	6	24
Week 3	6	7	13	1	4	5	18
Week 4	3	4	7	2	2	4	11
Week 5	3	1	4				4
Week 9		2	2	1		1	3
Week 6	3	2	5	1		1	6
Week 12					1	1	1
Week 16	1		1				1
Week 17		1	1				1
Grand Total	34	32	66	11	17	28	94



Figure 4.13. Trend of tuberculosis cases in the year 2019

The total number of cases this year is 94 (14%) of which 49 (52%) are male and 45 (48%) are female and 66 (70%) survived while 28 (30%) died. The age group with the highest cases is 30-39 with 22 cases (10 females and 12 males), and 6 deaths (2 females and 4 males) recorded. The second highest age group is 40-49 with 21 cases

(10 females and 11 males) and 9 deaths (1 female and 8 males) which is the highest death recorded by age group. The least age group is 80 and above with only 1 case (female) and the patient survived. Age group 0-9 had 7 cases (3 females and 4 males) and 1 case (male) lasted up to 9 weeks but no death was recorded. The first week has the highest

number of cases which is 25 cases (11 females and 14 males), 10 deaths (4 females and 6 males) were recorded for week 1 which is the highest death by week. The second highest week 2 with 24 cases (13 females and 11 males), with 6 deaths (2 females and 4 males) recorded which is the second highest death by week. Two (2) cases (1 female and 1 male) lasted up to week 17 and week 16 respectively and both survived.

Table 4.10. Trend of tuberculosis cases per week in the year 2020

Row Labels	ALIVE		ALIVE Total	DEAD		DEAD Total	Grand Total
	FEMALE	MALE		FEMALE	MALE		
Week 1	4	4	8		3	3	11
Week 2	6	5	11	2	2	4	15
Week 3	4	9	13	1		1	14
Week 4	4	4	8	1		1	9
Week 5	3	3	6				6
Week 15					1	1	1
Week 9		1	1				1
Week 8	1	1	2				2
Week 7					1	1	1
Week 11		1	1				1
Grand Total	22	28	50	4	7	11	61



Figure 4.14. Trend of tuberculosis cases in the year 2020

The total number of cases this year is 61 (9%) of which 35 (57%) are male and 26 (43%) are

female and 50 (82%) survived while 11 (18%) died. The age group with the highest cases is 20-29

with 15 cases (10 females and 5 males), 2 deaths (females) only was recorded. The second highest age group is 30-39 with 14 cases (8 females and 6 males), and only 2 deaths (1 male and 1 female) also recorded. The least age group is 80 and above with only 1 case that was admitted for about 2 weeks and survived. No death was recorded for the 0-9, 10-19, 70-79, and 80 and above age groups. In the 60-69 age group, no female was admitted. Week 2 had the highest number of cases which is 15 cases (8 females and 7 males), 4 deaths (2 females and 2 males) were recorded which is the highest number of deaths by week. The second highest number of cases by week is week 3 with 14 cases (5 females and 9 males) and only one death (female) recorded. One case (male) lasted for about 15 weeks but didn't survive. From week 5 to week 15 only 2 deaths were recorded.

Table 4.11. Trend of tuberculosis cases per week in the year 2021

Row Labels	ALIVE		ALIVE Total	DEAD		DEAD Total	Grand Total
	FEMALE	MALE		FEMALE	MALE		
Week 1	1	6	7	1	18	19	26
Week 2	6	3	9	1	7	8	17
Week 3	1	4	5	1	5	6	11
Week 4	2		2				2
Week 5					1	1	1
Week 8	1		1				1
Week 7		1	1		1	1	2
Week 6	1		1		1	1	2
Grand Total	12	14	26	3	33	36	62



Figure 4.15. Trend of tuberculosis cases in the year 2021

The total number of cases this year is 62 (9%) of which 47 (76%) are male and 15 (24%) are female and 26 (42%) survived while 36 (58%) died. The highest age groups are 50-59 and 60-69 with 10 cases each (for 50-59, 2 females and 8 males while for 60-69, 1 female and 9 males). For 50-59, 8 deaths (1 female and 7 female) were recorded while for 60-69, all the males died (this made 60-69 the highest death by age group). The second highest age group is 30-39 with 9 cases (3 females and 6 males) with only 2 deaths (1 male and 1 female) recorded. No female was admitted between 70-79 and 80 and above age groups and the total male cases for these two ages is 15 and total death is 13. No death was recorded for 0-9 age group. The week with the highest cases is week 1 with 26 cases (2 females and 24 males), week 1 also has the highest number of deaths with 19 deaths (1 female and 18 males) recorded. The second highest week is week 2 with 17 cases (7 females and 10 males) and 8 deaths (1 female and 7 males) recorded. No cases were admitted for more than 8 weeks.

