THE EFFECTS OF COVID-19 ON TUBERCULOSIS CASE DETECTION AND TREATMENT OUTCOMES: ANALYSIS OF ROUTINE TUBERCULOSIS PROGRAM DATA IN DAR ES SALAAM REGION, TANZANIA

Aman Kajange Wilfred, BSc

MSc (Project Management, Monitoring and Evaluation in Health) Dissertation.

Muhimbili University of Health and Allied Sciences

October, 2024

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

SCHOOL PUBLIC HEALTH AND SOCIAL SCIENCES (SPHSS)

MASTER OF SCIENCE IN PROJECT MANAGEMENT, MONITORING AND EVALUATION IN HEALTH (MSc PMMEH)

DISSERTATION RESEARCH REPORT

THE EFFECTS OF COVID-19 ON TUBERCULOSIS CASE DETECTION AND TREATMENT OUTCOMES: ANALYSIS OF ROUTINE TUBERCULOSIS PROGRAM DATA IN DAR ES SALAAM REGION, TANZANIA

By

Aman Kajange Wilfred

REG NO: HD/MUH/T.585/2022

A Dissertation submitted in Partial Fulfillment of the Requirement for the Degree of Master of Science in Project Management, Monitoring and Evaluation in Health of the Muhimbili University of Health and Allied Sciences

October, 2024

CERTIFICATION

The undersigned certifies that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled **"The Effects of COVID-19 on Tuberculosis Case Detection and Treatment Outcomes: Analysis of Routine Tuberculosis Program Data in Dar Es Salaam Region, Tanzania"** in fulfillment of the requirements for the degree of Master of Project Management, Monitoring and Evaluation in Health of Muhimbili University of Health and Allied Sciences

_____

Dr. Mughwira Mwangu

(Supervisor)

Date: _____

_____

Dr Mucho Mizinduko

(Co-supervisor)

Date: _____

DECLARATION AND STATEMENT OF COPYRIGHT

I Aman K. Wilfred, declare that this dissertation is my own original work and that it has not been submitted for a similar degree in any other University.

Signature……..…… Date……....…….....

"This thesis/dissertation is copyright material protected under the Berne Convention, the Copyright Act of 1999, and other international and national enactments, on that behalf, on intellectual property. It may not be reproduced by any means, in full or in part, except for short extracts in fair dealing; for research or private study, critical scholarly review or discourse with an acknowledgment, without the written permission of the Directorate of Postgraduate Studies, on behalf of both the author and the Muhimbili University of Health and Allied Sciences."

ACKNOWLEDGEMENT

I am immensely grateful to the Almighty God for His abundant grace throughout my entire study period of MSc. Project Management Monitoring and Evaluation in Health and for enabling me to complete my dissertation.

I extend my sincere gratitude to my esteemed supervisors, Dr. Mughwira Mwangu, and Dr. Mucho Mizinduko, for their determined commitment and invaluable guidance throughout the preparation of this dissertation. Their insightful comments and constant encouragement have been instrumental from the initial stages of proposal development to the completion of this work. I thank the entire staff from the Department of Development Studies and the faculty of Muhimbili University of Health and Allied Sciences (MUHAS) for the academic support and professional guidance they added to this work.

I would like to thank the office of the Regional Administrative Secretary-Dar es Salaam Region, all municipal councils of Dar es Salaam, and the health facilities I visited for granting permission to conduct this study and the maximum cooperation I received from them during the implementation of the study.

I would like to extend my appreciation to my fellow students for their cooperation, time-to-time review, and input in this work to shape this work to this stage.

DEDICATION

I dedicate this work to my family; my lovely wife Elinance Mbasha, my adoring daughter Gracious and my amazing son Gregory. They have been of great support throughout my academic life. I also dedicate this work to my mother Mary Hebron and siblings for their encouragement which gave me strength to endure this path. Their true affection and comprehension uplifted my spirit, providing me with the resilience to overcome obstacles and achieve the difficult tasks ahead. This work serves as a tribute to their trust in me, and I offer it to them with deep affection and gratitude.

TABLE OF CONTENTS

CERTIFICATION i
DECLARATION AND STATEMENT OF COPYRIGHT ii
ACKNOWLEDGEMENT iii
DEDICATION iv
TABLE OF CONTENTS v
LIST OF TABLES viii
LIST OF FIGURES ix
LIST OF ABBREVIATIONS x
DEFINITION OF KEY TERMS xi
ABSTRACT xii
CHAPTER ONE 1
1.0 INTRODUCTION 1
1.1 Background 1
1.2 Problem Statement 4
1.3 Conceptual framework 5
1.4 Rationale for the Study 7
1.5 Research Questions 7
1.5.1 Main research question 7
1.5.2 Specific Research Questions 7
1.6 Research Objectives 7
1.6.1 Broad research objective 7
1.6.2 Specific Research Objectives 8
CHAPTER TWO 9
2.0 LITERATURE REVIEW 9
2.1 The effect of COVID 19 on healthcare systems 9
2.2 Effect of COVID-19 on TB Case Detection 11
2.3 The effect of COVID-19 on loss to follow-up of TB patients 12
2.4 The effect of COVID-19 on mortality among TB patients 12
2.5 The effects of COVID-19 on treatment outcomes among TB patients 13
CHAPTER THREE 14
3.0 RESEARCH METHODOLOGY 14

3.1 Study Design 14
3.2 Study Setting 14
3.3 Target population 15
3.4 Sample size 15
3.5 Selection of health facilities 16
3.6 Inclusion and exclusion criteria 17
3.7 Data Collection 17
3.8 Data Management and Analysis 18
3.9 Ethical Consideration 19
CHAPTER FOUR 20
4.0 RESULTS 20
4.1 Selection of the health facilities 20
4.2 Geographical location of the selected health facilities 21
4.3 Baseline characteristics of study participants before COVID-19 (February- July 2010) and during COVID-19 (March-August 2020) 22
4.4 Objective 1: To determine the proportion of TB cases that were missed due to the COVID-19 pandemic in the Dar es Salaam region 25
4.5 Objective Two: To determine the extent of the effect the COVID-19 pandemic had on TB treatment outcomes among TB patients in the Dar es Salaam region 27
4.6 Objective 3: To assess the factors associated with poor TB treatment outcomes during the COVID-19 pandemic in the Dar es Salaam region 33
CHAPTER FIVE 38
5.0 DISCUSSION 38
5.1 Discussion 38
5.1.1 The effects of COVID-19 on Tuberculosis case detection 38
5.1.2 The effect of the COVID-19 pandemic on TB treatment outcomes among TB patients 39
5.1.3 Factors associated with unfavorable TB treatment outcomes before and during the COVID-19 pandemic 40
5.2 Strength of the Study 41
5.3 Study limitations 41

5.3.1 Suggestions for future research....42
6.0 CHAPTER SIX....43
7.0 CONCLUSION AND RECOMMENDATIONS....43
6.1 Conclusion....43
6.2 Recommendations....43
8.0 REFERENCES....45
9.0 APPENDICES....52
Appendix I: Data collection tool-COVID-19 Study....52
Appendix II: Informed consent form....55
Appendix III: Fomu ya ridhaa ya kushiriki katika utafiti....57
Appendix IV: Approval for Ethical Clearance....59
Appendix V: MUHAS Introduction Letter....61
Appendix VI: Permission letter from RAS office-Dar es Salaam....62
Appendix VII: Permission Letter from Kinondoni Municipal Council....64
Appendix VIII: Permission Letter from Ilala City Council....65
Appendix IX: Permission Letter from Ubungo Municipal Council....66
Appendix X: Permission Letter-DMO Kigamboni MC....67

LIST OF TABLES

Table 1: Baseline characteristics of study participants before COVID-19 (February- July 2010) and during COVID-19 (March-August 2020), (N=3698) 24

Table 2: Overall and by group proportion of TB cases missed during COVID-19, (N=3698).....26

Table 3: Treatment outcomes profile of DS-TB patient cohorts before and during COVID-19, (N=3,698).....27

Table 5: Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by district 29

Table 6: Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by gender, (N=3692).....30

Table 7: Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by age, (N=3692) 31

Table 8: Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by disease classification, (N=3692).....32

Table 9: Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by HIV status 32

Table 10: TB program operation during the COVID-19 pandemic in the visited health facilities, n=30 34

Table 11: Factors for unfavorable TB treatment outcomes before and during the COVID-19 pandemic 36

Table 11: Factors for unfavorable TB treatment outcomes before and during the COVID-19 pandemic (continued).....37

LIST OF FIGURES

Figure 1: A conceptual framework to show the impact of COVID-19 on TB case detection and treatment outcomes. 6

Figure 2: Flow of information on the selection of health facilities included in the study 21

Figure 3: Geographical location of the selected health facilities 22

Figure 4: Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 28

LIST OF ABBREVIATIONS

aOR	Adjusted Odds ratio
BCG	Bacillus Calmette-Guérin
CI	Confidence Interval
CTC	Care and Treatment Clinic
COVID- 19	Corona Virus Disease 2019 (COVID-19)
DOTS	Directly Observed Treatment, Short-Course
DS-TB	Drug Sensitive-Tuberculosis
ETL	Electronic TB Ledger
HIV	Human Immunodeficiency Virus
IPD	In-patient Department
LTFU	Loss to Follow-Up
MDR-TB	Multidrug Resistance TB
MUHAS	Muhimbili University of Health and Allied Sciences
NTLP	National TB and Leprosy Program
OR	Odds Ratio
PI	Principal Investigator
RCH	Reproductive and Child Health
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SD	Standard Deviation
TB	Tuberculosis
UK	United Kingdom
USSD	Unstructured Supplementary Service Data
WHO	World Health Organization

DEFINITION OF KEY TERMS

Tuberculosis

Tuberculosis (TB) is an infectious disease caused by a bacterium called *Mycobacterium tuberculosis*. The bacteria generally attack the lungs, but TB bacteria can also attack other parts of the body such as the kidney, spine, and brain.

COVID-19

Coronavirus disease is an infectious disease caused by the most recent coronavirus called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

Tuberculosis case detection

Means TB is diagnosed in a patient and reported to the TB surveillance systems, in the case of this study, reported to the TB treatment unit (Direct Observed Treatment (DOT) clinic and at the district level (the ETL).

Tuberculosis Treatment outcomes

Cured

A Pulmonary TB patient with bacteriologically confirmed TB at the beginning of treatment and who was smear or culture-negative in the last month of treatment and on at least one previous occasion.

Treatment completed

A TB patient who finished treatment successfully, with no indication of failure, yet there are no records showing negative sputum smear or culture results in the final month of treatment and on at least one prior occasion, either due to the tests not being performed or the results not being available.

Died

A TB patient who dies for any reason before starting or during the course of treatment.

Treatment failure

A TB patient whose sputum smear or culture is positive at five months or later in treatment.

Loss to follow-up

A TB patient who did not start treatment or whose treatment was interrupted for two consecutive months or more.

ABSTRACT

Introduction

Tuberculosis (TB) is a global health concern, causing significant morbidity and mortality worldwide. The COVID-19 pandemic has presented unprecedented challenges to the management of infectious diseases, including TB. The reprioritization of resources and the stigma associated with COVID-19 symptoms had the potential to disrupt TB diagnosis, treatment, and follow-up on care. This study aimed to assess the effects of COVID-19 on tuberculosis case detection and treatment outcomes in the Dar es Salaam Region of Tanzania.

Methods

This was a retrospective cohort study design, comparing two cohorts; the pre-COVID-19 era, February-July 2019, and the during the COVID-19 era, March-August 2020. Data sources were medical records of Tuberculosis patients from health facilities in Dar es Salaam and from the questionnaire to health facility in-charge or TB clinicians from the visited facilities. The study compared TB case detection and treatment outcomes between the pre-COVID-19 and during COVID-19 periods. The target population was all the notified TB cases in the health facilities in Dar es Salaam. A minimum of 1476 cases for each period was required to test the difference between the two periods. Data collection involved standardized data abstraction forms, capturing demographic information, clinical characteristics, treatment regimens, and outcomes, and a questionnaire that captured facility information related to COVID-19. Descriptive statistics, bivariate analyses, and multivariable logistic regression techniques were used in data analysis to determine the magnitude and factors for poor TB treatment outcomes.

Results

The results reveal that the overall proportion of missed TB cases during the pandemic was 13.5%. Females lost more cases, 21.1% (n=154) during COVID-19 compared to male counterparts (9.1%, n=114). Notification of TB cases among children was low during COVID-19, nearly by half of the cases, n=190 notified before COVID-19. In TB treatment outcomes, the overall results show a slight increase in the proportion of unfavorable treatment outcomes during the COVID-19 era, 5.4% (n=93) compared to the

pre-COVID-19 era, although the difference was not statistically significant (p=0.374). In the assessment of the factors, HIV status (positive), disease classification (Extra pulmonary TB Patients), and location (Kigamboni district) factors were found to prevail in both pre-and During the COVID-19 era as the factors for unfavorable TB treatment outcomes.

Conclusion

The COVID-19 pandemic had a significant impact on tuberculosis (TB) case detection. The variations were observed across districts, gender and type of TB patient referral, as observed in other countries. Also, the COVID-19 pandemic adversely affected TB treatment outcomes with increased unfavorable treatment outcomes such as mortality and loss to follow-up (poor adherence). The increased mortality and poor treatment adherence during the pandemic underscore the need for robust TB care and support systems, particularly during global health crises.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Tuberculosis (TB) is a major global health issue, causing significant morbidity and mortality among individuals of all ages worldwide (1). In 2019, approximately 10 million people fell ill with TB, and there were 1.4 million TB-related deaths globally (1). TB not only affects adults but also claims the lives of many children (2). Apart from children, TB has been reported to infect people with compromised immunity disproportionally; elders, HIV patients, and diabetic patients are at higher risk of contracting TB (3–5). Other studies have reported that some groups of people due to their predisposing factors like occupation are more vulnerable to TB (6).

Globally, factors contributing to the spread of TB are numerous. HIV infection increases TB risk by about 20 times (7), while other conditions like diabetes, malnutrition, and smoking also play substantial roles (8). Globalization has facilitated the spread of multidrug-resistant TB (MDR-TB) across borders (9). In developing countries, poverty, overcrowding, social inequalities, and deprived urban areas are strongly associated with TB incidence (10). The emergence of new challenges, such as multidrug resistance, migration to cities, and treatments with anti-tumor necrosis alpha factor, threatens recent progress in TB control (10).

Although tuberculosis (TB) is present everywhere in the world, South-East Asia and Africa account for the majority of TB cases. The World Health Organization (WHO) estimates that 2.8 million individuals in India had a tuberculosis infection in 2019 (11). Indonesia, being the second-largest contributor of TB cases in the world, recorded a total of 562,049 cases in the same year (11). In the African region, South Africa is a leading contributor of TB cases, it reported an incidence of 615 per 100,000 population in 2019 (12), followed by Nigeria with an incidence of 440 per 100,000 population (11). The Democratic Republic of Congo recorded a total case of 270,000 cases of TB in 2018, which translates into the burden of 321 cases per 100,000 population (13).

Tanzania is among the 30 listed high-burden TB countries (11), in 2019, it notified a total of 82,166 cases equivalent to 145 per 100,000 population. This notification of cases was

not uniform across the regions, as the Dar es Salaam region alone contributed 18% of all cases (14). Given the wide-range impact and distribution of TB, it remains a critical public health concern (15).

Numerous global efforts have been put in place to put the TB disease under control. Development of the Bacillus Calmette-Guérin (BCG) vaccine in the 1920s, the declaration of TB as a global health emergency in 1993, and the establishment of the Global Tuberculosis Program by the WHO, whereby the organization has since continued to provide technical guidance, developing strategies, and coordinating international efforts to combat TB (11). Other strategies, such as Directly Observed Treatment, Short-Course (DOTS), free TB treatment in most of countries, the Stop TB Partnership formed in 2000 as a network of organizations and countries dedicated to fighting TB, the establishment of the Global Fund in 2002, and End TB strategy of 2035 have been crucial strategies and mechanisms put forth in the global fight against TB.

These strategies have been reported to translate efforts into benefits. Generally, there is a global decline in the incidence of the disease from time to time. WHO reported a cumulative reduction of TB cases by 9% (from 142 to 130 new cases per 100,000 population) from 2015 to 2019 (11), the trend has been steady even in countries with high TB burden, in south Africa the incidence fell from 737/100,000 in 2017 to 615 per 100,000 in 2019 (12). This trend was not different from India, Pakistan, China, Ethiopia, and Zambia(16–20). Along with the falling notifications, improved treatment outcomes have been reported in the same countries.

The emergence of the Corona Virus Disease 2019 (COVID-19) in late 2019 presented unprecedented challenges for the management of infectious diseases, including TB. As governments and healthcare systems shifted their focus and resources towards controlling and mitigating the COVID-19 effects, the management of other diseases, such as TB, were significantly affected (21). The reprioritization of resources and diversion of healthcare staff's attention had the potential to affect TB diagnosis, treatment, and follow-up to care (21,22)

Another significant challenge posed by COVID-19 is the stigmatization of individuals presenting with symptoms similar to COVID-19, which may overlap with TB symptoms (23). This stigmatization may lead to delays in TB diagnosis and treatment initiation, as

well as increased loss to follow-up among TB patients (23,24). The fear of being labeled as a COVID-19 case may discourage individuals from seeking appropriate TB healthcare services, resulting in TB case notification and adverse treatment outcomes (23).

Tanzania was not exempted when it comes to the effects of COVID-19. For example, a recent rise in cases of vaccine-preventable diseases, as well as outbreaks of the same in some regions are linked to poor vaccination coverage during COVID-19 (25). Documenting the effects of COVID-19 on TB case detection and treatment outcomes is of paramount importance.

1.1.1 Description of Intervention

In contrast to conventional interventions such as carefully planned projects and programs, pandemics like COVID-19 have the potential to disrupt the normal functioning of health systems, leading to unforeseen consequences. Pandemics unfold suddenly, altering the landscape of programs, policies, and even laws. Their unexpected emergence may necessitate a shift of resources towards responding to the disease at hand, this may lead to an imbalance of efforts in other programs which may result in unprecedented effects.

