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Determinants of drop-offs in the targeted universal tuberculosis testing care cascade among people with HIV in rural and urban facilities in South Africa

Katlego Motlhaoleng – DipNSc, BCur, MPH, PhD
Fogarty HIV Associated TB Training Program Fellow – University of Cape Town (UCT)
PhD Supervisors: Prof Gary Maartens (UCT) and Prof Jonathan Golub (JHU)

OPTIMIZING INTENSIFIED TB CASE FINDING IN PEOPLE LIVING WITH HIV IN PEPFAR-SUPPORTED DISTRICTS IN SOUTH AFRICA

A DOCTORAL THESIS SUBMITTED BY

STUDENT: CAROLINE KATLEGO MOTLHAOLENG

STUDENT NUMBER: MTLCAR004

TO THE UNIVERSITY OF CAPE TOWN

FACULTY OF HEALTH SCIENCES

DEPARTMENT OF MEDICINE

IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

DOCTOR OF PHILOSOPHY

Date of Submission: 17 October 2025

Supervisor:

Professor Gary Maartens

Department of Medicine – University of Cape Town

Co-Supervisor:

Professor Jonathan Golub

School of Medicine – Johns Hopkins University

Chapter 5

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AOSIS

Page 1 of 9 Original Research

Determinants of drop-offs in the targeted universal tuberculosis testing care cascade among people with HIV in rural and urban facilities in South Africa

Check for updates

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Dates:
Received: 21 Sept. 2025
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Background: Targeted Universal Tuberculosis Testing (TUTT) is a strategy for early tuberculosis (TB) detection among people with HIV (PWH); however, drop-offs at key cascade stages limit its effectiveness.

Objectives: This study examines determinants of drop-offs at three stages: rapid molecular diagnostic test for TB (Xpert) TB treatment initiation, and completion.

Method: We conducted a retrospective analysis of routinely collected data in fiscal year 2022 from PWH on antiretroviral therapy (ART) in rural and urban facilities in KwaZulu-Natal, South Africa. Logistic regression identified determinants of drop-offs.

Results: Among 104 859 PWH, 66.7% were not tested using Xpert. Drop-offs were higher among PWH already on ART (Adjusted Odds Ratio [aOR] = 60.65, 95% confidence interval [CI]: 55.11–66.75), and those in multi-month dispensing (MMD; aOR = 1.42, 95% CI: 1.33–1.52) and differentiated models of care (DMoC; aOR = 1.10, 95% CI: 1.03–1.18) versus standard of care. Symptomatic PWH were less likely to experience Xpert drop-offs (aOR = 0.009, 95% CI: 0.008–0.011) than those without symptoms recorded. Of 1746 PWH diagnosed with TB, 6.3% did not initiate treatment, with higher drop-offs in DMoC (aOR = 29.22, 95% CI: 13.29–64.23) and MMD (aOR = 8.65, 95% CI: 2.72–27.48), but lower among symptomatic PWH (aOR = 0.05, 95% CI: 0.03–0.11). Among 1636 who started TB treatment, 25.6% did not complete it. Drop-offs were higher among those with previous TB (aOR = 2.50, 95% CI: 1.71–3.66), and lower among symptomatic PWH (aOR = 0.21, 95% CI: 0.15–0.29).

Conclusion: Findings reveal substantial drop-offs in Xpert testing and TB treatment completion, especially among PWH already on ART. Targeted strategies to identify and retain PWH at highest risk of drop-offs are important for optimising TUTT.

Keywords: TB screening; targeted universal TB Testing; drop-offs; TB care cascade; people with HIV; TB/HIV integration; differentiated service delivery.

What this study adds: This study identifies key determinants of drop-offs across the tuberculosis testing and treatment cascade among people with HIV (PWH) in South Africa. It highlights gaps linked to differentiated HIV care models and asymptomatic PWH, providing actionable evidence to inform targeted interventions and improve integration of tuberculosis services within HIV programmes.

Introduction

Tuberculosis (TB) remains a leading cause of morbidity and mortality among people with HIV (PWH), despite longstanding global efforts to integrate TB and HIV services.[1,2] In 2023, the WHO estimated approximately 161 000 HIV-associated TB deaths globally, with sub-Saharan Africa bearing the highest burden.[3] Given the strong epidemiological overlap between TB and HIV, targeted strategies are needed to improve TB case finding and reduce mortality in this population.[1,3] The Targeted Universal TB Testing (TUTT) strategy represents a major shift from symptom-based screening to routine rapid molecular testing for TB among all PWH and other high-risk groups,

Read online: Scan this QR code with your smart phone or mobile device to read online.