Table 4.12. Trend of tuberculosis cases per week in the year 2022

Row Labels	ALIVE	ALIVE Total	DEAD	DEAD Total	Grand Total
	MALE		FEMALE	MALE	
Week 1	10	10	1	18	29
Week 2	6	6		3	9

Week 3	2	2	3	3	5
Week 5	1	1	2	2	3
Week 7			1	1	1
Grand Total	19	19	27	28	47



Figure 4.16. Trend of tuberculosis cases in the year 2022

The total number of cases had this year is 47 (7%) of which 46 (98%) are male and 1 (2%) are female and 19 (40%) survived while 28 (60%) died. The highest age group is 60-69 with 22 cases (1 female and 21 males), and 15 deaths were recorded (1 female and 14 males). The second highest age group is 70-79 with 14 cases out of which 9 deaths were recorded. The least age group is 40-49 with only 1 case and no death. No case was admitted for 0-9, 10-19, 20-29, and 30-39 age groups. No death was recorded for the 50-59 age group. Week 1 has the highest number of cases with 29 cases (28 females and 1 male) out of which 19 (1 female and 18 male) deaths were recorded. The second highest is week 2 with 9 cases and 3 deaths recorded, only one case lasted up to 7 weeks (male) but didn't survive.

Table 4.13. Trend of tuberculosis cases per week in the year 2023

Row Labels	ALIVE MALE	ALIVE Total	DEAD MALE	DEAD Total	Grand Total
Week 1	10	10	13	13	23
Week 2	11	11	4	4	15
Week 3	4	4			4

Week 4	1	1	2	2	3
Week 5			1	1	1
Week 9	2	2			2
Week 7	1	1			1
Grand Total	29	29	20	20	49



Figure 4.17. Trend of tuberculosis cases in the year 2023

The total number of cases had this year is 49 (7%) of which 49 (100%) are male and 0 (0%) are female and 29 (59%) survived while 20 (41%) died. No female was diagnosed with PTB in the year 2023. The age group with the highest cases is 70-79 with 23 cases out of which 5 deaths were recorded. The second highest is 60-69 with 21 cases out of which 13 deaths were recorded and the least is 80 and above with 5 cases out of which 2 deaths were recorded, and only 3 age group cases were recorded in this year (70-79, 60-69 and 80 and above). The week with the highest number of cases is week 1 with 23 cases, 13 deaths were recorded for this week which is the highest by week. The second highest is week 2 with 15 cases and 4 deaths recorded. No case stayed for more than 9 weeks.

Table 4.14. Trend of tuberculosis cases per week in the year 2024

Row Labels	ALIVE		ALIVE Total	DEAD	DEAD Total	Grand Total
	FEMALE	MALE		MALE		
Week 1	2	14	16			16
Week 2	3	14	17	2	2	19
Week 3		3	3			3
Week 4		1	1			1
Week 5		2	2	1	1	3

Week 6	1	1		1		
Grand Total	5	35	40	3	3	43



Figure 4.18. Trend of tuberculosis cases in the year 2024

This data was collected for the period of the first six (6) weeks in this year (2024) and the total number of cases for this year so far is 43 (6%) of which 38 cases (88%) are males and 5 (12%) cases are female and 40 (93%) survived while 3 (7%) died. No cases for the age groups 0-9, 10-19, 20-29 and 30-39. The age group with the highest cases is 70-79 with 19 cases (3 females and 16 males) with only 2 deaths (males) recorded. The second highest age group is 60-69 with 9 cases (males) and only 1 death recorded. The lowest age group is 40-49, with only 3 cases (males) and no deaths recorded. The highest number of cases by week is 19 cases (3 females and 16 males) in week 2 with 2 deaths recorded, which is the highest death by week. The second highest is week 1 with 16 cases (2 females and 14 males) and no death recorded. No death was recorded in week 1, week 3, week 4, and week 6.

4.1 Correlation Analysis

A correlation analysis was done using R programming to determine the degree of relationship between the length of stay in the hospital and the age of the patient. The value obtained is approximately -0.169, implying a weak negative relationship (i.e., as age increases, the length of stay decreases and vice versa) between the length of stay in the hospital and the patient's age.