In Tanzania, COVID-19 modified the landscape of the operation of the TB program. For example, after the declaration of COVID-19 in the country, a number of things were changed. The number of clinic visits by TB patients i.e., for drug refill and retest were reduced to one day a week from three days a week before COVID-19. A number of TB clinics in multiple health facilities were converted into COVID-19 isolation wards due to their suitability to accommodate airborne diseases (at first COVID-19 was thought to be airborne disease) this led to the reallocation of TB clinics (premises) to other places whereby access, convenience, and safety couldn't be assured (no rigorous planning was done due to nature of emergency), other health facilities, for example, Amana Regional referral hospital in Dar es Salaam were converted into COVID-19 isolation and treatment centre necessitating reallocation of TB patients to other facilities.

Moreover, a considerable number of healthcare workers who were working in TB, were placed as frontline responders to COVID-19 due to their experience with infectious diseases, this reduced number of healthcare workers in TB.

Considering that these programs have predefined targets, it is crucial to investigate the extent of the effects brought by COVID-19 on the TB control program.

1.2 Problem Statement

The COVID-19 pandemic has had significant effects on global healthcare systems, including tuberculosis (TB) control programs. The effects were brought by the changes the pandemic posed to the well-established healthcare systems. Diversion of resources from other programs to fight the disease, implementation of COVID-19 control measures like lockdown and curfew, and fear of contracting diseases as a result of people's movements, especially in high-risk areas like health facilities, as well as fear of stigma when one reported the symptoms similar to COVID-19 posed critical challenges to the control programs like TB.

Several studies have assessed the effects of COVID-19 on TB services in different countries. The study conducted in Harare, Zimbabwe examined the effects of the COVID-19 pandemic on TB case detection and treatment outcomes and found decreased case detection of TB and treatment success rate during the COVID-19 as compared to the pre-COVID-19 period (26). A similar study conducted in Malawi assessing the impact of COVID-19 on TB and HIV programme services in Lilongwe reported decreased rate of TB case notification, but unchanged TB treatment success rate (27). The study conducted in Sierra Leone on the impact of COVID-19 on Tuberculosis case detection and treatment outcomes reported a decreased testing rate but an increased treatment success rate during the COVID-19 era than before the COVID-19 era (28). By and large, the negative effects of COVID-19 have been documented.

Given the fact that Tanzania was unique when it comes to the implementation of COVID-19 prevention measures. Unlike other countries in both third and first-world countries, Tanzania did not impose strict measures such as curfews and lockdowns, and strict social distancing rules, to mention some. Despite this interesting fact, yet, after a rigorous literature search, the researcher found that little has been documented on the effects of COVID-19 in the country. This study aimed to compare case detection and TB treatment outcomes before the COVID-19 era (February-July 2019) to the period during COVID-19 (March-August 2020) for the purpose of providing valuable insights for future healthcare planning and TB control strategies, particularly during epidemics.

1.3 Conceptual framework

Figure 1 below illustrates the conceptual framework of this study, highlighting the effects of the COVID-19 pandemic on global healthcare systems. The pandemic had the potential to disrupt well-established healthcare delivery systems. For example, certain health facilities were converted into isolation centers, and specific wards were dedicated to hospitalizing COVID-19 patients. This disruption had the potential to disturb the normal flow of patients, thereby affecting the processes of case detection and treatment for various diseases, including TB.

The diversion of resources from other programs to combat COVID-19 also had consequences for case detection and treatment. A considerable number of healthcare providers were reassigned to handle COVID-19 patients, leaving other diseases with less attention, thereby impacting TB case detection and treatment efforts.

The implementation of COVID-19 control measures such as lockdowns, curfews, and the fear of contracting diseases due to movement, particularly in high-risk areas like healthcare facilities, resulted in limited access to these facilities for diagnosis and treatment. Consequently, the outcomes of diagnosis and treatment likely to be affected.

Stigma played a significant role, particularly when individuals reported symptoms similar to those of COVID-19. This posed specific challenges for control programs like TB, as patients were hesitant to mention symptoms resembling COVID-19 for fear of being isolated. This fear of isolation decreased case detection rates.

These had potential effects on TB case detection and treatment outcomes.

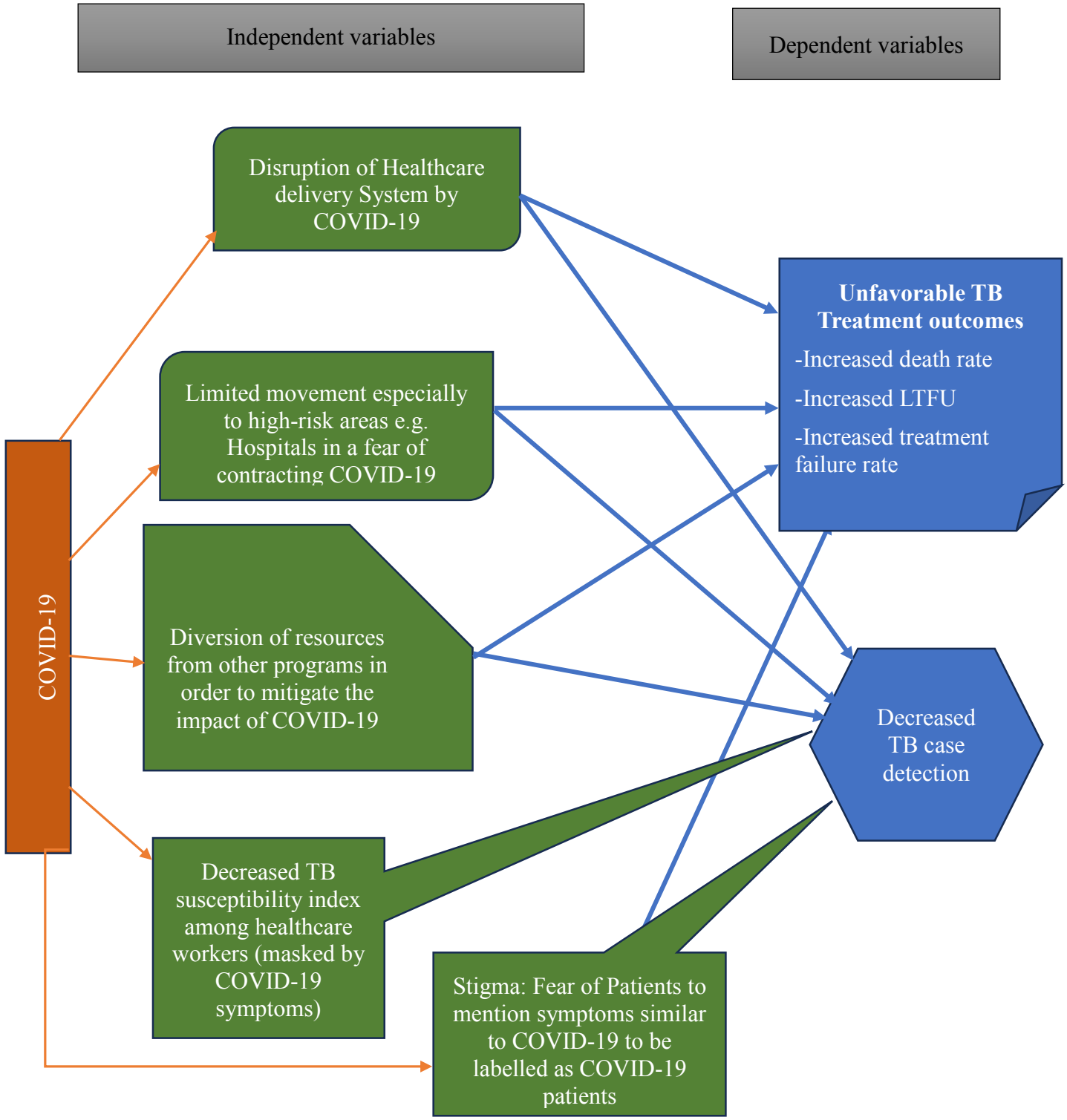


Figure 1: A conceptual framework to show the impact of COVID-19 on TB case detection and treatment outcomes.

1.4 Rationale for the Study

In Tanzania, like in many other countries, prioritization of resources and attention towards managing COVID-19 may have inadvertently affected the management of TB. Understanding the effects of the COVID-19 pandemic on TB case detection and treatment outcomes is crucial for designing targeted interventions to mitigate the potential negative consequences, especially during pandemics. However, no studies have specifically examined the effects of COVID-19 on TB case detection and treatment outcomes in Tanzania, particularly in the Dar es Salaam Region.

By analyzing routine TB program data before and during the pandemic, this study aims to fill the knowledge gap regarding how TB services were affected by COVID-19 in Dar es Salaam. The findings aimed to provide critical insights for policymakers to improve TB program resilience and ensure better preparedness for future public health emergencies.

1.5 Research Questions

1.5.1 Main research question

What were the effects of the COVID-19 pandemic on TB case detection and treatment outcomes, and the factors associated with unfavorable outcomes in the Dar es Salaam region?

1.5.2 Specific Research Questions

1. What is the proportion of TB cases that were missed due to COVID-19 in the Dar es Salaam region?
2. To what extent did COVID-19 affect TB treatment outcomes among TB patients in the Dar es Salaam region?
3. What were the factors associated with poor TB treatment outcomes during the COVID-19 pandemic in the Dar es Salaam region?

1.6 Research Objectives

1.6.1 Broad research objective

To assess the effects of COVID-19 on TB case detection and treatment outcomes, and factors associated with poor TB treatment outcomes in the Dar es Salaam region

1.6.2 Specific Research Objectives

1. To determine the proportion of TB cases that were missed due to the COVID-19 pandemic in the Dar es Salaam region
2. To determine the extent the COVID-19 pandemic had on TB treatment outcomes among TB patients in the Dar es Salaam region
3. To assess the factors associated with poor TB treatment outcomes during the COVID-19 pandemic in the Dar es Salaam region

Hypotheses

Null hypothesis (Ho) : COVID-19 did not affect TB case detection and treatment outcomes

Alternative hypothesis (Ha) : COVID-19 had effects on TB case detection and treatment outcomes

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 The effect of COVID 19 on healthcare systems

The emergence of COVID-19 presented exceptional challenges for the management of infectious diseases, including TB. All over the world, governments and healthcare systems shifted their focus and directed a considerable large number of resources towards controlling and mitigating the effects of COVID-19, due to that management of other diseases, including TB had been significantly affected (21). Reprioritization of resources and diversion of healthcare staff's attention had the potential to disrupt TB diagnosis, treatment, and follow-up to care (21,22).

In the WHO TB report of 2020, it was that reported 14 out of 30 high-burden TB countries reported reallocating TB funding to COVID-19, and 20 out of 30 high-burden TB countries reallocated national TB program staff at national or subnational level to mitigate the impact of COVID-19 (11). The Stop TB partnership reported that COVID-19 diverted funding away from TB, reporting a US$3.3 billion funding gap posted in 2019 amplified by the additional funding required to address pandemic-related disruptions (29). In the United Kingdom (UK) it was reported that some of TB activities such as the management of latent TB and non-transmissible TB infection were suspended because, in part, the TB workforce was re-directed to manage COVID-19 (30). In India, it was reported that Drug stockouts were frequent, and personnel and resources from health facilities and programs for tuberculosis were diverted to COVID-19 initiatives. In April 2020, 1 million fewer kids received a vaccination against BCG than in the same month in 2019 (31).

A similar pattern was seen in Africa; in South Africa, most medical facilities were reported to have transferred resources to combat COVID-19, making them frontlines for the pandemic. For instance, because TB centers are better suited to handle communicable diseases, TB hospitals have been transformed into these facilities (32). In sub-Saharan Africa, the COVID-19 epidemic caused disruptions to regular health care and diverted resources that were already scarce. Consequently, health initiatives targeting diseases such as tuberculosis, malaria, and HIV identified deficiencies in prevention and

treatment, potentially undoing progress achieved in achieving worldwide objectives. (33).

Similarly, COVID-19 reduced access to healthcare services and disruptions in routine services. Globally, a decrease in the number of people coming to health facilities for TB testing was reported. According to the Stop TB Partnership Report 2021, COVID-19 has had a significant effect on the number of people coming to health facilities for TB testing with 70% of healthcare workers surveyed noting a decrease in the number of individuals visiting health facilities for TB testing (29). According to the WHO, a limited number of health facilities in high-burden TB countries were offering outpatient care for individuals with drug-susceptible TB (only 7 out of 30 countries). Additionally, a reduced number of hospitals in these countries were providing inpatient care for individuals with drug-susceptible TB (only 9 out of 30 countries) (11). Similarly, in India, COVID-19 measures such as lockdown are reported to have catastrophic effects on healthcare provision and severely restricted access to tuberculosis diagnosis and treatment (31).

In Africa, a similar trend was observed, the study conducted in Ethiopia reported that during the implementation of COVID-19 preventive measures, there was a notable decrease in the number of cases across all outpatient departments. Furthermore, the number of visits related to surgical and medical emergencies saw a reduction of over 50% (34). A study conducted in Uganda revealed a decline in number of new HIV cases by 75%, with a similar 75% reduction in the initiation of isoniazid-preventive therapy to prevent secondary tuberculosis in just one month after mandatory lockdown policy was instituted in the country(35). A similar trend was observed in Kenya, Nigeria, and South Africa (36–38).

Another significant challenge posed by COVID-19 is the stigmatization of individuals presenting with symptoms similar to COVID-19, which may overlap with TB symptoms (23). This stigmatization may lead to delays in TB diagnosis and treatment initiation, as well as increased loss to follow-up among TB patients (23,24). The fear of being labeled as a COVID-19 case may discourage individuals from seeking appropriate TB health services, resulting in TB case notification reduction and adverse treatment outcomes (23). In South Africa, it was reported that the COVID-19 pandemic rapidly spread and resulted in the emergence of social stigma and discrimination against individuals suspected of

being exposed to the virus. Since the symptoms of COVID-19 and TB overlap, this stigma can also affect individuals with TB. Stigmatization and discrimination have negative consequences, such as disrupting social cohesion and isolating people. Due to this stigma, individuals may conceal their illness, which hinders their ability to seek timely medical assistance and discourages them from adopting the necessary social behaviors to prevent the transmission of both TB and COVID-19 (32). The studies conducted in Portugal and India showed similar findings (39,40). Patient delays prior to the first presentation to care rose by 25% compared with pre-pandemic levels, care-seeking decreased diagnosis rates by 25%, and diagnostic resource displacement (23).

2.2 Effect of COVID-19 on TB Case Detection

The global effect of the COVID-19 pandemic on TB detection has been widely documented. Several studies conducted in different countries have highlighted a significant decrease in TB notifications during the COVID-19 period compared to before the pandemic.

For instance, in Indonesia, a nationwide study analyzing the impact of the COVID-19 pandemic on tuberculosis control using program data revealed a 31% decline in TB notifications during the COVID-19 period compared to pre-COVID-19 (41). Similarly, a retrospective study conducted in Italy, focusing on an observational cohort analysis of TB patients, showed a 19.7% reduction in TB cases during the COVID-19 period compared to the pre-COVID-19 period (42). Likewise, in India, a study reported a substantial decrease, 63.3% in TB case notifications during the COVID-19 era compared to the pre-COVID-19 period (43).

In Africa, the COVID-19 pandemic has also had a significant impact on TB case notifications. A study conducted in Ethiopia revealed that routine TB diagnosis, care, and treatment were severely affected, resulting in a significant decrease in detected TB cases, approximately three times fewer cases were identified during the COVID-19 period compared to before the pandemic (44). Similar declines in TB case notifications during the COVID-19 pandemic were reported in Egypt, Mozambique, and Eswatini (45–47).

Overall, these studies indicate that the COVID-19 pandemic has led to a notable reduction in TB case detection globally, with various countries experiencing significant declines in TB notifications during the pandemic.

2.3 The effect of COVID-19 on loss to follow-up of TB patients

The worldwide effect of the COVID-19 pandemic on the follow-up of TB patients has been widely studied and documented. Multiple studies conducted in various countries have revealed a noteworthy increase in the follow-up of TB patients during the COVID-19 period compared to the time before the pandemic. A retrospective study conducted in Italy, focusing on an observational cohort analysis of TB patients, reported an increase in the proportion of patients who were lost to follow-up during the COVID-19 period, despite the efforts to keep TB services fully functional (42). Another study conducted in Vietnam on the effects of the COVID-19 Pandemic on Tuberculosis notifications reported an increased proportion of patients who were lost to care during the COVID-19 pandemic compared to pre-COVID-19 (48). Another study conducted in Indonesia reported an increased proportion of patients who were lost to care during the COVID-19 pandemic compared to pre-COVID-19 (49).

In Africa, the studies conducted reported mixed findings impact of COVID-19 on retention to care. A study conducted in Eswatini reported a 1.5% of loss to follow-up rate during the COVID-19 pandemic compared to a 0.7% loss to follow-up reported in the pre-COVID-19 era (47). A study conducted in Sierra Leone reported an improved retention to care during the COVID-19 pandemic (16.3%) compared to pre-pandemic (21.3%)(50)

Overall, these studies suggest that while there has been an overall increase in the follow-up of TB patients during the COVID-19 period, there are specific cases where patients have faced difficulties in maintaining their engagement with TB care, leading to increased loss to follow-up rates.

2.4 The effect of COVID-19 on mortality among TB patients

A study conducted in India reported an increase of 8% in death among TB patients during the COVID-19 pandemic compared to the pre-COVID-19 era (41). Similarly, in Italy, it was reported an increase in the proportion of TB patients who died during the COVID-19 period compared to the pre-COVID-19 era, despite the efforts to keep TB services fully functional (42). Another study conducted to assess the impact of COVID-19 on the diagnosis of tuberculosis and mortality in 11 countries in Europe, North America, and Australia reported more TB-related deaths were observed in the studied countries during

the pandemic compared to pre-COVID-19 pandemic (51). Similarly, a study conducted in three high-burden countries (Kenya, India, and Ukraine) revealed increased mortality during the pandemic (52).

In Africa, a study conducted in South Africa on the impact of COVID-19 on mortality among TB patients reported an increase in mortality during the COVID-19 pandemic. A study conducted in Eswatini also reported a significantly higher death rate during the pandemic compared to pre-pandemic. Other studies conducted in Uganda and Rwanda reported an increase in mortality among TB patients during the pandemic (51,53).