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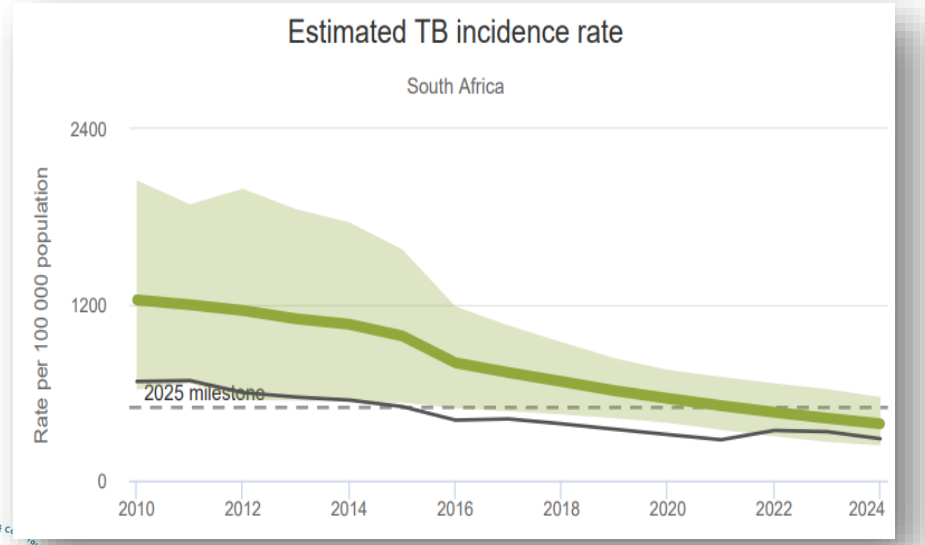
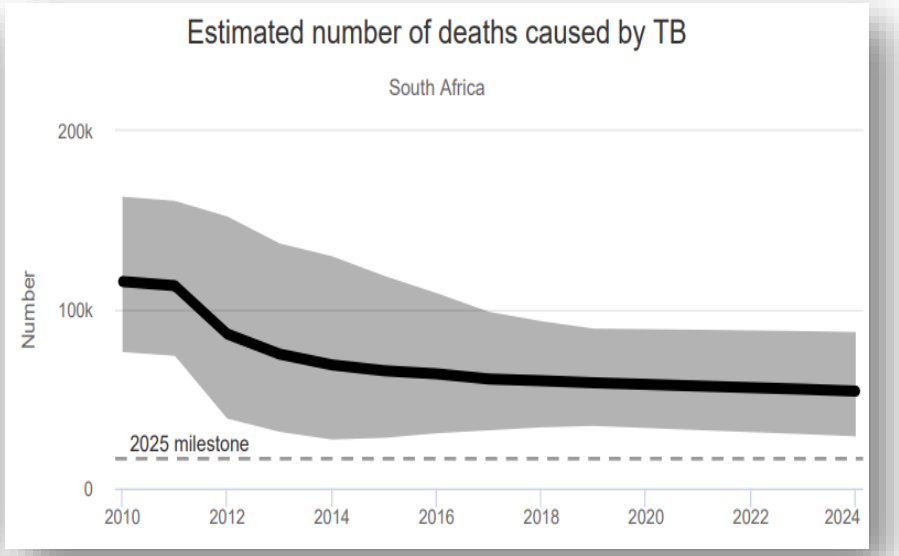
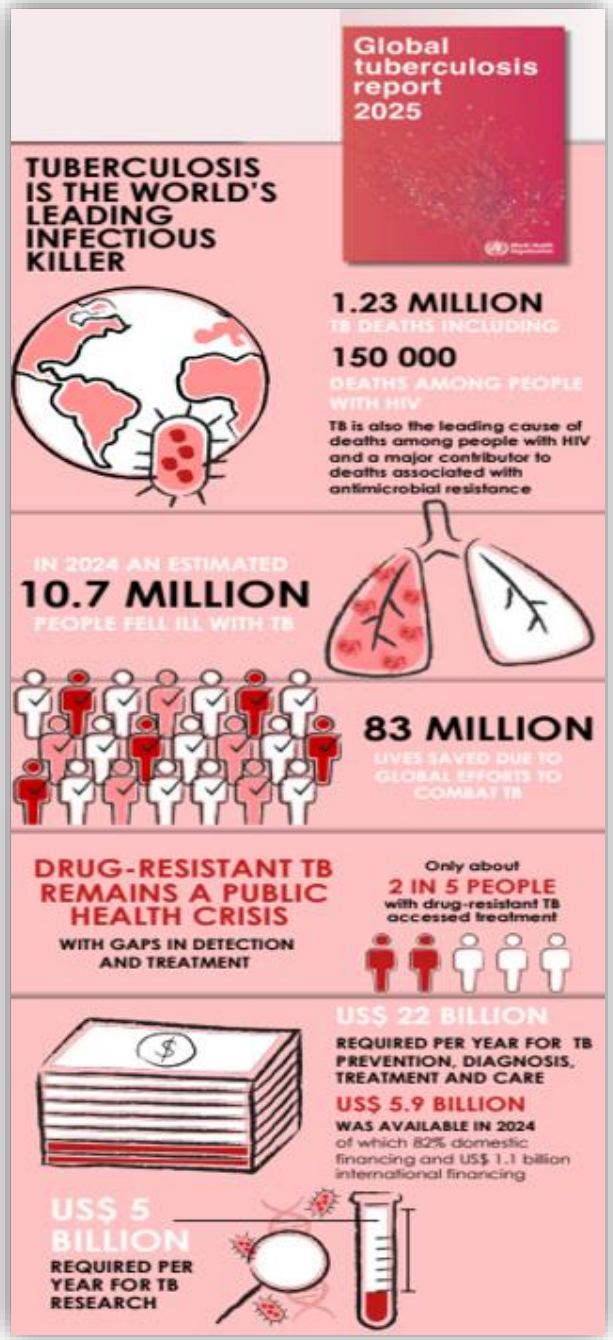
Background: TB Situation – South Africa

- An estimated 249,000 people developed TB in 2024 (389 per 100,000 population)
- People with HIV (PWH) account for 54% of South Africa TB burden
- TB Mortality: 54,000, including 29,000 deaths among PWH
- Approximately 65,000 people with TB were not diagnosed or reported in 2024
  - ➢ highlighting persistent gaps in case finding and treatment initiation
- South Africa is among the few high-burden countries that have achieved the WHO End TB Strategy milestone of a ≥50% reduction in TB incidence since 2015