IV. REGRESSION ANALYSIS

The formula below is a regression formula used to estimate relationships between a dependent variable and one or more independent variables.

$$Y = mX + b$$

Where, Y = Dependent variable, X = Independent variable, m = Slope, and b = Intercept

A regression analysis was also modeled using R programming. This was done using the length of stay as the dependent variable and the age of the patient as the independent variable and the result is seen below;

Coefficients:

	Estimate	Std. Error	t value
(Intercept)	21.89988	1.54718	14.155
AGE	-0.12649	0.02799	-4.519

Residual standard error: 16.2 on 692 degrees of freedom

Multiple R-squared: 0.02867, Adjusted R-squared: 0.02726

F-statistic: 20.42 on 1 and 692 DF, p-value: 7.297e-06 (0.000007297)

Therefore, the formula above becomes;

$$Y = 21.89988 - 0.12649X$$

Where, Y = Length of stay and X = Age

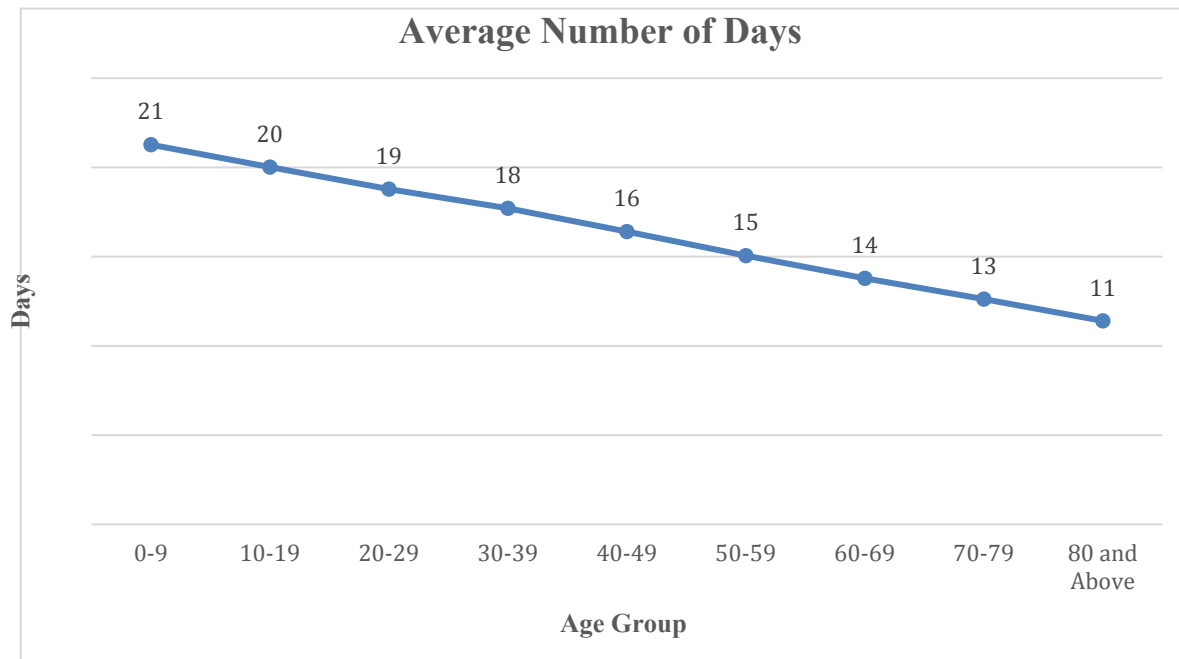


Figure 4.19. Average number of days in the hospital

The above line graph uses the regression formula ($Y = 21.89988 - 0.12649X$) to predict how long a patient will stay in the hospital given the age group the patient age falls in.

4.3 Hypothesis

H_0 : Age does not significantly affect the length of stay

H_1 : Age significantly influences the length of stay
Given, $\alpha = 0.05$ (5%). This means there's a 5% risk of rejecting the null hypothesis when it is true.

The p-value from the regression analysis above is 0.000007279 which is less than 0.05. This means we reject the null (H_0) hypothesis and accept the alternative hypothesis (H_1) which states that Age significantly influences the length of stay.

V. CONCLUSION

This work provided valuable insights into the factors influencing Tuberculosis treatment success and could help improve patient management strategies and treatment protocols. The analysis also includes correlation and regression which shows the relationship and model between age and length of stay in the hospital.

Some of the results gotten are:

1. Males age 50 and above are prone to TB and 45% of this age group die of TB, while

females within this age group are not prone to TB and 31% die of TB.

2. Children between the ages 1-19 have a higher survival rate.
3. Comparing 2024 and 2014, 22 cases in 2014 with 10 deaths recorded and 43 cases in 2024 with only 3 deaths recorded, this implies there is an improvement in tackling TB.
4. The correlation analysis carried out shows that there is a negative relationship between age and length of stay in the hospital, i.e., there is an inverse relationship between the two variables.

The regression model ($Y = 21.89988 - 0.12649X$) can be used to predict the length of stay in the hospital, given the patient's age.

VI. RECOMMENDATION

1. health sector should create awareness about TB to the general public especially to men aged 50 and above because one of the symptoms is cough which some people take or treat casually.
2. Children should be vaccinated young to avoid contracting TB.

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