2.5 The effects of COVID-19 on treatment outcomes among TB patients

Different studies have documented the negative effect of COVID-19 on TB treatment outcomes. A study conducted in Eswatini fitting data on logistic regression, reported higher odds of unfavourable outcomes (death, lost-to-follow-up, and not evaluated) during the pandemic than pre-pandemic (aOR 2.91, 95% CI: 2.17–3.89) (47). Similarly, a study conducted in Zimbabwe reported a decrease in TB treatment success from 80.9 to 69.3%, During the COVID-19 period and pre-COVID-19 respectively (26). A study conducted in Indonesia observed an insignificant change in TB treatment success rate over time (49).

The literature review shows that COVID-19 severely disrupted TB healthcare systems, with resources and personnel diverted to combat the pandemic. This led to a global decline in TB case detection, particularly in countries like India, Indonesia, and Ethiopia. Stigmatization due to overlapping symptoms of COVID-19 and TB also discouraged care-seeking. Loss to follow-up increased, and TB mortality rates rose in several high-burden countries. Overall, TB treatment outcomes worsened, with lower success rates and higher rates of unfavorable outcomes during the pandemic. These outcomes prevail even after concerted efforts at the global and national level efforts such as lockdown, and strict social distancing policies, to put COVID-19 under control, given Tanzania was unique when it comes to implementing such rules and policies, this called for a study, in a local setting, the Dar es Salaam region, which is characterized by a high number of both TB and COVID-19 cases to quantify the effects of COVID-19 on TB case detection and treatment outcomes.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Study Design

A retrospective cohort study design was employed to compare TB case detection and treatment outcomes between the two study periods i.e., pre-COVID-19; February 2019, and During COVID-19; March-August 2020. Medical records of TB patients from health facilities in the Dar es Salaam Region were extracted and analyzed. The design was chosen because the key aim was to compare two cohorts to determine the effect of COVID-19 on the TB program, and also because the program data was readily available to facilitate the comparisons.

This was a before and after, outcome evaluation study seeking to underscore the effects of COVID-19 on TB case detection and treatment outcomes.

3.2 Study Setting

The study was conducted in the Dar es Salaam Region, Tanzania. Dar es Salaam is one of Tanzania's 31 administrative regions, situated on the east coast of the country. It spans an area of 1,393 square kilometers (538 square miles). (54). According to the 2022 census, the region has a total population of 5,383,728 (55). The Indian Ocean borders the region to the east, and Pwani Region completely encloses it. The Ilala ward contains the region's capital and seat. The area bears the name of the actual city of Dar es Salaam. The region is Tanzania's richest region and is home to the nation's main financial, administrative, and industrial centers (54). Being a business hub, Dar es Salaam through Julius Nyerere International Airport receives big number of international travelers, making it the busiest corridor for international migration in the country.

Dar es Salaam has a high burden of TB cases, being among 31 regions notifying TB in the country, Dar es Salaam alone contributed 17% of all cases notified in 2021(56). As of December 2023, there were a total of 162 TB diagnostic facilities, of them, 62 were located in Ilala, 35 in Kinondoni, 29 in Temeke, 19 in Ubungo, and 17 in Kigamboni.

Regarding COVID-19, the Dar es Salaam region recorded a significant number of COVID-19 cases since the disease was declared in the country on 16th March 2020.

According to the Ministry of Health COVID-19 Situation Report NO. 33, between 23rd to 29th July 2022 Dar es Salaam contributed 67% of cases notified (25), this makes it an appropriate area for this study.

Also, the selection of the region considered data quality dimension. Although electronic data is available in the Electronic TB ledger (ETL) platform, the data in the platform is subject to errors, mainly transcription errors and missing data. Regarding the sensitivity of the topic, it was the interest of the researcher to obtain high-quality data, therefore data collection involved two steps verification, from the selected health facilities, electronic data was obtained and physical verification through registers and files was done to correct any data entry errors from the ETL. For this reason, the researcher proposed to conduct a study in a small area i.e., the Dar es Salaam region.

3.3 Target population

All drug-sensitive TB cases notified at all levels of health facilities providing TB services in Dar es Salaam, Tanzania.

3.4 Sample size

Estimation of sample size for this study utilized the sample size formula for cohort studies.

$$n\ (each\ group) = \frac{(p_0 q_0 + p_1 q_1)\left(z_{1-\alpha/2} + z_{1-\beta}\right)^2}{(p_1 - p_0)^2}$$

Where;

n=Sample size for each group

$Z_{(1-\alpha/2)}$ = Confidence interval, for this study $Z_{(1-\alpha/2)}$ is set at 95%, $Z_{(1-\alpha/2)}$ =1.96

$Z_{(1-\beta)}$ = power of the study, for this study is set at 80%

P0 =Proportion of unexposed at risk of disease/outcome i.e., for this study P0 80.9%

P1= Proportion of exposed at risk of disease/outcome i.e., for this study P1=69.3%

A study conducted in Harare; Zimbabwe reported a decrease in TB treatment success from 80.9 to 69.3%., the analyses done reported 95% confidence intervals, using a 1:1 allocation ratio between exposed and unexposed, a power of 80%, and correcting for finite population (total 14852 TB case notifications in 2020), the minimum sample size required was 1476 cases among exposed (April-July 2020) and 1476 cases among unexposed (March-August 2019) totalling 2952 cases notified as per calculation below.

$$n= \frac{((80.9*19.1) + (69.3*30.7)\ (1.96+0.84)^2}{(69.3-80.9)^2}$$

n=1842

correcting for finite population i.e., 14852 were notified in a year, for 6-months~7426

$$\textit{Formula:}\quad n' = \frac{1}{\frac{1}{n} + \frac{1}{N}}$$

Where;

n=originally calculated sample size

n'=Adjusted sample

From the formula above n'=1476, therefore the minimum sample size for each cohort was 1476 notified TB patients

3.5 Selection of health facilities

TB patient records from private and public dispensaries, health centres, and hospitals within the Dar es Salaam Region offering TB services (diagnosis and treatment) were included in the study. To ensure representativeness, sample proportion to size was used to allocate the sample. A list of all health facilities that were providing TB services (TB treatment) by levels and type of ownership was obtained from Regional TB and Leprosy coordinators. From the list, all facilities that were not in full operation during the study period (February-July 2019 and March-August 2020) for reasons other than the effects of COVID-19 were excluded. From the list of remaining health facilities, allocation

considered the size of the health facility (number of TB cases notified) as follows: low volume; less than 10 cases, medium volume, from 10 and 99, and high volume, 100 cases or more. From the list of eligible health facilities, 30 health facilities were randomly selected considering the proportion of total notified cases in each stratum. From the selected facilities all TB patient records were extracted in the respective periods.

3.6 Inclusion and exclusion criteria

3.6.1 Inclusion criteria

All DS-TB cases from public, private, and Faith-Based Organizations

3.6.2 Exclusion criteria

All Drug-resistant TB cases were excluded from the analysis because of longer follow-up (medication period) which could overlap the study periods

3.7 Data Collection

Data were collected from TB patient records using an abstraction form and from healthcare workers (Medical officer in-charge/DOT provider/TB clinician) using a short questionnaire.

Abstraction was from electronic (Electronic TB Ledger) with cross-checking of information from the TB treatment register (TB 03). Data included demographic information, clinical characteristics, type of diagnosis, treatment regimens, and treatment outcomes. Upon granted authorization from authorities (Regional and District Medical officers, and Facility in-charge), electronic data was accessed through the facility/TB data manager while registers were accessed through DOT providers. Facility-level data pertaining to; the level of health facility, status of alteration of normal services during COVID-19, funding status i.e., fund reallocations during COVID-19, information on cessation/temporary closure of project(s) targeted to increase TB case detection or improving treatment outcomes was collected from each of the selected health facility. Because facility-level information was required there is only one personnel, either a medical officer in charge/DOT provider or clinician administered the questionnaire per facility. The medical officer in charges/DOT provider/clinician were purposefully selected because they are the custodians (or have experience with TB services) of facility information that is enquired for this study.

The researcher, along with a research assistant, a medical doctor, who was trained on the study protocol and research ethics for two days, administered the questionnaire. Each evening after collecting data, the research assistant submitted all collected information to the researcher for management of data and analysis.

3.8 Data Management and Analysis

The routine data was extracted in Microsoft Office Excel. Data from the questionnaire was entered in EpiData software. Data from both sources was exported into Stata v18 software for further data management. Data cleaning involved inspecting all variable contents to see if they fit inclusion criteria as well as the expected range, also removing all the variables that were irrelevant to this study i.e., follow-up, and contact tracing were removed for the dataset, the clean dataset was used in data analysis. Data analysis was done descriptively and through analytical. Descriptive statistics were used to summarize patient characteristics and treatment outcomes for both study periods. Data that were continuous and normally distributed were reported in means and standard deviation. For categorical data proportions and respective percentages were reported.

For objectives (1 and 2)

For primary outcomes of interest (TB Case detection, death, loss to follow-up, treatment failure, and overall unfavorable treatment outcomes), the proportions were compared between pre-COVID-19 and during COVID-19 periods using appropriate statistical tests (e.g., chi-square test, Fisher's exact test, chi-square for trend). The chi-square test was used for those variables in two-by-two tables containing observations greater or equal to 5 in any of the cells, and Fisher’s test when any cell contains a number of observations less than 5, and the chi-square test for trend when months are used as categories. Associations were considered statistically significant at the 5% level of significance ($P < 0.05$).

For Objective 3:

Bivariate analyses on the dependent variable, unfavorable TB treatment outcomes against independent variables including age, sex, type of TB, level of health facility, ownership, and study period variable was performed to determine crude risk ratios. A dependent variable i.e., unfavorable treatment outcomes was defined as any of the following outcomes; death, treatment failure, or loss to follow-up and was coded as 1,

favourable treatment outcome was defined as either cured or treatment completion and was coded as 0. A statistical relationship model-building strategy was used to determine the variables that were entered in multivariable analysis. Multivariable logistic regression analysis was used to determine independent determinants of unfavorable TB treatment outcomes. The associations with p-values of <0.05 were considered significant.

3.9 Ethical Consideration

Ethical clearance was obtained from the MUHAS Senate Research and Publication Committee. Ethical guidelines were followed during the implementation of the study. Before accessing the information from health facilities, the researcher sought permission from both Regional and District authorities. Permission to conduct the study at the health facility level was obtained from the in-charges at the visited health facilities. Prior to obtaining facility-level information, consent was sought from healthcare providers who provided facility information. Information was treated confidential and accessed by the research team only, data in hardcopy was stored in a locked cabinet at the National Institute for Medical Research, and electronic data was kept in a computer protected by passwords using the codes stored in an encrypted format.

For retrospective data, informed consent was waived because the study involved the use of de-identified, retrospective data collected as part of routine program activities. There was no direct interaction with participants, and the analysis posed minimal risk to their privacy or well-being. The data was anonymized to protect confidentiality. All data handling procedures followed strict confidentiality protocols to ensure that participants' identities are protected.

CHAPTER FOUR

4.0 RESULTS

4.1 Selection of the health facilities

A total of 168 health facilities notified TB cases in 2019. Health facilities listed in 2019 were considered in selecting the facilities included in the study. A total of 21 facilities were removed from the list of potential facilities to be selected for having notified few cases (less than 3 cases in 6 months). Furthermore, 5 Military and 5 police-owned facilities were excluded from having complexities in the procedures of obtaining permission to conduct research. The 137 remaining facilities were subjected to random selection, whereby 30 facilities were randomly selected *(Figure 1)*.

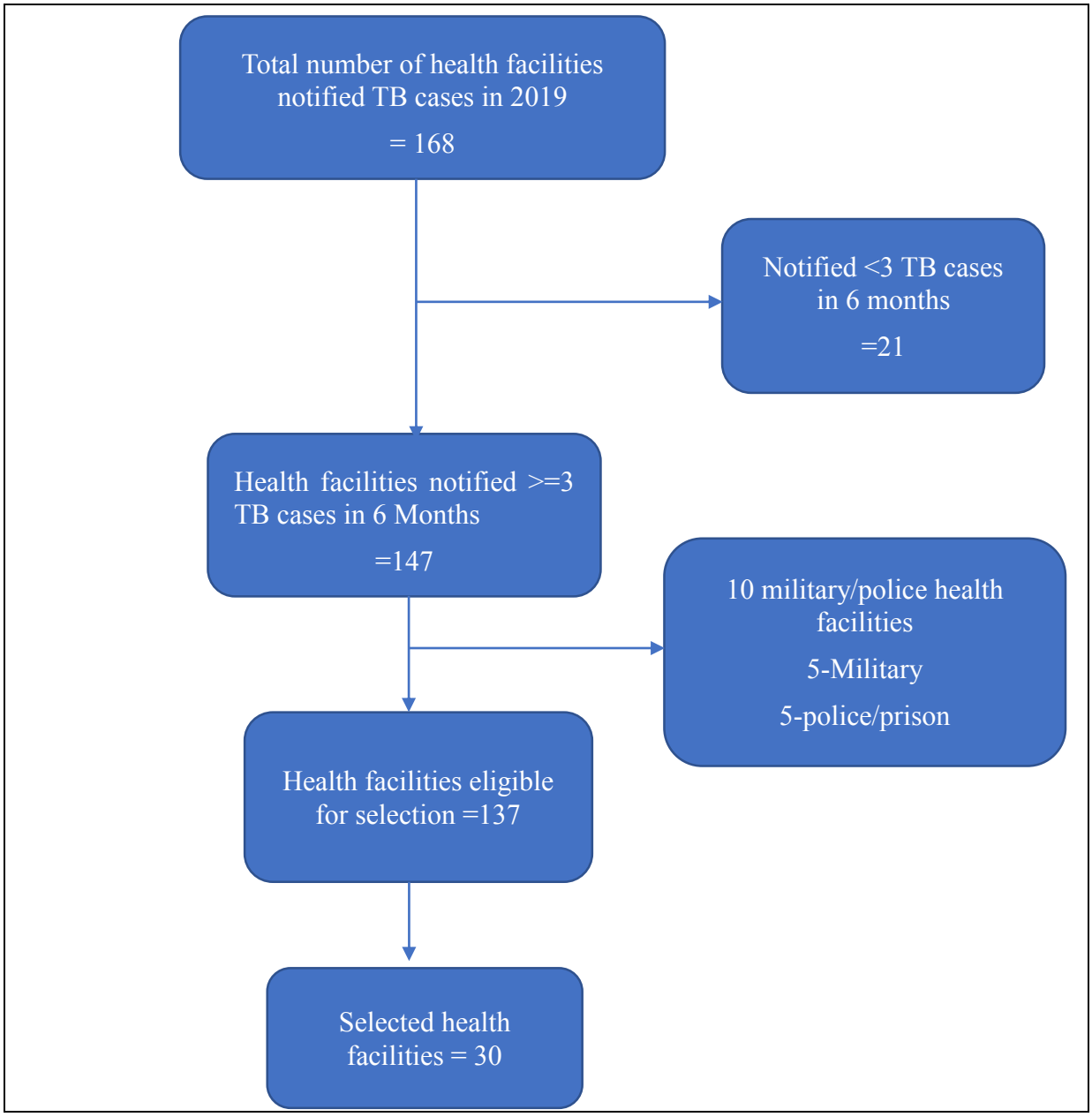


Figure 2: Flow of information on the selection of health facilities included in the study

4.2 Geographical location of the selected health facilities

The map below (Figure 3) shows the geographical distribution of the visited health facilities in this study. A total of 7 facilities were from Ilala, 9 from Kinondoni, 6 from Ubungo, 6 from Temeke and 2 from Kigamboni.

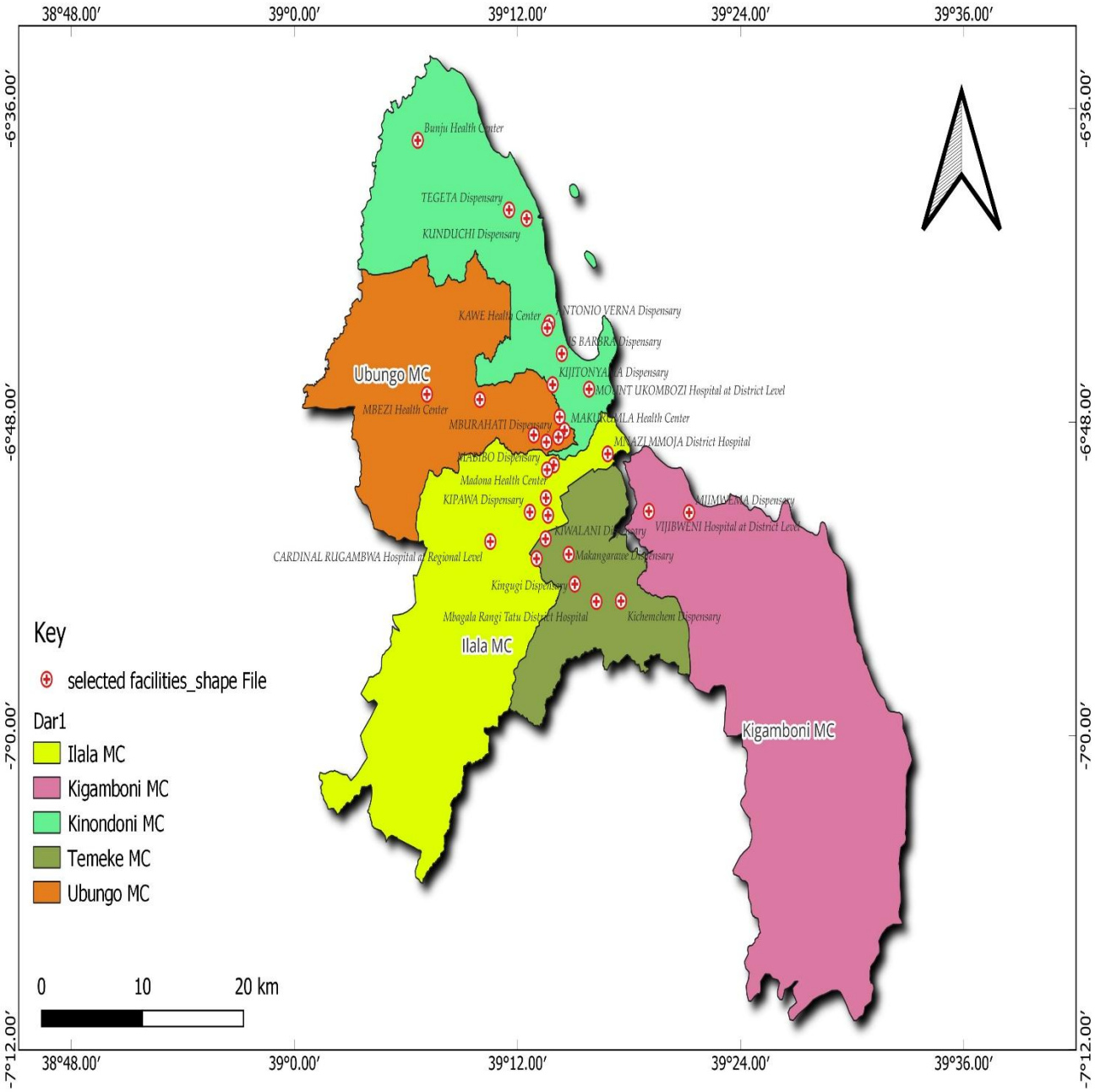


Figure 3: Geographical location of the selected health facilities

4.3 Baseline characteristics of study participants before COVID-19 (February-July 2010) and during COVID-19 (March-August 2020)

A total of 3698 TB patient information was extracted for the analysis. Of the 3698 patients included in the study, 1983 (53.6%) were from the before COVID-19 (February -July 2019) cohort and 1,715 (46.4%) were from during the COVID-19 (March-August 2020)

cohort. Most of the patients, 31% (n=1,147) were from the Ilala district, while the minority, 4.5% (n=166) were from the Kigamboni district. According to sex, nearly two-third, 64.6% (n=2390) were males, and they were consistently high in both before COVID-19, 63.1% (n=1252), and during COVID-19, 66.4% (n=1138). Based on age, in the combined data, most of the patients, 22.5% (n=831) were aged 25-34 years, while in before COVID-19, most of the patients, 21.3% (n=422) were aged 35-44 years, whereas in the during COVID-19 cohort, most of them, 23.9% (n=410) were aged 25-34, the overall mean (SD) was 33 (18.7) years.