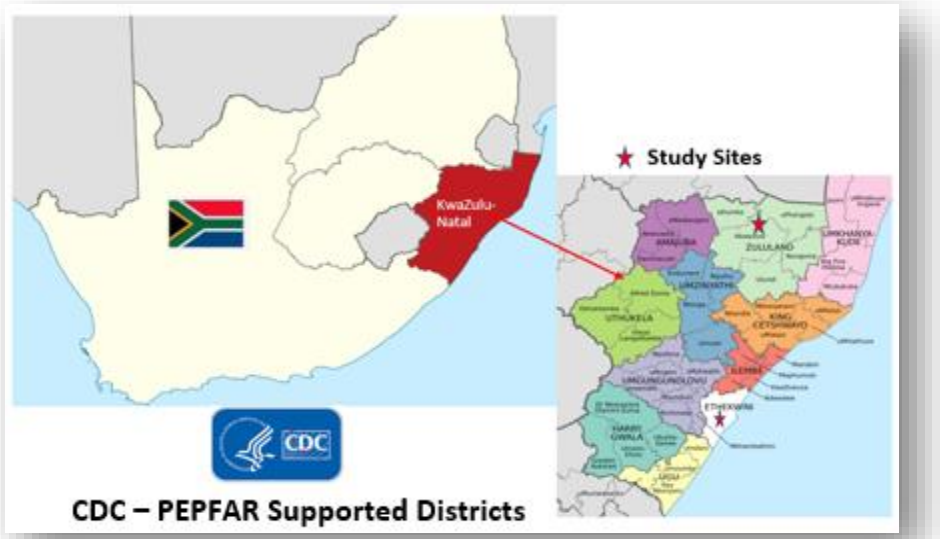




Source: WHO Global Tuberculosis Report, 2025

Aim: To investigate the determinants of drop-offs in the Targeted universal TB testing (TUTT) care cascade among PWH, focusing on three key stages:

1. Failure to receive an Xpert test
2. Failure to initiate TB treatment after diagnosis
3. Failure to complete TB treatment after initiation



Methods: Retrospective analysis of routinely collected program data in fiscal year 2022 from PWH on antiretroviral therapy (ART) in rural and urban facilities in KwaZulu-Natal, South Africa

Analysis approach: Descriptive statistics, Univariate and Multivariate logistic regression

PWH not tested for TB (Xpert Test)

- Age
- Sex
- District
- ART Delivery
- ART Status
- W4SS Result
- Previous TB
- Viral Load Test

Eligible PWH not started on TB treatment

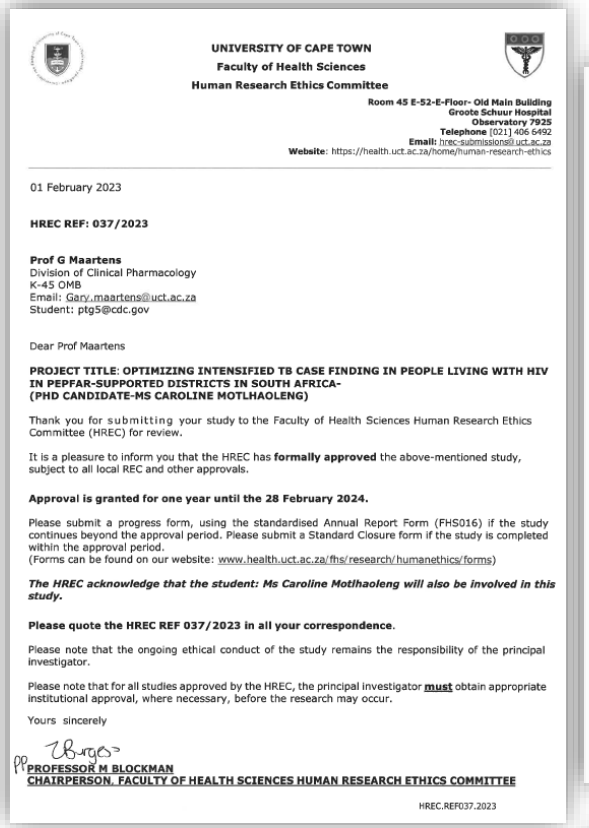
- Age
- Sex
- District
- ART Delivery
- ART Status
- W4SS Result
- Previous TB
- Viral Load Test

PWH started TB treatment but did not complete it

- Age
- Sex
- District
- ART Delivery
- ART Status
- W4SS Result
- Previous TB
- Viral Load Test

Predictors

Fiscal Year 2022 (October 1st, 2021 – September 30th, 2022



UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room 45 E-52-E-Floor- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone: (021) 406 6492
Email: hrec-submissions@uct.ac.za
Website: https://health.uct.ac.za/home/human-research-ethics

01 February 2023

HREC REF: 037/2023

Prof G Maartens
Division of Clinical Pharmacology
K-45 OMB
Email: Gary.maartens@uct.ac.za
Student: ptg5@cdc.gov

Dear Prof Maartens

PROJECT TITLE: OPTIMIZING INTENSIFIED TB CASE FINDING IN PEOPLE LIVING WITH HIV IN PEPFAR-SUPPORTED DISTRICTS IN SOUTH AFRICA- (PHD CANDIDATE-MS CAROLINE MOTLHAOLENG)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study, subject to all local REC and other approvals.

Approval is granted for one year until the 28 February 2024.

Please submit a progress form, using the standardised Annual Report Form (FHS016) if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Ms Caroline Motlhaoleng will also be involved in this study.

Please quote the HREC REF 037/2023 in all your correspondence.