In terms of referral type, self-referral constituted the majority of the patients, 50% (n=1,849), it was higher before COVID-19, 60.0% (n=1,189) than during the COVID-19 era 38.5% (n=660). In terms of treatment history, the majority of the patients, 95.7% (n=3,540) were new in treatment, and it was maintained in both eras, before COVID-19, 96.1% (n=1,905) and during COVID-19, 95.3% (n=1,635). Considering disease classification, the majority of the patients, 84.2% (n=3,115) had pulmonary TB, the share was consistently high in both eras, before COVID-19, 87.7%, n=1,740 and during COVID-19, 80.2% n=1,375. According to HIV status, nearly a quarter of the patients, 24.4% (n=899) were HIV co-infected, the distribution was almost similar before COVID-19, 24.8% (n=492), and during COVID-19, 23.8% (n=407) *(table 1).*

Table 1: Baseline characteristics of study participants before COVID-19 (February-July 2010) and during COVID-19 (March-August 2020), (N=3698)

Characteristic	Before COVID-19 (February -July 2019)	During COVID-19 (March-August 2020)	Total
N	1,983 (53.6%)	1,715 (46.4%)	3,698 (100.0%)
District			
Ilala	614 (31.0%)	533 (31.1%)	1,147 (31.0%)
Kigamboni	75 (3.8%)	91 (5.3%)	166 (4.5%)
Kinondoni	532 (26.8%)	367 (21.4%)	899 (24.3%)
Temeke	541 (27.3%)	490 (28.6%)	1,031 (27.9%)
Ubungo	221 (11.1%)	234 (13.6%)	455 (12.3%)
Sex			
Female	731 (36.9%)	577 (33.6%)	1,308 (35.4%)
Male	1,252 (63.1%)	1,138 (66.4%)	2,390 (64.6%)
Age (years)[cat]			
0-14	402 (20.3%)	212 (12.4%)	614 (16.6%)
15-24	268 (13.5%)	233 (13.6%)	501 (13.5%)
25-34	421 (21.2%)	410 (23.9%)	831 (22.5%)
35-44	422 (21.3%)	377 (22.0%)	799 (21.6%)
45-54	246 (12.4%)	267 (15.6%)	513 (13.9%)
55+	224 (11.3%)	216 (12.6%)	440 (11.9%)
Mean (SD)	31.6 (19.2)	34.7 (17.9)	33.0 (18.7)
Referrals			
CTC	287 (14.5%)	218 (12.7%)	505 (13.7%)
Community	269 (13.6%)	239 (13.9%)	508 (13.7%)
IPD	0 (0.0%)	5 (0.3%)	5 (0.1%)
Others	238 (12.0%)	541 (31.5%)	779 (21.1%)
RCHS	0 (0.0%)	52 (3.0%)	52 (1.4%)
Self	1,189 (60.0%)	660 (38.5%)	1,849 (50.0%)
Treatment History			
New	1,905 (96.1%)	1,635 (95.3%)	3,540 (95.7%)
Relapse	42 (2.1%)	51 (3.0%)	93 (2.5%)
Treatment after failure patient	4 (0.2%)	5 (0.3%)	9 (0.2%)
Treatment after LTFU patient	8 (0.4%)	8 (0.5%)	16 (0.4%)
Other	24 (1.2%)	16 (0.9%)	40 (1.1%)
Disease classification			
Both	15 (0.8%)	12 (0.7%)	27 (0.7%)
Extra pulmonary	228 (11.5%)	328 (19.1%)	556 (15.0%)
Pulmonary	1,740 (87.7%)	1,375 (80.2%)	3,115 (84.2%)
HIV Status			
Positive	492 (24.8%)	407 (23.8%)	899 (24.4%)
Negative	1,490 (75.2%)	1,300 (76.2%)	2,790 (75.6%)

Key: cat=Age category according to National Tuberculosis and Leprosy Program Report, 2020

4.4 Objective 1: To determine the proportion of TB cases that were missed due to the COVID-19 pandemic in the Dar es Salaam region

The objective was answered by calculating the difference in TB case notifications before COVID-19 and during COVID-19. The relative difference (percentage difference) was obtained by dividing the difference obtained by the number of cases notified in 2019 (before COVID-19). The results show that 13.5% (n=268) of cases were missed during the COVID-19 pandemic. Based on the districts, Kinondoni missed more cases, 31.0% (n=165) during COVID-19 compared to other districts. Kigamboni and Ubungo districts experienced an increase in TB cases during COVID-19 than before COVID-19 (+21.3% (n=16) vs + 5.9% (n=13)). In terms of sex, females lost more cases, 21.1% (n=154) during COVID-19 compared to male counterparts (9.1%, n=114). Notification of TB cases among children was low during COVID-19, nearly by half of the cases, n=190 notified before COVID-19, while for those aged 45-54 years, their notification was up by 8.5% (n=21).

Among self-referrals, notification was down by 44.5% (n=529) compared to the pre-COVID-19 era, notification in "other types" of referral was higher during COVID-19 by 127% (n=303) compared to the pre-COVID-19 era. In treatment history, "other" treatment history had lower notification by 33.3% (n=8) in the COVID-19 era than in the pre-COVID-19, relapse case notification was higher by 21.4% (n=9) during the COVID-19 pandemic compared to the pre-COVID-19. Notification among pulmonary TB patients was down by 21% (n=365) compared to the pre-COVID-19 era, on the other hand, notification among extra pulmonary TB patients was up by 43.9% (n=100) during COVID-19. HIV-positive patients experienced more decline in cases, 17.3% (n=85) compared to HIV-negative counterparts, 12.8% (n=190) *(table 2)*.

Table 2: Overall and by group proportion of TB cases missed during COVID-19, (N=3698)

Characteristic	Before COVID-19 (February - July 2019)	During COVID-19 (March-August 2020)	Difference	Percentage difference
N	1,983	1,715	268	13.5%
District				
Ilala	614	533	81	13.2%
Kigamboni	75	91	-16	+21.3%
Kinondoni	532	367	165	31.0%
Temeke	541	490	51	9.4%
Ubungo	221	234	-13	+5.9%
Sex				
Female	731	577	154	21.1%
Male	1,252	1,138	114	9.1%
Age (years)				
0-14	402	212	190	47.3%
15-24	268	233	35	13.1%
25-34	421	410	11	2.6%
35-44	422	377	45	10.7%
45-54	246	267	-21	+8.5%
55+	224	216	8	3.6%
Referrals				
CTC	287	218	69	24.0%
Community	269	239	30	11.2%
IPD	0	5	-5	
Others	238	541	-303	+127.3%
RCHS	0	52	-52	N/A
Self	1,189	660	529	44.5%
Treatment History				
New	1,905	1,635	270	14.2%
Relapse	42	51	-9	+21.4%
Treatment after failure patient	4	5	-1	+25.0%
Treatment after lost to follow up patient	8	8	0	0.0%
Other	24	16	8	33.3%
Disease classification				
Both	15	12	3	20.0%
Extra pulmonary	228	328	-100	+43.9%
Pulmonary	1,740	1,375	365	21.0%
HIV Status				
Positive	492	407	85	17.3%
Negative	1,490	1,300	190	12.8%

4.5 Objective Two: To determine the extent of the effect the COVID-19 pandemic had on TB treatment outcomes among TB patients in the Dar es Salaam region

Treatment outcomes profile of the Drug Sensitive Tuberculosis (DS-TB) patient cohorts, before and during COVID-19

The DS-TB treatment outcomes namely; completed treatment, cured, died, lost to follow-up, and treatment failure as defined by the NTLP were assessed. Of the outcomes, the highest share was the treatment completion in both eras, 54.8% (n=1087) in the pre-COVID-19, and 50.5% (n=866) during the COVID-19 era. The cured outcome was higher during COVID-19, 43.8% (n=751) compared to the pre-COVID-19, 40.3% (n=800). Death outcome was almost similar in both eras (3.5% before COVID-19 and 3.8% during COVID-19). Not evaluated patients were more, 5 (0.3%) in the COVID-19 era than, 1 (0.1%) in the pre-COVID-19 era *(table 3)*.

Table 3: Treatment outcomes profile of DS-TB patient cohorts before and during COVID-19, (N=3,698)

DS-TB Treatment Outcome	Cohort		
	Before COVID-19 (February -July 2019)	During COVID-19 (March-August 2020)	Total
Completed treatment	1087 (54.8)	866 (50.5)	1953 (52.8)
Cured	800 (40.3)	751 (43.8)	1551 (41.9)
Died	70 (3.5)	65 (3.8)	135 (3.6)
Lost to follow-up	20 (1.0)	25 (1.5)	45 (1.2)
Treatment failed	5 (0.3)	3 (0.2)	8 (0.2)
Not evaluated	1 (0.1)	5 (0.3)	6 (0.2)
Total	1983	1715	3698

Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19

Favorable treatment outcomes as defined by NTLP entail completed treatment and cured patients at the end of treatment outcome evaluation, the remaining outcomes; death, treatment failure, and loss to follow-up constitute unfavorable treatment outcomes. The results from this study show a slight increase in the proportion of unfavorable treatment outcomes during the COVID-19 era, 5.4% (n=93) compared to the pre-COVID-19 era, 4.8% (n=93) although the difference was not statistically significant (p=0.374) *(Figure 4)*.

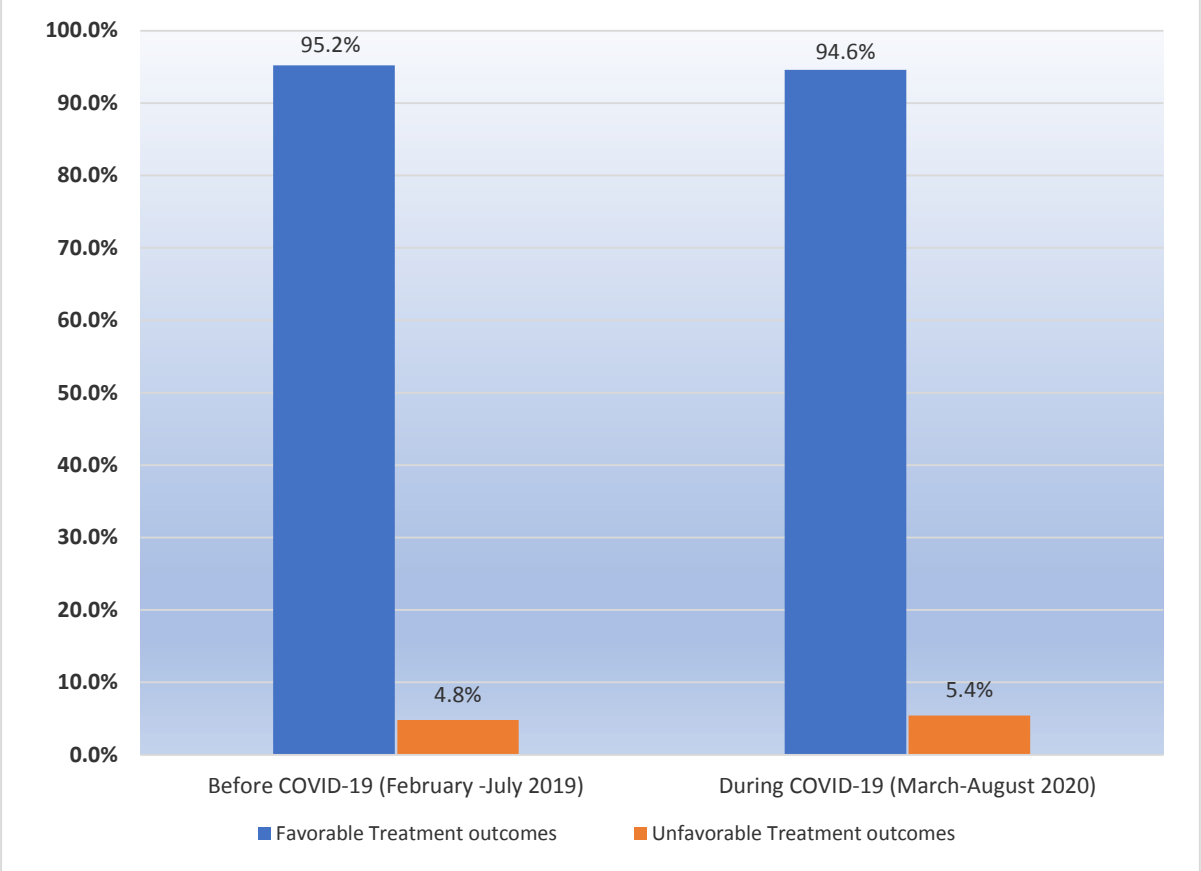


Figure 4: Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19

Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by district

Comparing treatment outcomes before and during COVID-19 within the districts, the results show that, of the 5 districts, Kinondoni had the worst unfavorable treatment outcomes, with a difference of 3.8% between pre-COVID-19 and during COVID-19, p-value=0.002 compared to other districts. Ilala had a better performance during COVID-19 i.e., the unfavorable treatment decreased by 1.9%, it was 4.1% during COVID-19 compared to 6.0% in the pre-COVID-19, although the difference was not statistically significant (P-value=0.15), Temeke district as well had better treatment outcomes during COVID-19 than in the pre-COVID-19, i.e., the unfavorable treatment outcomes decreased by 0.9% during COVID-19, the observed difference did not reach statistical significance, as well, p-value=0.51. Other districts showed worse performance during the COVID-19 era than in the pre-COVID-19 era, Ubungo (6.8% vs 5.4%, p=0.53) and Kigamboni (15.4% vs 12.2%, p=0.55) ***(table 5).***

Table 5: Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by district

Era	**Ilala**[a]		**Kinondoni**[b]		**Temeke**[c]		**Ubungo**		**Kigamboni**[e]	
	Favorable Treatment outcomes	Unfavorable Treatment outcomes	Favorable Treatment outcomes	Unfavorable Treatment outcomes	Favorable Treatment outcomes	Unfavorable Treatment outcomes	Favorable Treatment outcomes	Unfavorable Treatment outcomes	Favorable Treatment outcomes	Unfavorable Treatment outcomes
Total	1087 (94.8)	59 (5.2%)	868 (96.8%)	29 (3.2%)	980 (95.2%)	49 (4.8%)	427 (93.8%)	28 (6.2%)	142 (86.1%)	23 (13.9%)
Before COVID-19	577 (94.0%)	37 (6.0%)	523 (98.3%)	9 (1.7%)	513 (94.8%)	28 (5.2%)	209 (94.6%)	12 (5.4%)	65 (87.8%)	9 (12.2%)
During COVID-19	510 (95.9%)	22 (4.1%)	345 (94.5%)	20 (5.5%)	467 (95.7%)	21 (4.3%)	218 (93.2%)	16 (6.8%)	77 (84.6%)	14 (15.4%)
Difference in the unfavorable outcomes	-	(1.9%)	-	3.8%	-	(0.9%)	-	1.4%	-	3.2%

Key= - indicates non-applicable region, letters a-e denote the p-values in the respective districts i.e., a=0.15, b=0.002, c=0.51, d=0.53, e=0.5. the () in the last row indicates the numerical value (difference) was negative.

Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by gender

Based on gender, the results show, that among females, unfavorable treatment outcomes increased during COVID-19 than in the pre-COVID-19 era (7.5% vs 5.1%) although the difference was not statistically significant (p-vale=0.07), furthermore, the results show that among males, there were low unfavorable treatment outcomes during COVID-19 era than in the pre-COVID-19 era as well (4.4% vs 4.6%), also, the observed difference did not reach statistical significance (p-value=0.79) ***(table 6).***

Table 6: Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by gender, (N=3692)

	Females			**Males**		
Era	**Favorable Treatment outcomes**	**Unfavorable Treatment outcomes**	**p-value**	**Favorable Treatment outcomes**	**Unfavorable Treatment outcomes**	**p-value**
Before COVID-19	694 (94.9%)	37 (5.1%)	0.07	1,193 (95.4%)	58 (4.6%)	0.79
During COVID-19	532 (92.5%)	43 (7.5%)		1,085 (95.6%)	50 (4.4%)	
Total	1226 (93.9)	80 (61.1)		2278 (95.5)	108 (4.5)	

Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by age

Age was recategorized into 0-14 years as children, 15-54 years as adults, and 55+ years as elderly per NTLP categorization. The results show that, among children, unfavorable treatment outcomes were low during COVID-19 compared to pre-COVID-19 (0.5% vs 3.0%) with a significant difference between the two periods (p-value=0.04). Among adults, treatment outcomes were worse during COVID-19 compared with the pre-CIVID-19 era (5.1% vs 4.9%) although the difference was not significant (p-value=0.81), also elders had poorer treatment outcomes during COVID-19 than in the pre-COVID-19 (12.6% vs 7.6%) although the difference was not significant (p-value=0.08) ***(table 7).***

Table 7: Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by age, (N=3692)

Era	**Children (0-14 years)**			**Adults (15-54 years)**			**Elderly (55+)**		
	Favorable Treatment outcomes	Unfavorable Treatment outcomes	p-value [f]	Favorable Treatment outcomes	Unfavorable Treatment outcomes	p-value	Favorable Treatment outcomes	Unfavorable Treatment outcomes	p-value
Before COVID-19	390 (97.0%)	12 (3.0%)	0.04	1,290 (95.1%)	66 (4.9%)	0.81	207 (92.4%)	17 (7.6%)	0.08
During COVID-19	211 (99.5%)	1 (0.5%)		1,218 (94.9%)	65 (5.1%)		188 (87.4%)	27 (12.6%)	
Total	601 (97.9)	13 (2.1%)		2508 (95.0%)	131 (5.0%)		395 (90.0%)	44 (10.0%)	

Key: f-indicates the p-value was calculated based on Fisher's exact test

Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by disease classification

In terms of disease classification, all patients diagnosed with both pulmonary and extra-pulmonary classified as “both” had unfavorable treatment in both era. On the other side, extra-pulmonary patients had more unfavorable treatment outcomes during COVID-19 compared to pre COVID-19 era (8.6% vs 7.9%, p-value=0.78), also among pulmonary TB patients, there were more unfavorable treatment outcomes during COVID-19 era compared to the pre-COVID-19 era (4.7% vs 4.4%, p-value=0.68) ***(table 8).***

Table 8: Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by disease classification, (N=3692)

Era	Extra pulmonary			Pulmonary		
	Favorable Treatment outcomes	**Unfavorable Treatment outcomes**	**p-value**	**Favorable Treatment outcomes**	**Unfavorable Treatment outcomes**	**p-value**
Before COVID-19	210 (92.1%)	18 (7.9%)	**0.78**	1,662 (95.6%)	77 (4.4%)	**0.68**
During COVID-19	299 (91.4%)	28 (8.6%)		1,306 (95.3%)	65 (4.7%)	
Total	509 (91.7)	46 (8.3)		2968 (95.4)	142 (4.6)	

NB: All 15 patients diagnosed with both pulmonary and extra-pulmonary TB before COVID-19 and during COVID-19 had no unfavorable treatment outcomes.

Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by HIV status

Treatment outcomes by HIV status of the patients were analyzed, both HIV-positive and negative experienced more unfavorable treatment outcomes during COVID-19 than in the pre-COVID-19 era. The unfavorable treatment outcome stood at 10.1% during COVID-19 than 9.8% in the pre-COVID-19 among HIV Positive, although the difference was not statistically significant. In HIV-negative patients, unfavorable treatment outcomes were as high as 4.5% during COVID-19 compared to 3.2% before the COVID-19 era, the observed difference did not reach statistical significance., p-value=0.22 ***(table 9).***

Table 9: Favorable and Unfavorable Treatment outcomes of DS-TB patient cohorts before and during COVID-19 by HIV status

Era	HIV-Positive			HIV-Negative		
	Favorable Treatment outcomes	**Unfavorable Treatment outcomes**	**p-value**	**Favorable Treatment outcomes**	**Unfavorable Treatment outcomes**	**p-value**
Before COVID-19	444 (90.2%)	48 (9.8%)	0.87	1,442 (96.8%)	47 (3.2%)	0.22
During COVID-19	366 (89.9%)	41 (10.1%)		1,244 (96.0%)	52 (4.0%)	
Total	810 (90.1%)	89 (9.9%)		2686 (96.4%)	99 (3.6%)	

4.6 Objective 3: To assess the factors associated with poor TB treatment outcomes during the COVID-19 pandemic in the Dar es Salaam region

TB program operation during the COVID-19 pandemic in the visited health facilities

In order to assess the factors associated with unfavorable treatment outcomes, TB program operation status was assessed to determine changes in the landscape of program functioning during COVID-19. Of the 30 visited health facilities, only one health facility (3.3%) had a project/intervention that stopped TB case detection activities during the COVID-19 pandemic, while 60% (n=18) of the health facilities had project/interventions that reduced TB case detection activities during the COVID-19 pandemic.

For the activities to improve treatment outcomes, no health facility reported having a project that stopped its function, while 20% (n=6) reported having projects/interventions that reduced their activities. Four health facilities (13.3%) had their TB medical staff reallocated from TB to fight COVID-19, and only one facility gave up its TB premise to accommodate COVID-19 patients/presumptive. One health facility (3.3%) reported to have funds reallocated from the TB program to fight COVID-19 *(Table 10)*.

Table 10: TB program operation during the COVID-19 pandemic in the visited health facilities, n=30

	Frequency (%)
The facility had a project/intervention that stopped TB case detection activities during the COVID-19 pandemic	
Yes	1 (3.3%)
No	29 (96.7%)
The facility had projects/interventions that reduced its TB case detection activities during the COVID-19 pandemic	
Yes	18 (60.0%)
No	12 (40.0%)
The facility had a project/intervention meant to improve TB treatment outcomes but stopped its activities after COVID-19 came in	
Yes	0 (0%)
No	30 (100.0%)
The facility had a project/intervention meant to improve TB treatment outcomes that reduced its activities during the COVID-19 pandemic	
Yes	6 (20.0%)
No	24 (80.0%)
The facility had TB medical staff reallocated with COVID-19 duties during COVID-19 pandemic	
Yes	4 (13.3%)
No	26 (86.7%)
The facility had its TB premise shifted to accommodate COVID-19 patients	
Yes	1 (3.3%)
No	29 (96.7%)
The facility experienced reallocation of funds meant for TB to COVID-19 during the pandemic	
Yes	1 (3.3%)
No	28 (93.3%)
I don't know	1 (3.3%)

Factors for unfavorable TB treatment outcomes before and during the COVID-19 pandemic

The factors for unfavorable TB treatment were assessed to determine if there was a shift of factors between the pre-COVID-19 and during COVID-19. Demographic and clinical factors were assessed, in the Pre COVID-19, patients from Kigamboni district had 6.54 (95%CI: 1.91-22.33, p=0.003) and from Ilala district had 4.03 (95%CI: 1.02-15.94, p=0.047) time likely of having unfavorable treatment outcomes compared to patients from Kinondoni district. Kigamboni district remained the factor [OR=2.29 (95%CI: 1.39-3.77, P=0.001) during the COVID-19 pandemic. In the pre-COVID-19, age was not associated with unfavorable treatment outcomes, however, during COVID-19 elders (55+) were 19.69 (95%CI: 2.30-168.25, P=0.006) more likely to have unfavorable treatment outcomes compared to children (0-14 years).

HIV status (positive) remained an important factor for unfavorable treatment outcomes before the pandemic (OR=2.81 (95%CI:1.44-5.48, p=0.002) and during the pandemic (OR=2.73 (95%CI: 1.79-4.18, p<0.001). According to treatment history, treatment after lost to follow-up patients were 9.99 (95%CI: 2.24-44.51, p=0.003) times more likely to have unfavorable treatment outcomes before COVID-19, and they were 5.19 (95%CI: 2.11-12.73, p<0.001) times likely to have unfavorable treatment outcomes compared to new patients during the pandemic. Extra-pulmonary TB patients were 1.95 (95%CI: 1.22-3.10, p=0.005) times likely to have unfavorable treatment outcomes before the pandemic and had 1.56 (95%CI:1.08-2.26, p=0.018) timely likely to have unfavorable treatment outcomes during the pandemic.

In the pooled analysis (pre- and during COVID-19), patients from the Kigamboni district were 4.67 (95%CI: 2.57-8.46, p<0.001) more likely to have unfavorable treatment outcomes compared to the patients from Kinondoni district. According to age, elders (55+ years) had 3.68 (95%CI: 1.73-7.81, p=0.001) more likely to have unfavorable treatment outcomes compared to children (0-14 years). HIV-positive patients were 2.74 (95%CI:1.98-3.80, p<0.001) more likely to have unfavorable treatment outcomes compared to HIV-negative counterparts. Treatment after lost to follow-up patients were 7.45 (95%CI: 3.37-16.44, p<0.001), and extra-pulmonary TB patients were 1.81 (95%CI: 1.34-2.45, p<0.001) more likely to have unfavorable treatment outcomes compared to new TB patients and pulmonary TB patients respectively. During the COVID-19 period had no association with treatment outcomes (OR=1.08 (0.79-1.48), p=0.631) (table 11).

Table 11: Factors for unfavorable TB treatment outcomes before and during the COVID-19 pandemic

Factor	Before COVID-19		During COVID-19		Across the two periods	
	Adjusted Odds ratio	P-Value	Adjusted Odds ratio	P-Value	Adjusted Odds ratio	P-Value
Sex						
Male	Ref		Ref		Ref	
Female	0.96 (0.69-1.34)	0.831	1.46 (1.14-1.87)	0.003	1.22 (0.94-1.58)	0.131
District						
Kinondoni Municipal Council	Ref		Ref		Ref	
Ilala Municipal Council	4.03 (1.02-15.94)	0.047	1.06 (0.48-2.32)	0.885	1.79 (0.76-4.20)	0.18
Kigamboni Municipal Council	6.54 (1.91-22.33)	0.003	2.29 (1.39-3.77)	0.001	4.67 (2.57-8.46)	<0.001
Temeke Municipal Council	2.90 (0.91-9.21)	0.071	0.89 (0.56-1.41)	0.608	1.57 (0.89-2.77)	0.123
Ubungo Municipal Council	2.71 (0.66-11.22)	0.168	1.24 (0.38-4.07)	0.721	1.86 (0.60-5.73)	0.282
Ownership						
Private			Ref			
Public			9.88 (0.74-132.02)	0.083		
Age (Years)						
0-14	Ref		Ref		Ref	
15-54	1.06 (0.57-1.96)	0.862	7.48 (0.94-59.27)	0.057	1.64 (0.90-3.01)	0.106
55+	1.84 (0.80-4.25)	0.155	19.69 (2.30-168.25)	0.006	3.68 (1.73-7.81)	0.001

Key: ref =reference, green region indicates the variables that didn't enter in the multivariable model of having the p-value>0.2 in the bivariate analysis. Blue region indicates N/A variables, -=No observation of interest (unfavorable treatment outcome) in a particular row.

Table 11: Factors for unfavorable TB treatment outcomes before and during the COVID-19 pandemic (continued)

Factor	Before COVID-19		During COVID-19		Across the two periods	
	Adjusted Odds ratio	P-Value	Adjusted Odds ratio	P-Value	Adjusted Odds ratio	P-Value
Referral type						
CTC	1.05 (0.53-2.10)	0.88	0.66 (0.36-1.19)	0.165	0.87 (0.56-1.35)	0.535
Community	1.01 (0.55-1.84)	0.982	0.94 (0.38-2.31)	0.886	0.96 (0.57-1.60)	0.861
Other	Empty	0.287	0.91 (0.44-1.89)	0.8	0.80 (0.36-1.80)	0.59
Self	Ref		Ref		Ref	
HIV Status						
Negative	Ref		Ref			
Positive	2.81 (1.44-5.48)	0.002	2.73 (1.79-4.18)	<0.001	2.74 (1.98-3.80)	<0.001
History of treatment						
New	Ref		Ref		Ref	
Relapse	1.22 (0.42-3.56)	0.711	1.15 (0.40-3.30)	0.79	1.11 (0.46-2.68)	0.821
Treatment after failure patient	-		-		-	
Treatment after lost to follow up patient	9.99 (2.24-44.51)	0.003	5.19 (2.11-12.73)	<0.001	7.45 (3.37-16.44)	<0.001
Other	1.84 (0.40-8.39)	0.434	2.26 (1.07-4.76)	0.032	2.19 (0.84-5.67)	0.107
Disease classification						
Both	-		-		-	
Extra pulmonary	1.95 (1.22-3.10)	0.005	1.56 (1.08-2.26)	0.018	1.81 (1.34-2.45)	<0.001
Pulmonary	Ref		Ref		Ref	
Period						
Before COVID-19					Ref	
During COVID-19					1.08 (0.79-1.48)	0.631

CHAPTER FIVE

5.0 DISCUSSION

5.1 Discussion

5.1.1 The effects of COVID-19 on Tuberculosis case detection

This study found that TB case detection was down by 13.5% during the COVID-19 pandemic, and variation was across districts, whereby Kinondoni district lost a significant number of cases, while Kigamboni and Ubungo experienced increased cases during the COVID-19 pandemic. Further, the study discovered that females lost more cases than their male counterparts. Children lost many cases during the COVID-19 pandemic, while adults had more cases during the pandemic, and self-referral patients' cases were down during COVID-19 compared to the pre-COVID-19 era. TB case detection among pulmonary TB patients was low during COVID-19 compared to the pre-COVID-19. These findings imply that there was a significant setback for TB control efforts during the COVID-19 pandemic, potentially leading to undiagnosed cases in the community.

The findings from this study concur with studies conducted elsewhere. The study conducted in Indonesia, analyzing TB program data revealed a 31% decline in TB notifications during the COVID-19 period compared to pre-COVID-19 (41). A retrospective study conducted in Italy showed a 19.7% reduction in TB cases during the COVID-19 period compared to the pre-COVID-19 period (42). Similarly, a study conducted in India reported a massive decrease in TB case notifications during the COVID-19 era compared to the pre-COVID-19 period (43). In African countries, a similar trend was observed, A study conducted in Ethiopia revealed that routine TB diagnosis was severely affected, leading to a significant decrease in detected TB cases during the COVID-19 period compared to before the pandemic (44). Similar declines in TB case notifications during the COVID-19 pandemic were reported in Egypt, Mozambique, and Eswatini (45–47). A study conducted in Malawi reported a 35.9% decrease in TB notifications, with women and girls more affected than men and boys (57). Another study conducted in Malawi reported a decrease in TB case detection, with children and females more affected (58), conversely, a study in India reported the COVID-19 pandemic adversely impacted TB diagnosis, resulting in a significant

reduction in active TB case detection, but the paper does not differentiate effects between females and males (59). Studies show that the COVID-19 pandemic significantly impacted TB and HIV services in several African countries. Studies in Malawi, Zimbabwe, Kenya, and Ghana reported substantial decreases in TB case detection among people living with HIV (26,58,60,61). These findings highlight the urgent need to revise TB control strategies during the pandemic

5.1.2 The effect of the COVID-19 pandemic on TB treatment outcomes among TB patients

The findings from this study reveal a slight increase in the proportion of unfavorable treatment outcomes during the COVID-19 era, 5.4% compared to the pre-COVID-19 era, 4.8%, with both males and females experiencing poorer treatment outcomes during COVID-19 than pre-COVID-19. Among pulmonary TB patients, there were more unfavorable treatment outcomes during the COVID-19 era, 4.7% compared to the pre-COVID-19 era, 4.4%. Both HIV-negative and positive had more unfavorable treatment outcomes during COVID-19 than the COVID-19 era. The rate of unfavorable treatment outcomes varied across districts, whereby the Ilala and Temeke districts had better treatment outcomes while the remaining districts experienced worse outcomes. Overall, the death rate and loss to follow-up were higher during COVID-19 than in the pre-COVID-19. The observed increased gap in unfavorable treatment outcomes (death rate and loss to follow-up) signifies the critical gaps in TB control programs during COVID-19 pandemic.

Different studies have documented the findings similar to this study. A study conducted in Eswatini fitting data on logistic regression, reported higher odds of unfavorable outcomes (death, lost-to-follow-up, and not evaluated) during the pandemic than pre-pandemic (47). Further, a study conducted in Zimbabwe reported a decrease in TB treatment success from 80.9 to 69.3%, during the COVID-19 period and pre-COVID-19 respectively (26). Studies conducted in Ethiopia, Senegal, India, and Kazakhstan documented higher rates of unfavorable treatment outcomes during COVID-19 than in the pre-COVID-19 (62–64).

On poor adherence in care (loss to follow-up), the findings from this study are similar to studies conducted in Africa and beyond, a study conducted in Italy reported an increase in the proportion of patients who were lost to follow-up during the COVID-19 period, despite the efforts to keep TB services fully functional (42). Studies conducted in Vietnam, Indonesia, and India reported similar results (41,48,49,65). In Africa, the studies reported mixed findings on the impact of COVID-19 on the retention in care. A study conducted in Eswatini reported a 1.5% loss to follow-up rate during the COVID-19 pandemic compared to a 0.7% loss to follow-up reported in the pre-COVID-19 era (47). A study conducted in Sierra Leone reported an improved retention in care during the COVID-19 pandemic than in pre-pandemic (50).

The effects of COVID-19 on increased death rates have been widely documented, A study conducted in India reported an increase of 8% in death among TB patients during the COVID-19 pandemic compared to the pre-COVID-19 era (41). Similarly, in Italy, it was reported an increase in the proportion of TB patients who died during the COVID-19 period compared to the pre-COVID-19 era, (42). A multi-country study conducted covering 11 countries in Europe, North America, and Australia reported more TB-related deaths were observed in the studied countries during the pandemic compared to the pre-COVID-19 pandemic (51). Likewise, a study conducted in three high-burden countries (Kenya, India, and Ukraine) revealed increased mortality during the pandemic (52). In the African context, a similar trend of high mortality rate was observed in South Africa, Eswatini, Uganda, and Rwanda (47,53,66,67). The findings imply that the COVID-19 pandemic intensified treatment challenges and worsened outcomes for TB patients, highlighting the need for strengthened healthcare systems and targeted interventions to mitigate such impacts during global health crises.