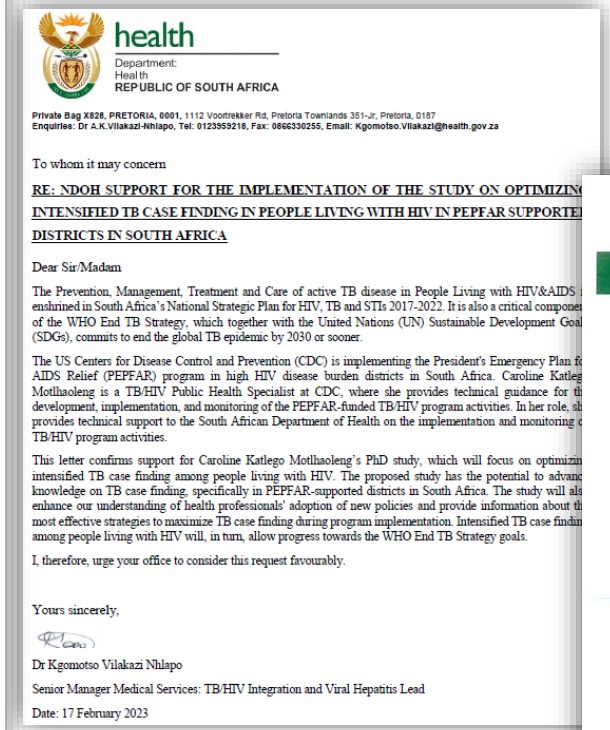
Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

pp **PROFESSOR M BLOCKMAN**
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE

HREC.REF037.2023



health
Department:
Health
REPUBLIC OF SOUTH AFRICA

Private Bag X828, PRETORIA, 0001, 1112 Voortrekker Rd, Pretoria Townlands 351-Jr, Pretoria, 0187
Enquiries: Dr A.K.Vilakazi-Nhlapo, Tel: 0123959218, Fax: 0866330255, Email: Kgomotso.Vilakazi@health.gov.za

To whom it may concern

RE: NDOH SUPPORT FOR THE IMPLEMENTATION OF THE STUDY ON OPTIMIZING INTENSIFIED TB CASE FINDING IN PEOPLE LIVING WITH HIV IN PEPFAR SUPPORTED DISTRICTS IN SOUTH AFRICA

Dear Sir/Madam

The Prevention, Management, Treatment and Care of active TB disease in People Living with HIV&AIDS enshrined in South Africa's National Strategic Plan for HIV, TB and STIs 2017-2022. It is also a critical compone of the WHO End TB Strategy, which together with the United Nations (UN) Sustainable Development Goal (SDGs), commits to end the global TB epidemic by 2030 or sooner.

The US Centers for Disease Control and Prevention (CDC) is implementing the President's Emergency Plan fo AIDS Relief (PEPFAR) program in high HIV disease burden districts in South Africa. Caroline Katleg Motlhaoleng is a TB/HIV Public Health Specialist at CDC, where she provides technical guidance for th development, implementation, and monitoring of the PEPFAR-funded TB/HIV program activities. In her role, sh provides technical support to the South African Department of Health on the implementation and monitoring TB/HIV program activities.

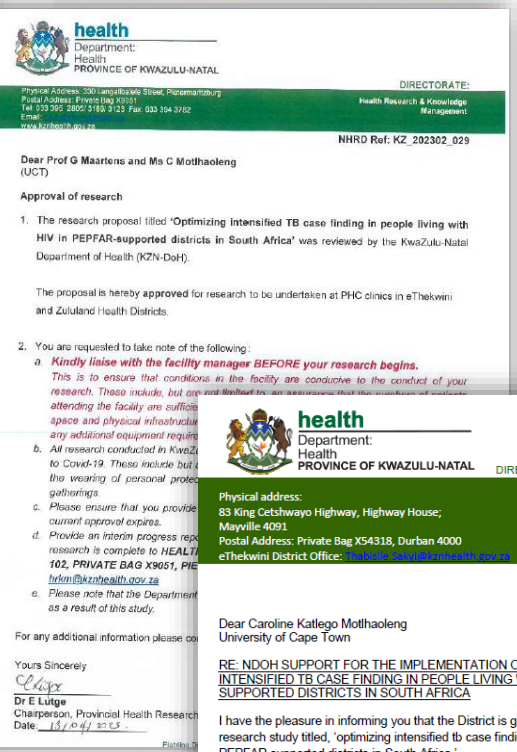
This letter confirms support for Caroline Katlego Motlhaoleng's PhD study, which will focus on optimizin intensified TB case finding among people living with HIV. The proposed study has the potential to advanc knowledge on TB case finding, specifically in PEPFAR-supported districts in South Africa. The study will als enhance our understanding of health professionals' adoption of new policies and provide information about th most effective strategies to maximize TB case finding during program implementation. Intensified TB case findin among people living with HIV will, in turn, allow progress towards the WHO End TB Strategy goals.

I, therefore, urge your office to consider this request favourably.

Yours sincerely,

Dr Kgomotso Vilakazi Nhlapo
Senior Manager Medical Services: TB/HIV Integration and Viral Hepatitis Lead
Date: 17 February 2023

APPROVED



health
Department:
Health
PROVINCE OF KWAZULU-NATAL

DIRECTORATE: Health Research & Knowledge Management

NHRD Ref: KZ_202302_029

Dear Prof G Maartens and Ms C Motlhaoleng
(UCT)

Approval of research

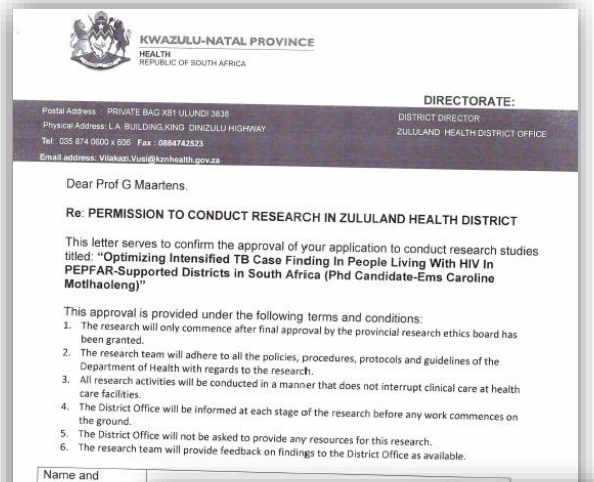
1. The research proposal titled **'Optimizing intensified TB case finding in people living with HIV in PEPFAR-supported districts in South Africa'** was reviewed by the KwaZulu-Natal Department of Health (KZN-DoH).