5.1.3 Factors associated with unfavorable TB treatment outcomes before and during the COVID-19 pandemic

The results from this study show that living in Kigamboni District, being HIV positive, receiving treatment after loss to follow-up compared to new patients, and having Extra-pulmonary TB were independent determinants of unfavorable treatment outcomes in both before the COVID-19 era and during the COVID-19 era. While on the shift of the factors,

the study found that women and older adults (55+ years) became vulnerable to unfavorable treatment outcomes during COVID-19 as opposed to before the COVID-19 era. Other studies found COVID-19 pandemic has significantly impacted tuberculosis (TB) treatment outcomes, particularly for female patients (68,69), and older age (58,64), while these findings from this study are consistent with the findings from this study, other studies show males had poorer treatment outcomes than females (64,69). The findings from this study highlight the need to tailor TB services to female and older people, especially during pandemics like COVID-19.

Consistent with the results from this study, other studies found being an HIV patient is a determinant of unfavorable treatment outcomes (47,64,70), also patients with poor adherence had a higher likelihood of having poor TB treatment outcomes (47,71,72), as well as, having extra-pulmonary TB (59). These findings highlight the importance of addressing the challenges and paying extra attention to HIV patients, those with poor medication adherence, and extrapulmonary TB patients.

5.2 Strength of the Study

Relevance and Timeliness: This study addresses a critical and timely issue; the impact of COVID-19 on TB case detection and treatment outcomes. This enhances the understanding of the challenges the pandemics can bring to the health systems.

Impactful findings and implications: The potential findings of this study can inform public health policy and programmatic responses to TB management, especially in the context of pandemics.

Potential for Generalizability: The study's setting in a major urban area like Dar es Salaam, which has a high burden of TB, enhances the applicability of findings to similar contexts in Tanzania and other regions facing similar challenges.

5.3 Study limitations

This study included drug-sensitive TB patients only, excluding Multidrug resistance TB(MDR-TB) patients with longer follow-up periods, which could result in overlapping the study periods. Due to this exclusion, the generalization of the findings applies only to drug-sensitive TB patients.

In this study, health facilities operating under military and police were excluded of having a long process of obtaining permission to conduct a study. Exclusion of these health limits the generalization of the findings to the patients receiving TB services in non-military/police health facilities.

Conducting a retrospective study means that, the researcher utilized readily available data, which necessitates the analyses confined to the available data, this has the potential to introduce bias due to unmeasured confounders, to overcome this challenge, the researcher utilized all the variables possible included in the dataset to control for the confounders.

5.3.1 Suggestions for future research

Despite interesting findings from this study, the study didn't include Multidrug resistance TB(MDR-TB) of having longer follow-up. Biologically, MDR-TB patients are more burdened by the bacillus causing poor bacteria clearance, hence poor outcomes, moreover due to longer treatment time (15-24 months) MDR-TB patients always face social and economic burden (catastrophic costs), which predicts poor treatment outcomes. Therefore, the researcher suggests a similar study be conducted to cover MDR-TB patients to quantify the unfavorable treatment outcomes and factors associated with unfavorable treatment outcomes.

6.0 CHAPTER SIX

7.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

This study demonstrates that the COVID-19 pandemic significantly affected TB case detection and treatment outcomes in the Dar es Salaam region, with a 13.5% decline in case detection. Certain districts, such as Kinondoni, experienced more substantial losses, while others, like Kigamboni, saw an increase in cases. Females, children, and self-referred patients were disproportionately affected by the decrease in TB detection during the pandemic.

Additionally, the study found an increase in unfavorable treatment outcomes, with higher death rates and loss to follow-up, particularly in districts like Ubungo and Kigamboni. Vulnerable groups, such as older adults (55+ years) and HIV-positive patients, were identified as having poorer treatment outcomes during the pandemic. The increased mortality and poor treatment adherence during the pandemic underscore the need for robust TB care and support systems, particularly during global health crises.

6.2 Recommendations

Based on the findings from this study, the researcher recommends the following,

1. Kinondoni district should learn strategies applied by Kigamboni and Ubungo districts which despite interference of the COVID-19 pandemic in the TB program, the districts kept the TB case detection rate increasing. The common mechanism adopted by TB program implementors who managed to increase TB case notification and improved treatment outcomes during COVID-19 includes the use of information technology such as the use of the **Unstructured Supplementary Service Data (USSD) code** to enhance self-screening, drug dispensing, and evaluation of medication adherence.
2. TB program in Dar es Salaam to ensure enhanced TB services among females and children who are vulnerable to stocks brought by pandemics like COVID-19. Despite the good health-seeking behavior among women, the results from this study show TB case detection among females was significantly affected during COVID-

19, therefore tailored interventions such as phone calls and reminders to enhance provider or self-screening among females should be considered during pandemics.

Also, during the pandemic as the movement becomes limited, the program should consider integrating TB services at the family level such as the provision of health education to a family member who encounters a health facility to educate other family members on preventing and screening TB as an alternative to the community-based service provision to enhance more screening among children as they have a longer time to stay with family members compared to community members during pandemics, as is evidenced in this study by improved TB treatment outcomes during COVID-19 among few notified TB cases among children.

3. TB program in Dar es Salaam should continue working on improving treatment outcomes among groups such as HIV patients, and extrapulmonary TB patients who are prone to poor TB treatment outcomes. The program should consider approaches such as nutritional support and enhanced TB screening using technologies such as urine-LAM tests among people living with HIV for early detection and early initiation of treatment which are associated with favorable treatment outcomes.

8.0 REFERENCES

1. World Health Organization. Global tuberculosis report 2020. World Health Organization; 2020.
2. World Health Organization. Global tuberculosis report 2021: TB deaths and incidence. Global tuberculosis report. World Health Organization; 2021.
3. Teo AKJ, Rahevar K, Morishita F, Ang A, Yoshiyama T, Ohkado A, et al. Tuberculosis in older adults: case studies from four countries with rapidly ageing populations in the western pacific region. BMC Public Health. 2023 Dec 1;23(1).
4. Zumla A, Malon P, Henderson J, Grange JM. Impact of HIV infection on tuberculosis. Postgrad Med J. 2000;(76):259–68.
5. Restrepo BI. Schlossberg D, editor. Vol. 4, Microbiology Spectrum. 2016. Diabetes and Tuberculosis. Available from: https://journals.asm.org/doi/10.1128/microbiolspec.TNMI7-0023-2016
6. Soko RN, Burke RM, Feasea HRA. Impact of COVID-19 on tuberculosis notifications in Blantyre Malawi : an interrupted time series analysis and qualitative study with healthcare workers. 2021; Available from: http://eprints.whiterose.ac.uk/172842/
7. Jurado LF, Palacios DM, Jurado LF, Palacios DM. Tuberculosis: A Risk Factor Approach. Tuberculosis [Internet]. 2018 Mar 16 [cited 2024 Oct 8]; Available from: https://www.intechopen.com/chapters/59122
8. Fox GJ, Menzies D. Epidemiology of Tuberculosis immunology. Adv Exp Med Biol. 2013;783:1–32.
9. Saleh J, Adamu HI. Globalization and the Spread of Multi-Drug Resistant Tuberculosis. Journal of Health, Medicine and Nursing. 2015;
10. Millet JP, Moreno A, Fina L, Baño L Del, Orcau A, De Olalla PG, et al. Factors that influence current tuberculosis epidemiology. Vol. 22, European Spine Journal. 2013.
11. World Health Organization. Global tuberculosis report 2020. World Health Organization; 2020.
12. Conan N, Simons E, Ohler L, Mbatha M, van Cutsem G, Huerga H. Prevalence of TB and health-seeking behaviour. International Journal of Tuberculosis and Lung Disease. 2022 May 1;26(5):463–5.
13. World Health Organization. Integrating tuberculosis screening into community-based HIV activities: Case study of Demographic Republic of Congo. 2020.
14. United Republic of Tanzania. The National Tuberculosis and Leprosy Programme (NTLP), Annual Report for 2019 [Internet]. 2020. Available from: www.ntlp.go.tz

15. Perez-Velez CM, Marais BJ. Tuberculosis in Children. New England Journal of Medicine [Internet]. 2012 Jul 26;367(4):348–61. Available from: http://www.nejm.org/doi/abs/10.1056/NEJMra1008049

16. Dhamnetiya D, Patel P, Jha RP, Shri N, Singh M, Bhattacharyya K. Trends in incidence and mortality of tuberculosis in India over past three decades: a joinpoint and age–period–cohort analysis. BMC Pulm Med. 2021 Dec 1;21(1).

17. Penjor K, Kuenzang, Tshokey T, Wangdi K. The trend of tuberculosis case notification and predictors of unsuccessful treatment outcomes in Samdrup Jongkhar district, Bhutan: A fourteen-year retrospective study. Heliyon. 2021 Mar 1;7(3).

18. Wang YS, Zhu WL, Li T, Chen W, Wang WB. Changes in newly notified cases and control of tuberculosis in China: time-series analysis of surveillance data. Infect Dis Poverty. 2021 Dec 1;10(1).

19. Agizew TB, Dememew ZG, Leta T, Hiruy N, Tesema E, Abelti EA, et al. Prospects for tuberculosis elimination in Ethiopia: feasibility, challenges, and opportunities. Pan African Medical Journal. 2022;43.

20. Lungu P, Kasapo C, Mihova R, Chimzizi R, Sikazwe L, Banda I, et al. A 10-year Review of TB Notifications and Mortality Trends Using a Joint Point Analysis in Zambia - a High TB burden country. International Journal of Infectious Diseases. 2022 Nov 1;124:S30–40.

21. Oga-Omenka C, Tseja-Akinrin A, Boffa J, Heitkamp P, Pai M, Zarowsky C. Commentary: Lessons from the COVID-19 global health response to inform TB case finding. Healthcare. 2021 Jun 1;9(2).

22. Dheda K, Perumal T, Moultrie H, Perumal R, Esmail A, Scott AJ, et al. The intersecting pandemics of tuberculosis and COVID-19: population-level and patient-level impact, clinical presentation, and corrective interventions. Vol. 10, The Lancet Respiratory Medicine. Elsevier Ltd; 2022. p. 603–22.

23. Hogan AB, Jewell BL, Sherrard-Smith E, Vesga JF, Watson OJ, Whittaker C, et al. Potential impact of the COVID-19 pandemic on HIV, tuberculosis, and malaria in low-income and middle-income countries: a modelling study. Lancet Glob Health. 2020 Sep 1;8(9):e1132–41.

24. Buonsenso D, Iodice F, Sorba Biala J, Goletti D. COVID-19 effects on tuberculosis care in Sierra Leone. Vol. 27, Pulmonology. Elsevier Espana S.L.U; 2021. p. 67–9.

25. United Republic of Tanzania. Ministry of Health: COVID-19 Situation Report No. 46: From 23-29 July 2022. 2022.

26. Thekkur P, Takarinda KC, Timire C, Sandy C, Apollo T, Kumar AMV, et al. Operational research to assess the real-time impact of COVID-19 on TB and HIV services: The experience and response from health facilities in Harare, Zimbabwe. Trop Med Infect Dis. 2021 Jun 1;6(2).

27. Thekkur P, Tweya H, Phiri S, Mpunga J, Kalua T, Kumar AM V, et al. 2021, 6, 81. Special Programme for Research and Training in Tropical Disease (TDR), World Health Organization. Trop Med Infect Dis [Internet]. 2021;1211. Available from: https://doi.org/10.3390/tropicalmed

28. Lakoh S, Jiba DF, Baldeh M, Adekanmbi O, Barrie U, Seisay AL, et al. Impact of covid-19 on tuberculosis case detection and treatment outcomes in sierra leone. Trop Med Infect Dis. 2021 Sep 1;6(3).

29. Stop TB partnership. The impact of COVID-19 on the TB epidemic: A community perspective Results of a Global Civil Society Affected by COVID-19. 2021.

30. Togun T, Kampmann B, Stoker NG, Lipman M. Anticipating the impact of the COVID-19 pandemic on TB patients and TB control programmes. Ann Clin Microbiol Antimicrob. 2020 May 23;19(1).

31. Dheda K, Perumal T, Moultrie H, Perumal R, Esmail A, Scott AJ, et al. The intersecting pandemics of tuberculosis and COVID-19: population-level and patient-level impact, clinical presentation, and corrective interventions. Lancet Respir Med. 2022 Jun 1;10(6):603–22.

32. Zhou S, Van Staden Q, Toska E. Resource reprioritisation amid competing health risks for TB and COVID-19. Vol. 24, International Journal of Tuberculosis and Lung Disease. International Union Against Tuberculosis and Lung Disease (The Union); 2020. p. 1215–6.

33. Chanda-Kapata P, Ntoumi F, Kapata N, Lungu P, Mucheleng'anga LA, Chakaya J, et al. Tuberculosis, HIV/AIDS and Malaria Health Services in sub-Saharan Africa – A Situation Analysis of the Disruptions and Impact of the COVID-19 Pandemic. International Journal of Infectious Diseases. 2022 Nov 1;124:S41–6.

34. Abdela SG, Berhanu AB, Ferede LM, van Griensven J. Essential healthcare services in the face of COVID-19 prevention: Experiences from a referral hospital in Ethiopia. American Journal of Tropical Medicine and Hygiene. 2020 Sep 1;103(3):1198–200.

35. Bell D, Hansen KS, Kiragga AN, Kambugu A, Kissa J, Mbonye AK. Predicting the impact of COVID-19 and the potential impact of the public health response on disease burden in Uganda. American Journal of Tropical Medicine and Hygiene. 2020 Sep 1;103(3):1191–7.

36. Gichuna S, Hassan R, Sanders T, Campbell R, Mutonyi M, Mwangi P. Access to Healthcare in a time of COVID-19: Sex Workers in Crisis in Nairobi, Kenya. Glob Public Health. 2020 Oct 2;15(10):1430–42.

37. Odume B, Falokun V, Chukwuogo O, Ogbudebe C, Useni S, Nwokoye N, et al. Impact of COVID-19 on TB active case finding in Nigeria. Public Health Action. 2021 Jan 9;10(4):157–62.

38. Siedner MJ, Kraemer JD, Meyer MJ, Harling G, Mngomezulu T, Gabela P, et al. Access to primary healthcare during lockdown measures for COVID-

19 in rural South Africa: An interrupted time series analysis. BMJ Open. 2020 Oct 5;10(10).

39. Alfaiate A, Rodrigues R, Aguiar A, Duarte R. Tuberculosis and COVID-19 related stigma: Portuguese patients experiences. Tuberc Respir Dis (Seoul) [Internet]. 2023 Mar 31; Available from: http://e-trd.org/journal/view.php?doi=10.4046/trd.2022.0062

40. Bhanot D, Singh T, Verma SK, Sharad S. Stigma and Discrimination During COVID-19 Pandemic. Front Public Health. 2021 Jan 12;8.

41. Surendra H, Elyazar IR, Puspaningrum E, Darmawan D, Pakasi TT. Impact of the COVID-19 pandemic on tuberculosis control in Indonesia: a nationwide analysis of programme data and health system vulnerabilities. Available from: https://doi.org/10.1101/2023.02.09.23285740

42. Magro P, Formenti B, Marchese V, Gulletta M, Tomasoni LR, Caligaris S, et al. Impact of the SARS-CoV-2 epidemic on tuberculosis treatment outcome in Northern Italy. European Respiratory Journal. 2020 Oct 1;56(4).

43. Bardhan M, Hasan MM, Ray I, Sarkar A, Chahal P, Rackimuthu S, et al. Tuberculosis amidst COVID-19 pandemic in India: unspoken challenges and the way forward. Trop Med Health. 2021 Dec 1;49(1).

44. Mohammed H, Oljira L, Roba KT, Yimer G, Fekadu A, Manyazewal T. Containment of COVID-19 in Ethiopia and implications for tuberculosis care and research. Infect Dis Poverty. 2020 Sep 16;9(1).

45. Hashem MK, Hussein AARM, Amin MT, Mahmoud A, Shaddad AM. The burden of COVID-19 pandemic on tuberculosis detection: a single-center study. The Egyptian Journal of Bronchology. 2022 Dec;16(1).

46. Manhiça I, Augusto O, Sherr K, Cowan J, Cuco RM, Agostinho S, et al. COVID-19-related healthcare impacts: An uncontrolled, segmented time-series analysis of tuberculosis diagnosis services in Mozambique, 2017-2020. BMJ Glob Health. 2022 Apr 20;7(4).

47. Masina HV, Lin IF, Chien LY. The Impact of the COVID-19 Pandemic on Tuberculosis Case Notification and Treatment Outcomes in Eswatini. Int J Public Health. 2022 Oct 26;67.

48. Hasan T, Nguyen VN, Nguyen HB, Nguyen TA, Le HTT, Pham CD, et al. Retrospective Cohort Study of Effects of the COVID-19 Pandemic on Tuberculosis Notifications, Vietnam, 2020. Emerg Infect Dis. 2022 Mar 1;28(3):684–92.

49. Lestari T, Kamaludin, Lowbridge C, Kenangalem E, Poespoprodjo JR, Graham SM, et al. Impacts of tuberculosis services strengthening and the COVID-19 pandemic on case detection and treatment outcomes in Mimika District, Papua, Indonesia: 2014–2021. PLOS Global Public Health. 2022 Sep 30;2(9):e0001114.

50. Buonsenso D, Iodice F, Sorba Biala J, Goletti D. COVID-19 effects on tuberculosis care in Sierra Leone. Vol. 27, Pulmonology. Elsevier Espana S.L.U; 2021. p. 67–9.

51. Kadota JL, Reza TF, Nalugwa T, Kityamuwesi A, Nanyunja G, Kiwanuka N, et al. Impact of shelter-in-place on TB case notifications and mortality during the COVID-19 pandemic. Vol. 24, International Journal of Tuberculosis and Lung Disease. International Union Against Tuberculosis and Lung Disease (The Union); 2020. p. 1212–4.

52. Cilloni L, Fu H, Vesga JF, Dowdy D, Pretorius C, Ahmedov S, et al. The potential impact of the COVID-19 pandemic on the tuberculosis epidemic a modelling analysis. EClinicalMedicine. 2020 Nov 1;28.

53. Makuza JD, Jeong D, Soe P, Bartlett S, Velásquez García HA, Binka M, et al. Impact of COVID-19 pandemic on HCV care cascade in Rwanda: Ecological study from July 2019 to June 2021. Clin Liver Dis (Hoboken). 2022 Jul 1;20(1):25–30.