   The proposal is hereby **approved** for research to be undertaken at PHC clinics in eThekwini and Zululand Health Districts.

2. You are requested to take note of the following:
   a. ***Kindly liaise with the facility manager BEFORE your research begins.*** *This is to ensure that conditions in the facility are conducive to the conduct of your research. These include, but are not limited to, an assurance that the number of patients attending the facility are sufficie... space and physical infrastructu... any additional equipment require...*
   b. *All research conducted in KwaZ... to Covid-19. These include but a... the wearing of personal protec... gatherings.*
   c. *Please ensure that you provide... current approval expires.*
   d. *Provide an interim progress repo... research is complete to HEALT... 102, PRIVATE BAG X9051, PIE... helen@kznhealth.gov.za*
   e. *Please note that the Department... as a result of this study.*

For any additional information please co...

Yours Sincerely
Dr E Lutge
Chairperson, Provincial Health Research...
Date: 13/04/2023



KWAZULU-NATAL PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

DIRECTORATE:
DISTRICT DIRECTOR
ZULULAND HEALTH DISTRICT OFFICE

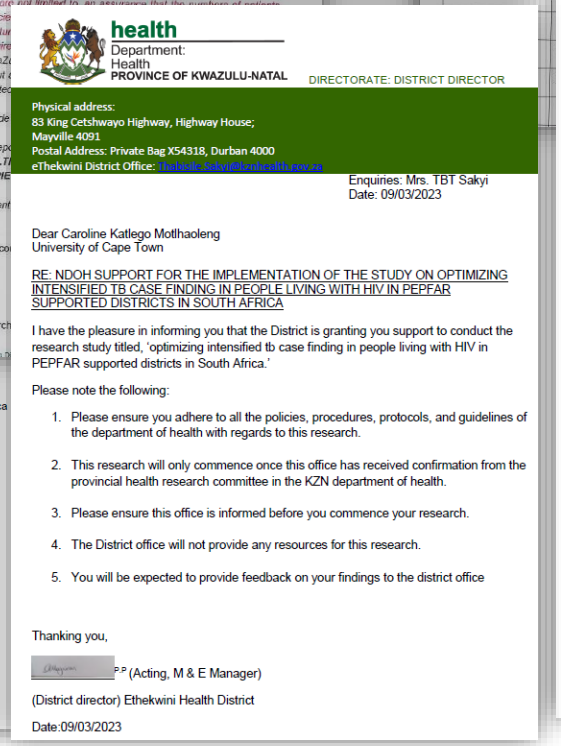
Dear Prof G Maartens.

Re: PERMISSION TO CONDUCT RESEARCH IN ZULULAND HEALTH DISTRICT

This letter serves to confirm the approval of your application to conduct research studies titled: **"Optimizing Intensified TB Case Finding In People Living With HIV In PEPFAR-Supported Districts in South Africa (Phd Candidate-Ems Caroline Motlhaoleng)"**

This approval is provided under the following terms and conditions:
1. The research will only commence after final approval by the provincial research ethics board has been granted.
2. The research team will adhere to all the policies, procedures, protocols and guidelines of the Department of Health with regards to the research.
3. All research activities will be conducted in a manner that does not interrupt clinical care at health care facilities.
4. The District Office will be informed at each stage of the research before any work commences on the ground.
5. The District Office will not be asked to provide any resources for this research.
6. The research team will provide feedback on findings to the District Office as available.

Name and Surname
Signature
Position



health
Department:
Health
PROVINCE OF KWAZULU-NATAL

DIRECTORATE: DISTRICT DIRECTOR

Physical address:
83 King Cetshwayo Highway, Highway House;
Mayville 4091
Postal Address: Private Bag X54318, Durban 4000
eThekwini District Office: Thabisile.Sakyi@kznhealth.gov.za

Enquiries: Mrs. TBT Sakyi
Date: 09/03/2023

Dear Caroline Katlego Motlhaoleng
University of Cape Town

RE: NDOH SUPPORT FOR THE IMPLEMENTATION OF THE STUDY ON OPTIMIZING INTENSIFIED TB CASE FINDING IN PEOPLE LIVING WITH HIV IN PEPFAR SUPPORTED DISTRICTS IN SOUTH AFRICA

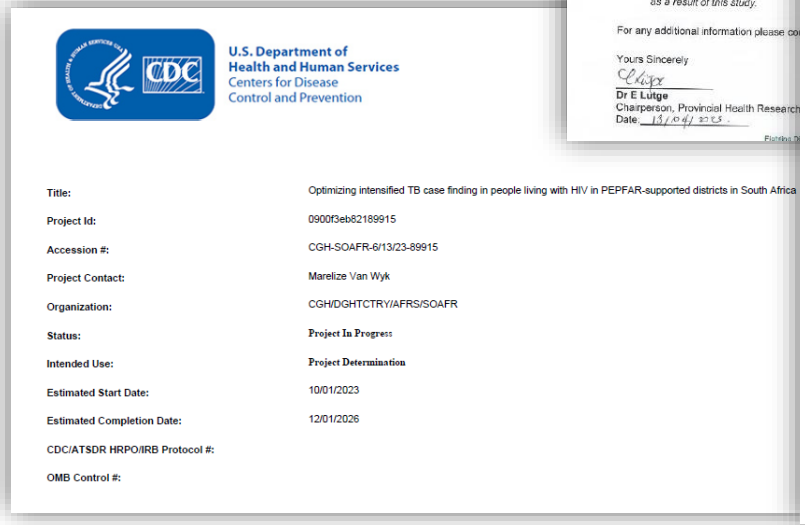
I have the pleasure in informing you that the District is granting you support to conduct the research study titled, 'optimizing intensified tb case finding in people living with HIV in PEPFAR supported districts in South Africa.'