54. Dar es Salaam Region - Wikipedia [Internet]. [cited 2024 Feb 23]. Available from: https://en.wikipedia.org/wiki/Dar_es_Salaam_Region

55. United Republic of Tanzania. The 2022 Population and Housing Census: Age and Sex Distribution. 2022.

56. United Republic of Tanzania. The National Tuberculosis and Leprosy Programme (NTLP) Annual Report for 2021. 2021.

57. Soko RN, Burke RM, Feasey HRA, Sibande W, Nliwasa M, Henrion MYR, et al. Effects of Coronavirus Disease Pandemic on Tuberculosis Notifications, Malawi. Emerg Infect Dis. 2021 Jul 1;27(7):1831–9.

58. Thekkur P, Tweya H, Phiri S, Mpunga J, Kalua T, Kumar AMV, et al. Assessing the Impact of COVID-19 on TB and HIV Programme Services in Selected Health Facilities in Lilongwe, Malawi: Operational Research in Real Time. Tropical Medicine and Infectious Disease 2021, Vol 6, Page 81 [Internet]. 2021 May 19 [cited 2024 Jul 11];6(2):81. Available from: https://www.mdpi.com/2414-6366/6/2/81/htm

59. Hazra D, Chawla K, Shenoy VP, Pandey AK, S N. The aftermath of COVID-19 pandemic on the diagnosis of TB at a tertiary care hospital in India. J Infect Public Health [Internet]. 2021 Aug 1 [cited 2024 Jul 11];14(8):1095–8. Available from: https://pubmed.ncbi.nlm.nih.gov/34274858/

60. Mbithi I, Thekkur P, Chakaya JM, Onyango E, Owiti P, Njeri NC, et al. Assessing the Real-Time Impact of COVID-19 on TB and HIV Services: The Experience and Response from Selected Health Facilities in Nairobi, Kenya. Tropical Medicine and Infectious Disease 2021, Vol 6, Page 74 [Internet]. 2021 May 10 [cited 2024 Jul 10];6(2):74. Available from: https://www.mdpi.com/2414-6366/6/2/74/htm

61. Osei E, Amu H, Kye-Duodu G, Kwabla MP, Danso E, Binka FN, et al. Impact of COVID-19 pandemic on Tuberculosis and HIV services in

Ghana: An interrupted time series analysis. PLoS One [Internet]. 2023 Sep 1 [cited 2024 Jul 10];18(9):e0291808. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0291808

62. Kaso AW, Hareru HE, Kaso T, Agero G. Factors Associated with Poor Treatment Outcome among Hospitalized COVID-19 Patients in South Central, Ethiopia. Biomed Res Int. 2022;2022.

63. Gandhi AP, Kathirvel S, Rehman T. Effect of COVID-19 lockdown on the pathway of care and treatment outcome among patients with tuberculosis in a rural part of northern India: a community-based study. J Rural Med. 2022;17(2):59–66.

64. Gabdullina M, Maes EF, Horth RZ, Dzhazybekova P, Amanova GN, Zikriyarova S, et al. COVID-19 pandemic and other factors associated with unfavorable tuberculosis treatment outcomes—Almaty, Kazakhstan, 2018–2021. Front Public Health. 2023;11.

65. Jamwal A, Mohanty A, Swami A, Turbadkar D. Impact of COVID-19 on tuberculosis services: an experience from a tertiary care hospital. J Med Microbiol [Internet]. 2022 [cited 2024 Jul 11];71(6). Available from: https://pubmed.ncbi.nlm.nih.gov/35737515/

66. Loveday M, Cox H, Evans D, Furin J, Ndjeka N, Osman M, et al. Opportunities from a new disease for an old threat: Extending COVID-19 efforts to address tuberculosis in South Africa. South African Medical Journal. 2020 Dec 1;110(12):1160–7.

67. Bbuye M, Sekitoleko I, Zawedde Muyanja S, Hopkinson D, Siddharthan T, Robertson N, Et Al. Describing The Effect Of The Covid-19 Pandemic On Tb Care In Uganda: A Cross-Sectional Study. Chest [Internet]. 2021 Oct 1 [Cited 2024 Jul 11];160(4):A2512. Available from: http://journal.chestnet.org/article/S0012369221036461/fulltext

68. George S, Paranjpe A, Nagesh P, Saalim M. Barriers to treatment adherence for female Tuberculosis (TB) patients during the COVID-19 pandemic: Qualitative evidence from front-line TB interventions in Bengaluru City, India. Indian J Public Health [Internet]. 2022 Jan 1 [cited 2024 Jul 11];66(1):38–44. Available from: https://pubmed.ncbi.nlm.nih.gov/35381712/

69. Migliori GB. Tuberculosis and COVID-19 co-infection: description of the global cohort The TB/COVID-19 Global Study Group. [cited 2024 Jul 11]; Available from: https://doi.org/10.1183/13993003.02538-2021

70. Lakoh S, Jiba DF, Baldeh M, Adekanmbi O, Barrie U, Seisay AL, et al. Impact of COVID-19 on Tuberculosis Case Detection and Treatment Outcomes in Sierra Leone. Tropical Medicine and Infectious Disease 2021, Vol 6, Page 154 [Internet]. 2021 Aug 19 [cited 2024 Jul 11];6(3):154. Available from: https://www.mdpi.com/2414-6366/6/3/154/htm

71. Revita NCT, Sukartini T, Makhfudli M, Acob JRU, Hasanudin H, Aini HN. The Impact of COVID-19 Pandemic on Tuberculosis Patient Treatment Adherence. Jurnal Respirasi. 2022 May 31;8(2):113–8.

72. Yakupogullari Y, Ermis H, Kazgan Z, Otlu B, Bayindir Y, Gulbas G, et al. Diagnostic and treatment outcomes of patients with pulmonary tuberculosis in the first year of COVID-19 pandemic. East Mediterr Health J [Internet]. 2022 Sep 1 [cited 2024 Jul 11];28(9):682–9. Available from: https://pubmed.ncbi.nlm.nih.gov/36205207/

9.0 APPENDICES

Appendix I: Data collection tool-COVID-19 Study

Title: ASSESSMENT THE IMPACT OF COVID-19 ON TUBERCULOSIS CASE DETECTION AND TREATMENT OUTCOMES: AN ANALYSIS OF ROUTINE SERVICE DATA IN DAR ES SALAAM REGION, TANZANIA

A: Individual level information

District: _____

Name of Health facility: _____ Ownership of Health Facility*: _____ Level of health facility_____

Data transcription for (Year): _____

District TB#	**Patient Names**	**Sex;** 1 =Female 2 =Male	**Age** (Years)	**Referral:** 1.community 2 Self 3.CTC 4.Other	**Type of TB;** 1=PTB+ 2=PTB- 3=EPTB 4=Unclassfied	**Laboratory results;** 1=AFB+ 2=AFB - 3=Gx T 4=Gx N 5=Gx Ti 6=Gx I	**Other examination** 1=X-ray; 2=Other	**HIV status** 1. Positive 2. Negative 3. Unknown	**HIV + on CPT** 1. Yes 2. N0	**HIV+ on ART** 1. Yes 2. No	**Treatment history:** 1.New case 2.Relapse 3.Failure 4.Return after lost 5.Others treated	**Treatment outcome:** 1=Cured; 2=Completed; 3=Failure; 4=Died; 5=Loss to follow up 6=Transferred out

B: Facility level information (mark the appropriate response)

Qn. B1: Was there any project/intervention meant to increase TB case detection at this facility stopped functioning when COVID-19 was declared in the country? Specifically, any time between April-July 2020

Yes ☐
No ☐
I don't know ☐

Qn. B2: Was there any project/intervention meant to increase TB case detection at this facility reduced its activities when COVID-19 was declared in the country? Specifically, any time between April-July 2020

Yes ☐
No ☐
I don't know ☐

Qn. B3: Was there any project/intervention meant to improve treatment outcomes stopped its activities when COVID-19 declared in the country? Specifically, any time between April-July 2020

Yes ☐
No ☐
I don't know ☐

Qn. B4: Was there any project/intervention meant to improve treatment outcomes reduced its activities when COVID-19 declared in the country? Specifically, any time between April-July 2020

Yes ☐
No ☐
I don't know ☐

Qn. B5: Was there any staff (Medical personnel) from TB clinic reallocated to respond to COVID-19 when it was declared in the country? Specifically, any time between April-July 2020

Yes ☐
No ☐
I don't know ☐

Qn. B5.1. If yes to Qn. B5, how many staff were reallocated?

_____ out of _____ total number of staff.

Qn. B6: Was there a reallocation of TB clinic premises to accommodate COVID-19 suspects/patients when COVID-19 declared in the country? Specifically, any time between April-July 2020

Yes ☐
No ☐
I don't know ☐

Qn. B7: Was there any reallocation of funds meant for TB services to COVID-19 when COVID-19 declared in the country? Specifically, any time between April-July 2020

Yes ☐
No ☐
I don't know ☐

Qn. B7.1. If yes to Qn. B7, how much was reallocated?

_____ out of _____ total amount of funds set aside for TB services.

Appendix II: Informed consent form

Effects of COVID-19 on Tuberculosis Case Detection and Treatment Outcomes: Analysis of Routine Tuberculosis Program Data in Dar Es Salaam Region, Tanzania

For 18-year-olds and older

Greetings: My name is Aman K. Wilfred, I am pursuing a master's of science in project management, monitoring and evaluation in health at the Muhimbili University of Health and Allied Sciences. I am conducting research intending to determine the effects of COVID-19 on tuberculosis case detection and treatment outcomes in the Dar es salaam region.

Study Purpose:

We are conducting research to determine the extent COVID-19 has impacted TB case detection, and its effects on treatment outcomes. You will be asked a number of questions; the answers you will provide will help us gain understanding of the effects of pandemics such as COVID-19 disease on TB program. The National strategy to control the effects of outbreaks in the TB program will be informed by the findings of this study.

Research procedures:

Upon your agreement to partake in this study, you will be asked questions about what happened to the TB programs during the period COVID-19 was picking. One of our researchers will record your answers in the special form.

Privacy:

The information you will provide during the interview will be kept confidential and will not be shared with anyone who is not involved in this study. We would like to assure you that only the researchers participating in this study will be able to access your information

and we will keep your information confidential. we will write down all the answers you will give in this interview on a special form of this study (loaded in the tablets).

Advantages and disadvantages of participating in the study:

No implications is expected for your involvement in this study. However, this information will be used to inform the National Strategy for Combating pandemics like COVID-19 in order to control their effects.

Reimbursement:

No compensation will be made for your participation in this study. Enrollment in this research is entirely voluntary. Please let us know if you would like to participate in this study or not.

Right to refuse or withdraw from research:

You can change your decision at any time during the interview. You have the right to withdraw from this study at any time without any penalty or discrimination in access to government services.

Should you have any concern; If you have any queries about the study you can contact the principal investigator of this study Mr. Aman K. Wilfred through phone number 0658682665, or Dr. Mughwira Mwangu through phone number 0713253513, or Dr. Mucho Mizinduko through phone number 0752307988. You can also contact the Director for, research and Publications Dr Bruno Sunguya P. O. BOX 65001, Dar es Salaam, for any matters concerning this study.

Declaration of interviewee: I have read the consent form, I have understood the purpose and methodology of the study, and I have committed to taking part.

Name of the participant: _____

Signature: _____

Date: _____

Signature of the Research: _____

Date: _____

Appendix III: Fomu ya ridhaa ya kushiriki katika utafiti

UTAFITI JUU YA ATHARI ZA UVIKO-19 KATIKA UGUNDUZI NA MATOKEO YA MATIBABU YA KIFUA KIKUU KATIKA MKOA WA DAR ES SALAAM

<u>Kwa ajili ya wenye umri wa miaka 18 na kuendelea</u>

Habari,

Ninaitwa Aman K. Wilfred, ni mwanafunzi wa shahada ya uzamili katika chuo kikuu cha afya Muhimbili. Nafanya utafiti kuangalia athari za UVIKO-19 katika ugunduzi na matokeo matitabu ya kifua kikuu katika mkoa wa Dar es Salaam.

Lengo la utafiti

Tunafanya utafiti ili kuweza kujua kiwango achambo UVIKO-19 umeleta katika programu ya kifua kikuu katika eneo la ugunduzi, pia athari katika matokeo ya matibabu ya kifua kikuu. Utaulizwa maswali kadhaa ambayo yatatusaidia kupata uelewa mzuri juu ya hatua zilizochukuliwa katika kituo chako cha kutolea huduma kuhusiana na UKIVO-19, pia mwenendo wa wagonjwa au wateja waliokuwa wanatafuta huduma za kifua kikuu wakati wa kipindi cha UVIKO-19.

Taratibu za tafiti

Endapo utakubali kushiriki katika utafiti huu, tutakuuliza maswali kuhusiana na hali ilivyokuwa wakati UVIKO-19 umeshika kasi nchini. Majibu yetu yatarekodiwa na moja ya watafiti wetu kwenye fomu maalumu.

Usiri: Taarifa utakazozitoa katika mahojiano kwa ajili ya utafiti huu zitakuwa siri na hatutazitoa wala kumpatia mtu yeyote asiyehusika na utafiti huu. Tunapenda kukuhakikishia kuwa ni baadhi tu ya watafiti wanaoshiriki utafiti huu ambao wataweza kufahamu taarifa zako na tutazitunza kwa usiri mkubwa.

Madhara

Hakuna madhara yanayotarajiwa kwa washiriki wa utafiti huu.

Faida na hasara za kushiriki: Hatutegemei athari zozote kwa kushiriki kwako kwenye utafiti huu. Walakini, taarifa hizi zitatumika kutaarifu Mkakati wa Kitaifa wa kupambana na magonjwa ya mlipuko kama UVIKO-19 ili kuweza kuzuia athari zinazoweza kutokana na magonjwa ya mlipuko.

Fidia: Hatutakupatia malipo yoyote kwa wewe kushiriki katika utafiti. Kushiriki katika utafiti huu ni hiari wako. Kama hutopenda kushiriki katika utafiti huu tafadhali tuambie, na kama unataka kushiriki katika utafiti huu tuambie.

Haki ya kukataa au kujiondoa katika utafiti: Una haki ya kubadili uamuzi wako endapo utaona ni vyema kufanya hivyo. Unayo haki ya kujitoa katika utafiti huu wakati wowote, uamuzi wako hautaathiri kwa namna yoyote ufanyaji kazi katika kituo hiki cha huduma.

Mtu wa kuwasiliana nae endapo utakuwa swali au maoni:

Kama utakuwa na maswali yoyote au dukuduku, unaweza kuuliza/kutoa wakati wowote

Kama utakuwa na swali lolote kuhusu tafiti hii usisite kuwasiliana na mtafiti kiongozi Mr. Aman K.Wilfred kwenye namba ya simu 0658682665, Dr. Mughwira Mwangu kutumia namba za simu 0713253513 au Dr. Mucho Mizinduko kwenye namba ya simu 0752307988. Pia unaweza kuwasiliana na mkurugenzi wa research na machapisho Dr Bruno Sunguya S. L. P. 65001, Dar es Salaam, kwa jambo lolote kuhusiana na utafiti huu.

Mshiriki: Nimesoma/nimesomewa fomu ya ridhaa na nimeelewa malengo ya utafiti na namna utakavyofanyika. Ninakubali kushiriki katika utafiti huu.

Jina la Mshiriki: _____

Sahihi ya Mshiriki: _____

Tarehe: _____

Sahihi ya Mtafiti: _____

Tarehe: _____

Appendix IV: Approval for Ethical Clearance

UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

OFFICE OF THE DIRECTOR – RESEARCH, PUBLICATIONS AND INNOVATION

Ref. No.DA.282/298/01.C/2130 Date: 02/04/2024

MUHAS-REC-04-2024-2130
AMAN K. WILFRED
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: THE EFFECTS OF COVID-19 ON TUBERCULOSIS CASE DETECTION AND TREATMENT OUTCOMES: ANALYSIS OF ROUTINE TUBERCULOSIS PROGRAM DATA IN DAR ES SALAAM REGION, TANZANIA

Reference is made to the above heading,

I am pleased to inform you that the Chairman has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 02/04/2024
EXPIRATION DATE OF APPROVAL: 02/04/2025

STUDY DESCRIPTION:
Purpose:

The purpose of this cohort study is to determine the effects of COVID-19 on tuberculosis case detection and treatment outcomes.

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided: https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%2014554.pdf and in the MUHAS archives.

The PI is required to:

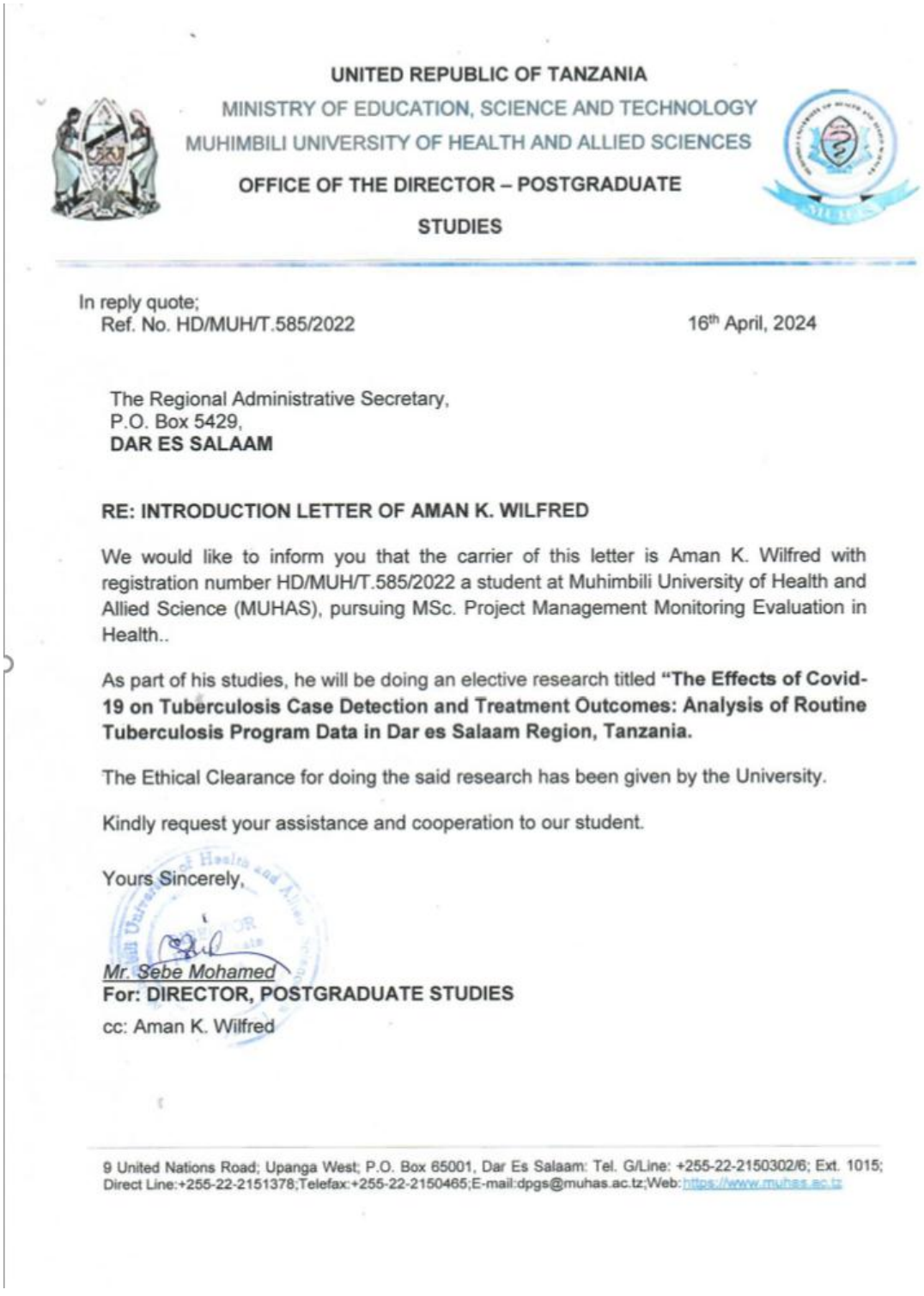
1. Submit bi-annual progress reports and final report upon completion of the study.
2. Report to the IRB any unanticipated problem involving risks to subjects or others including adverse events where applicable.
3. Apply for renewal of approval of ethical clearance one (1) month prior its expiration if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain Data Transfer Agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Apply for and obtain Material Transfer Agreement (MTA) from NIMR, if research materials (samples) will be shipped to a foreign country.
8. Apply for and obtain permission to publish the results from National Institute for Medical Research. The application should be before submitting to a publisher and not concurrently through the email publications@nimr.or.tz.
9. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
10. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
11. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website https://drp.muhas.ac.tz/.



Dr. Nahya Salim Masoud,

Chairperson, MUHAS Research and Ethics Committee

Appendix V: MUHAS Introduction Letter



UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR – POSTGRADUATE STUDIES

In reply quote;
Ref. No. HD/MUH/T.585/2022 16th April, 2024

The Regional Administrative Secretary,
P.O. Box 5429,
DAR ES SALAAM

RE: INTRODUCTION LETTER OF AMAN K. WILFRED

We would like to inform you that the carrier of this letter is Aman K. Wilfred with registration number HD/MUH/T.585/2022 a student at Muhimbili University of Health and Allied Science (MUHAS), pursuing MSc. Project Management Monitoring Evaluation in Health..

As part of his studies, he will be doing an elective research titled **"The Effects of Covid-19 on Tuberculosis Case Detection and Treatment Outcomes: Analysis of Routine Tuberculosis Program Data in Dar es Salaam Region, Tanzania.**

The Ethical Clearance for doing the said research has been given by the University.

Kindly request your assistance and cooperation to our student.

Yours Sincerely,

Mr. Sebe Mohamed
For: DIRECTOR, POSTGRADUATE STUDIES
cc: Aman K. Wilfred

9 United Nations Road; Upanga West; P.O. Box 65001, Dar Es Salaam: Tel. G/Line: +255-22-2150302/6; Ext. 1015; Direct Line:+255-22-2151378;Telefax:+255-22-2150465;E-mail:dpgs@muhas.ac.tz;Web: https://www.muhas.ac.tz

Appendix VI: Permission letter from RAS office-Dar es Salaam

JAMHURI YA MUUNGANO WA TANZANIA

Ofisi ya Rais

TAWALA ZA MIKOA NA SERIKALI ZA MITAA

Mkoa Wa Dar Es Salaam
Anwani Ya Simu:
Simu: 2203156/58
Fa: +25522203213
Tovuti: Www.Dsm.Go.Tz
Barua Pepe: Ras@Dsm.Go.Tz
Unapojibu Tafadhali Taja:

Ofisi Ya Mkuu Wa Mkoa
3 Barabara Ya Rashidi Kawawa,
S. L. P. 5429,
12880 - Dar Es Salaam.

08 Mei, 2024

Kumb. Na. EA.260/307/01B/138

Mkurugenzi wa Halmashauri ya Jiji,
S. L. P. 20950,
DAR ES SALAAM.

Wakurugenzi wa Manispaa,
Kinondoni, Temeke, Ubungo na Kigamboni,
DAR ES SALAAM.

YAH: UTAFITI "The effects of COVID-19 on Tuberculosis case detection and treatment outcomes: Analysis of routine tuberculosis program data in Dar es Salaam"

Tafadhali husika na kichwa cha habari hapo juu.

2. Ofisi ya Mkuu wa Mkoa wa Dar es Salaam inautambulisha utafiti tajwa hapo juu ambao umeombewa kibali kutoka Chuo Kikuu cha Tiba na Sayansi Shirikishi Muhimbili (MUHAS kumb.na: HD/MUH/T.585/2022). Utafiti unafanywa na Mwanachuo Aman K. Wilfred wa shahada ya uzamili katika usimamizi wa miradi, ufuatiliaji na tathimini katika Afya kuanzia tarehe 02 Aprili, 2024 hadi 02 April, 2025.Utafiti utafanyika katika Halimashauri ya Jiji la Dar es Salaam, Manispaa ya Kinondoni Temeke, Kigamboni, Ubungo kwenye Vituo vinavyo toa huduma ya kifua kikuu hususan Hospitali za Rufaa za Mkoa, Hospitali za Wilaya, Vituo vya Afya na Zahanati.

4. Mtafiti ataangalia takwimu za kifua kikuu za mwaka 2019/20 katika vituo vitakavyo chaguliwa. Pia mtafiti atafanya mahojiano na mfawidhi wa kituo husika ili kupata taarifa huska kuhusu kifua kikuu wakati wa mlipuko wa ugonjwa wa korona katika kituo hicho.

5. Lengo la utafiti ni kukidhi matakwa ya mtaala wa masomo na kubanini madhara ya mlipuko wa ugonjwa wa korona katika utambuzi na matokeo ya tiba katika huduma ya kifua kikuu.

6. Kwa barua hii, **Mtafiti Aman K. Wilfred** amepewa kibali cha kufanya utafiti kwa kuwa ndiye mwenye dhamana ya kuusimamia.

Nashukuru kwa ushirikiano.

Dkt. Mohamed Mang'una
Kny: KATIBU TAWALA WA MKOA
DAR ES SALAAM

Nakala: Katibu Tawala Mkoa,
DAR ES SALAAM – Aione katika jalada

Appendix VII: Permission Letter from Kinondoni Municipal Council

JAMHURI YA MUUNGANO WA TANZANIA

OFISI YA RAIS,
TAWALA ZA MIKOA NA SERIKALI ZA MITAA

HALMASHAURI YA MANISPAA YA KINONDONI

Unapojibu tafadhali taja:

Kumb. Na. HB.345/520/01 22 Mei, 2024

MGANGA MFAWIDHI,
Kituo cha Afya Magomeni
Kituo cha Afya Bunju
Kituo cha Afya Tandale,
Kituo cha Afya Kawe,
Zahanati ya Kunduchi
Zahanati ya J.S. Babhra
Zahanati ya Kijitonyama
Zahanati ya Tegeta

YAH: KIBALI CHA KUFANYA UTAFITI KATIKA VITUO VYA KUTOLEA HUDUMA ZA AFYA KATIKA MANISPAA YA KINONDONI

Husika na mada tajwa hapo juu.

2. Ofisi ya Mganga Mkuu wa Manispaa ya Kinondoni inapenda kumtambulisha kwako mtafiti Ndg. **Amani K. Wilfred** kutoka Chuo kikuu cha Sayansi na Afya Shirikishi Muhimbili kuwa wamepewa kibali cha kukusanya takwimu za utafiti kuhusu **"The Effect of COVID 19 on tuberculosis case detection and treatment outcomes: Analysis of Routine Tuberculosis Program data in Dar Es Salaam, Tanzania".**

3. Utafiti utafanyika kwa kipindi cha kuanzia **22/05/2024** hadi **20/05/ 2025.**

4. Kwa barua hii unaombwa kutoa ushirikiano kwa mtafiti huyo ili kumuwezesha kukamilisha jukumu hilo kikamilifu na kwa wakati.

Nakutakia kazi njema.

Dkt. Ezra Ngereza
Kny: MGANGA MKUU WA MANISPAA

Barua zote zitumwe kwa Mkurugenzi wa Manispaa Manispaa ya Kinondoni, S.L.P. 31902, 2 Barabara ya Morogoro, 14883 Dar es Salaam, Unaweza pia kuwasiliana nasi kwa Simu: +255 2170173 Nukushi: 2172606, Barua pepe – info@kinondonimc.go.tz

Appendix VIII: Permission Letter from Ilala City Council

JAMHURI YA MUUNGANO WA TANZANIA

OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA
HALMASHAURI YA JIJI LA DAR ES SALAAM

Ref. DCC/D.F.31/IX/52 **03 June, 2024**

Mganga Mfawidhi

.....

YAH: UTAMBULISHO WA UTAFITI KUHUSU 'THE EFFECTS OF COVID -19 ON TUBRCULOSIS CASE DETECTION AND TREATMENT OUTCOMES: ANALYSIS OF ROUTINE TUBERCULOSIS PROGRAM DATA IN DAR ES SALAAM'

Tafadhali husika na kichwa cha habari hapo juu.

2. Ofisi ya Mganga Mkuu wa Halmashauri ya Jiji inapenda kumtambulisha **Ndg. Aman K. Wilfred** anayesoma Shahada ya Uzamili katika usimamizi wa miradi, ufuatiliaji na tathmini katika Afya kutoka Chuo kikuu cha Afya na Sayansi Shirikishi Muhimbili (MUHAS).

3. Amepewa kibali kufanya tafiti tajwa hapo juu katika Halmashauri ya Jiji la Dar es Salaam. Lengo kuu la tafiti hii ni kubaini madhara ya mlipuko wa ugonjwa wa korona katika utambuzi wa ugonjwa wa Kifua kikuu katika vituo vya kutolea huduma afya

4. Utafiti huu unatarajiwa kufanyika kuanzia tarehe **03/06/2024** hadi tarehe **30/07/2024**, katika vituo vinavyotoa huduma ya kifua kikuu katika halmashauri ya Jiji la Dar es Salaam.

4. Kwa barua hii naomba umpokee mtafiti huyu na kumpa ushirikiano kulingana na taratibu na miongozo iliyopo.

Natanguliza shukrani zangu za dhati

Anence Kamasho

Kny: MGANGA MKUU
HALMASHAURI YA JIJI LA DAR-ES-SALAAM

Kny: MGANGA MKUU HALMASHAURI YA JIJI
DAR ES SALAAM

OFISI YA MKURUGENZI, 1 MTAA WA MISSIONI, S.L.P 20950, 11883 DAR ES SALAAM,SIMU NA 2128800, 2128805.Tovuti.www.dcc.gp.tz.

Barua pepe info@ilalamc.go.tz

NB: Mtafiti amepewa sharti la kurudisha nakala ya matokeo ya tafiti hii pindi amalizapo uandishi wa taarifa. Endapo mtafiti huyu hatarudisha taarifa taratibu zilizowekwa za ufuatiliaji chuoni zitazingatiwa.

Appendix IX: Permission Letter from Ubungo Municipal Council

JAMHURI YA MUUNGANO WA TANZANIA

OFISI YA RAIS,
TAWALA ZA MIKOA NA SERIKALI ZA MITAA

HALMASHAURI YA MANISPAA YA UBUNGO

Unapojibu tafadhali taja:

Kumb.Na. EA/155/216//01/64 Tarehe: 30 Mei, 2024

WAGANGA WAFAWIDHI,
KITUO CHA AFYA KIMARA, MBEZI,
MAKUMRULA, MAKUBURI
ZAHANATI MABIBO, NA MBURAHATI,
MANISPAA YA UBUNGO,
DAR ES SALAAM.

YAH: UTAFITI"THE EFFECTS OF COVID-19 ON TUBERCULOSIS CASE DETECTION AND TREATMENT OUTCOMES: ANALYSIS OF ROUTINE TUBERCULOSIS PROGRAM DATA IN DAR ES SALAAM.

Husika na somo tajwa hapo juu,

2. Ofisi ya Mganga Mkuu wa Manispaa imepokea barua yenye Kumb. Na. EA 260/307/01B/138 ya tarehe 08 Mei,2024 kutoka Ofisi ya Katibu Tawala wa Mkoa wa Dar es Salaam inamtambulisha **mtafiti Aman K. Wilfred** ambaye ameombewa kibali kutoka Cho Kikuu cha Tiba na Sayansi Shirikishi Muhimbili (MUHAS) kwa ajili ya kufanya utafiti tajwa.

3. Mtafiti ataangalia takwimu za kifua kikuu za mwaka 2019/20 katika vituo vitakavyochaguliwa. Pia mtafiti atafanya mahojiano na Mfawidhi wa kituo husika ili kupata taarifa husika kuhusu kifua kikuu wakati wa mlipuko wa ugonjwa wa korona.

4. Lengo la utafiti ni kukidhi matakwa ya mtaala wa masomo na kubaini madhara ya mlipuko wa ugonjwa wa korona katika utambuzi na matokeo ya tiba katika uriuma ya kifua kikuu kuanzia tarehe **30 Mei, 2024** hadi **20 Mei, 2025.**

5. Kwa barua hii, tafadhali mpokee na kumpatia ushirikiano atakaohitaji.

MGANGA MKUU WA MANISPAA

Dkt. Tuliweni Mwinuka
MGANGA MKUU WA MANISPAA

Nakala : Mkurugenzi wa Manispaa,
Halmashauri ya Manispaa ya Ubungo - Aione kwenye Jalada.

Barua zote zitumwe kwa Mkurugenzi wa Manispaa, Luguruni, Barabara ya Morogoro, S.L.P. 55068, Dar es Salaam.
Unaweza pia kuwasiliana nasi kwa Simu. 0222-926341, Nukushi; 0222-92342, Tovuti; www. ubungomc.go.tz,
Barua pepe; info@ubungomc.go.tz

Appendix X: Permission Letter-DMO Kigamboni MC

JAMHURI YA MUUNGANO WA TANZANIA
OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA
HALMASHAURI YA MANISPAA KIGAMBONI

[Barua zote zipelekwe kwa Mkurugenzi wa Manispaa Kigamboni]

Simu: +255 22-2928468
Fax: +255 22-2928469
Baruapepe: info@kigamboni.go.tz
Tovuti: www.kigamboni.go.tz
Unapo jibu tafadhali taja:

S.L.P. 36009,
KIGAMBONI,
DAR ES SALAAM,
TANZANIA.

Kumb. Na. AC.24/283/01C/112

28/05/2024

MGANGA MFAWIDHI,
HOSPITALI YA VIJIBWENI

Seen
HS
30/5/2024

YAH: RUHUSA YA BW. AMAN K. WILFRED KUFANYA UTAFITI (RESEARCH)

Tafadhali husika na somo tajwa hapo juu na rejea,

2. Mtafiti kutoka Chuo Kikuu cha Tiba na Sayansi Shirikishi Muhimbili (MUHAS), amekubaliwa kufanya utafiti (Research) juu ya **"The effects of COVID 19 on Tuberculosis case detection and treatment outcomes: Analysis 0f routine tuberculosis program data in Dar es Salaam"** katika Hospitali ya Vijibweni *kuanzia* tarehe 02 Aprili, 2024 hadi tarehe 02 Aprili, 2025.

3. *Hivyo, Halmashauri haitawajibika na malipo ya aina yoyote kwa kipindi chote cha utafiti kwa Mhusika.*

4. Nawatakia kazi njema.

KNY - MGANGA MKUU
MANISPAA YA KIGAMBONI

Dkt. L. D. Ngamtwa
MGANGA MKUU WA MANISPAA YA KIGAMBONI

NAKALA: Mkurugenzi wa Manispaa ya Kigamboni - Aione kwenye Jalada

Appendix XI: Permission Letter from Temeke Municipal Council

TEMEKE MUNICIPAL COUNCIL

ALL CORRESPONDENCE TO BE ADDRESSED TO MUNICIPAL DIRECTOR

P.O.Box 45232
Tel: 2850142

TEMEKE MUNICIPAL MEDICAL
OFFICE OF HEALTH
DAR ES SALAAM
TANZANIA.

Date: 31/05/024

M/c
SPRF Yombovituka Disp
Kichemchem Disp, Kinguji Disp
Makangarawe Disp, Sigara Disp
Mbagala Hosp.

RE: PERMISSION TO CONDUCT HEALTH RESEARCH ACTIVITIES IN TEMEKE MUNICIPALITY.

Please refer to the above heading.

Extension of Permission has been granted to Mr/Mrs/Ms./Prof./Dr. AMANI WILFRED from-(Institution) MUHAS Address DSM to Tel. No to collect data for research work in your area.

The research title is The effects of covid-19 on tuberculosis case detection and treatment outcomes, analysis of routine tuberculosis program data in DSM, Region, Tanzania

She/he has submitted the proposal for the mentioned study to the MMOH Office as a pre-condition prior to authorisation.

The researchers have been instructed and agreed to submit the research progress reports and final results to the MMOH prior to any publications.

Data collection will restart on 31/05/024 to May 2025

Sample size /

This research work is part of Academic fulfilment for Diploma/Advanced Diploma/Degree/master /PhD it is part of ongoing research in your institution

I am kindly requesting you to give him/her the necessary assistance so as to accomplish this task timely.

Yours Sincerely

AGNES KYAMBA
For: Temeke Municipal Medical Officer of Health

FOR MUNICIPAL MEDICAL OFFICER
OF HEALTH
TEMEKE