Please note the following:

1. Please ensure you adhere to all the policies, procedures, protocols, and guidelines of the department of health with regards to this research.
2. This research will only commence once this office has received confirmation from the provincial health research committee in the KZN department of health.
3. Please ensure this office is informed before you commence your research.
4. The District office will not provide any resources for this research.
5. You will be expected to provide feedback on your findings to the district office

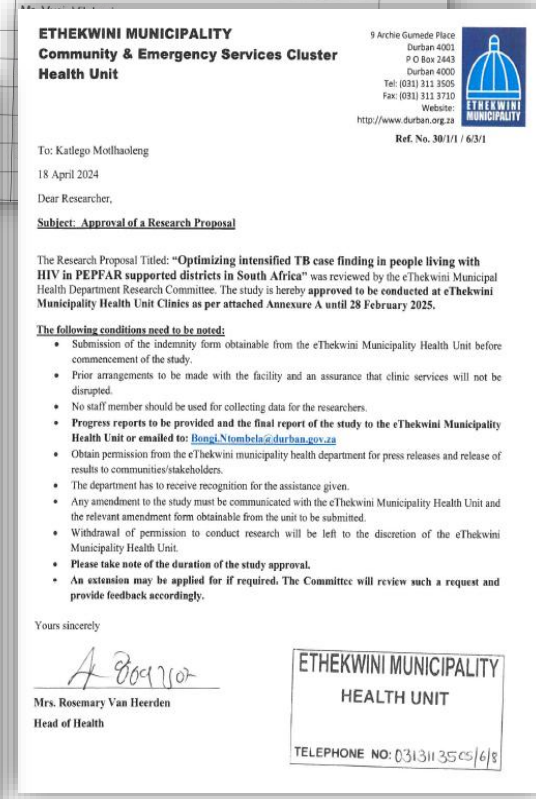
Thanking you,

P.P (Acting, M & E Manager)
(District director) Ethekwini Health District
Date:09/03/2023



U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Title:	Optimizing intensified TB case finding in people living with HIV in PEPFAR-supported districts in South Africa
Project Id:	0900f3eb82189915
Accession #:	CGH-SOAFR-6/13/23-89915
Project Contact:	Marelize Van Wyk
Organization:	CGH/DGHTCTRY/AFRS/SOAFR
Status:	**Project In Progress**
Intended Use:	**Project Determination**
Estimated Start Date:	10/01/2023
Estimated Completion Date:	12/01/2026
CDC/ATSDR HRPO/IRB Protocol #:	
OMB Control #:	



ETHEKWINI MUNICIPALITY
Community & Emergency Services Cluster
Health Unit

9 Archie Gumede Place
Durban 4001
P O Box 2443
Durban 4000
Tel: (031) 311 3505
Fax: (031) 311 3710
Website:
http://www.durban.org.za

Ref. No. 30/1/1 / 6/3/1

To: Katlego Motlhaoleng

18 April 2024

Dear Researcher,

Subject: Approval of a Research Proposal

The Research Proposal Titled: **"Optimizing intensified TB case finding in people living with HIV in PEPFAR supported districts in South Africa"** was reviewed by the eThekwini Municipal Health Department Research Committee. The study is hereby **approved to be conducted at eThekwini Municipality Health Unit Clinics as per attached Annexure A until 28 February 2025.**

The following conditions need to be noted:

- Submission of the indemnity form obtainable from the eThekwini Municipality Health Unit before commencement of the study.
- Prior arrangements to be made with the facility and an assurance that clinic services will not be disrupted.
- No staff member should be used for collecting data for the researchers.
- **Progress reports to be provided and the final report of the study to the eThekwini Municipality Health Unit or emailed to: Bongi.Ntombela@durban.gov.za**
- Obtain permission from the eThekwini municipality health department for press releases and release of results to communities/stakeholders.
- The department has to receive recognition for the assistance given.
- Any amendment to the study must be communicated with the eThekwini Municipality Health Unit and the relevant amendment form obtainable from the unit to be submitted.
- Withdrawal of permission to conduct research will be left to the discretion of the eThekwini Municipality Health Unit.
- **Please take note of the duration of the study approval.**
- **An extension may be applied for if required. The Committee will review such a request and provide feedback accordingly.**

Yours sincerely

Mrs. Rosemary Van Heerden
Head of Health

ETHEKWINI MUNICIPALITY
HEALTH UNIT
TELEPHONE NO: 031311 3505/6/8

- ✓ UCT HREC
- ✓ CDC
- ✓ NDoH
- ✓ KZN Province DoH (NHRD)
- ✓ Zululand District DoH
- ✓ eThekwini District DoH
- ✓ eThekwini Municipality

Results

Characteristics of People with HIV by District Type and Overall

Variable	Urban (N=53,234)	Rural (N=51,625)	All People with HIV (N=104,859)
Sex:			
Female	36,100 (67.8%)	35,980 (69.7%)	72,080 (68.7%)
Male	17,134 (32.2%)	15,645 (30.3%)	32,779 (31.3%)
Age Category:			
5–14	975 (1.8%)	1,016 (2.0%)	1,991 (1.9%)
15–24	8,782 (16.5%)	8,364 (16.2%)	17,146 (16.4%)
25–34	15,800 (29.7%)	15,042 (29.1%)	30,842 (29.4%)
35–44	12,600 (23.7%)	12,302 (23.8%)	24,902 (23.7%)
45–54	6,608 (12.4%)	6,560 (12.7%)	13,168 (12.6%)
55–64	4,334 (8.1%)	4,188 (8.1%)	8,522 (8.1%)
65+	4,135 (7.8%)	4,153 (8.0%)	8,288 (7.9%)
ART Status:			
Starting ART	4,359 (8.2%)	3,357 (6.5%)	7,716 (7.4%)
Already on ART	48,875 (91.8%)	48,268 (93.5%)	97,143 (92.6%)
ART Delivery Model:			
SoC	5,029 (9.4%)	6,874 (13.3%)	11,903 (11.4%)
MMD	17,283 (32.5%)	12,330 (23.9%)	29,613 (28.2%)
DMoC	30,922 (58.1%)	32,421 (62.8%)	63,343 (60.4%)
W4SS Done:			
Yes	53,216 (100.0%)	50,808 (98.4%)	104,024 (99.2%)
No	18 (0.0%)	817 (1.6%)	835 (0.8%)
W4SS Result:			
Positive	2,880 (5.4%)	2,391 (4.6%)	5,271 (5.0%)
Negative	50,336 (94.6%)	48,417 (93.8%)	98,753 (94.2%)
N/A	18 (0.0%)	817 (1.6%)	835 (0.8%)
Previous TB:			
Yes	949 (1.8%)	406 (0.8%)	1,355 (1.3%)
No	52,285 (98.2%)	51,219 (99.2%)	103,504 (98.7%)
Viral Load Test Done:			
Yes	45,181 (84.9%)	42,354 (82.0%)	87,535 (83.5%)
No	8,053 (15.1%)	9,271 (18.0%)	17,324 (16.5%)

FY2022: Fiscal Year 2022 (October 1st, 2021 – September 30th, 2022)
ART: Antiretroviral Therapy
SoC: Standard of Care
MMD: Multi-Month Dispensing
DMoC: Differentiated Models of Care
W4SS: WHO Four Symptom Screen

** Most individuals in SoC were initiating ART ("Starting ART"), consistent with clinical practice in which new ART patients attend monthly visits during early treatment*

Drop-Off 1: Factors Associated with People with HIV on ART not Receiving Xpert Test

	Univariate		Multivariate	
	OR (95% CI)	P-value	aOR (95% CI)	P-value
Age				
5–14 (Ref)	1		1	
15–24	0.90 (0.81–0.99)	0.028	0.87 (0.77–0.99)	0.040
25–34	0.89 (0.81–0.98)	0.022	0.88 (0.78–1.00)	0.046
35–44	0.96 (0.87–1.06)	0.387	0.89 (0.78–1.00)	0.059
45–54	1.20 (1.09–1.33)	<0.001	0.88 (0.77–1.00)	0.053
55–64	1.28 (1.15–1.42)	<0.001	0.91 (0.79–1.03)	0.145
65+	1.23 (1.11–1.37)	<0.001	0.87 (0.77–1.00)	0.048
Sex				
Male (Ref)	1		1	
Female	1.03 (1.00–1.06)	0.046	0.89 (0.86–0.92)	<0.001
District				
Urban (Ref)	1		1	
Rural	0.30 (0.29–0.30)	<0.001	0.17 (0.16–0.18)	<0.001
ART Delivery				
SoC (Ref)	1		1	
MMD	4.89 (4.67–5.12)	<0.001	1.42 (1.33–1.52)	<0.001
DMoC	3.49 (3.35–3.63)	<0.001	1.10 (1.03–1.18)	0.003
ART Status				
Starting ART (Ref)	1		1	
Already on ART	36.79 (33.55–40.36)	<0.001	60.65 (55.11–66.75)	<0.001
W4SS Result				
Negative (Ref)	1		1	
Positive	0.016 (0.014–0.019)	<0.001	0.009 (0.008–0.011)	<0.001
Not Screened	9.33 (6.71–12.97)	<0.001	15.56 (11.15–21.72)	<0.001
Previous TB				
No (Ref)	1		1	
Yes	0.91 (0.81–1.02)	0.097	0.68 (0.58–0.79)	<0.001
Viral Load Done				
No (Ref)	1		1	
Yes	0.83 (0.80–0.86)	<0.001	0.79 (0.75–0.83)	<0.001

OR: Odds Ratio
aOR: Adjusted Odds Ratio
CI: Confidence Interval
Ref: Reference Group
ART: Antiretroviral Therapy
W4SS: WHO Four Symptom Screen
TB: Tuberculosis
SoC: Standard of Care
MMD: Multi-Month Dispensing
DMoC: Differentiated Models of Care

Drop-Off 2: Factors Associated with Eligible People with HIV not Started on TB Treatment

	Univariate		Multivariate	
	OR (95% CI)	P-value	aOR (95% CI)	P-value
Age				
5–14 (Ref)	1		1	
15–24	0.26 (0.88–0.76)	0.014	0.17 (0.05–0.60)	0.006
25–34	0.32 (0.12–0.89)	0.029	0.32 (0.10–0.98)	0.047
35–44	0.28 (0.10–0.81)	0.018	0.20 (0.06–0.65)	0.008
45–54	0.26 (0.76–0.89)	0.032	0.16 (0.03–0.70)	0.015
55–64	0.54 (0.17–1.74)	0.303	0.10 (0.02–0.44)	0.002
65+	0.18 (0.04–0.81)	0.025	0.18 (0.03–1.00)	0.051
Sex				
Male (Ref)	1		1	
Female	1.42 (0.96–2.08)	0.078	0.76 (0.46–1.25)	0.280
District				
Urban (Ref)	1		1	
Rural	1.23 (0.83– 1.82)	0.298	0.38 (0.21–0.68)	0.001
ART Delivery				
SoC (Ref)	1		1	
MMD	25.90 (10.82–62.04)	<0.001	8.65 (2.72–27.48)	<0.001
DMoC	50.44 (27.45–92.70)	<0.001	29.22 (13.29–64.23)	<0.001
ART Status				
Starting ART (Ref)	1		1	
Already on ART	1.96 (1.27– 3.03)	0.002	0.43 (0.21–0.88)	0.020
W4SS Result				
Negative (Ref)	1		1	
Positive	0.05 (0.03–0.08)	<0.001	0.05 (0.03–0.11)	<0.001
Not Screened	0.47 (0.06–3.96)	0.488	0.48 (0.01–17.59)	0.690
Previous TB				
No (Ref)	1		1	
Yes	1.94 (1.12–3.34)	0.017	4.46 (2.14–9.28)	<0.001
Viral Load Done				
No (Ref)	1		1	
Yes	0.56 (0.33–0.93)	0.026	0.32 (0.15–0.67)	0.002

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Drop-Off 3: Factors Associated with People with HIV not Completing TB Treatment

	Univariate		Multivariate	
	OR (95% CI)	P-value	aOR (95% CI)	P-value
Age				
5–14 (Ref)	1		1	
15–24	2.50 (0.72–8.62)	0.147	2.43 (0.61–9.75)	0.210
25–34	2.09 (0.61–7.13)	0.240	2.12 (0.53–8.41)	0.287
35–44	2.63 (0.77–9.00)	0.124	2.47 (0.62–9.87)	0.201
45–54	2.73 (0.76–9.75)	0.123	2.40 (0.58–10.00)	0.229
55–64	1.67 (0.44–6.27)	0.450	1.22 (0.28–5.35)	0.791
65+	1.89 (0.50–7.12)	0.348	1.65 (0.37–7.38)	0.512
Sex				
Male (Ref)	1		1	
Female	1.04 (0.84–1.31)	0.703	0.98 (0.77–1.24)	0.872
District				
Urban (Ref)	1		1	
Rural	1.12 (0.89–1.41)	0.315	0.89 (0.68–1.16)	0.387
ART Delivery				
SoC (Ref)	1		1	
MMD	0.65 (0.14–3.01)	0.580	0.25 (0.06–1.11)	0.069
DMoC	1.70 (0.67–4.35)	0.267	0.63 (0.21–1.91)	0.418
ART Status				
Starting ART (Ref)	1		1	
Already on ART	1.27 (1.01–1.60)	0.040	0.92 (0.71–1.21)	0.568
W4SS Result				
Negative (Ref)	1		1	
Positive	0.27 (0.20–0.35)	<0.001	0.21 (0.15–0.29)	<0.001
Not Screened	0.20 (0.02–1.69)	0.138	0.19 (0.02–1.71)	0.138
Previous TB				
No (Ref)	1		1	
Yes	2.27 (1.59–3.24)	<0.001	2.50 (1.71–3.66)	<0.001
Viral Load Done				
No (Ref)	1		1	
Yes	0.76 (0.54–1.07)	0.117	0.77 (0.52–1.15)	0.210

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Summary of Findings

PWH not tested for TB (Xpert Test)

Most substantial drop-off: two-thirds of PWH (66.7%) were not tested. Drop-offs were high among urban PWH, established on ART in DMoC and MMD, and asymptomatic.

Eligible PWH not started on TB treatment

6.3% PWH did not initiate TB treatment due to death, loss to follow-up, and transfer-out, with drop-offs again highest in DMoC and MMD, asymptomatic PWH, and those with previous TB history.

PWH started TB treatment but did not complete it

One in four PWH (25.6%) who initiated TB treatment did not complete it, with men, asymptomatic PWH, and those with a previous TB history more likely to drop-off.

Limitations

Generalizability	• Findings may not be generalizable beyond the study districts due to differences in healthcare infrastructure and program implementation
Routine line-list program data	• Incomplete records and potential misclassification may have affected data quality
Exclusions	• Xpert trace results (n=42) were excluded from the drop-off analysis due to the absence of clinical follow-up data to assess alignment with the national trace algorithm • Invalid or rejected Xpert results (n=745) were excluded because these results did not provide a definitive test outcome required to determine progression through the cascade
Associations not explored	• Individual-level factors such as socioeconomic status, stigma, or care-seeking behaviours were not assessed and may influence cascade outcomes • Facility-level factors such as staffing levels, workflow efficiency, diagnostic capacity, and facility readiness were not available in the programmatic dataset and therefore could not be assessed as potential contributors to cascade drop-offs • Associations by viral load level or suppression status could not be explored, as routinely extracted programmatic data for this analysis did not include individual viral load measurements, and categorized suppression data were not incorporated into the regression models

Key Takeaways and Recommendations

Two-thirds of PWH were not tested for TB

- Identifying and addressing specific barriers to TB testing is crucial for improving testing coverage and early detection
- Strengthen health promotion and create awareness
- Integrate TUTT into differentiated HIV care models, particularly at ART refill and review visits
- Develop tailored urban interventions and prioritized TB testing during high-volume encounters

Linkage to treatment gaps

- Strengthen linkage to treatment systems to ensure prompt TB treatment initiation
- Reinforce recall and tracking mechanisms for DMoC/MMD PWH diagnosed with TB
- Prioritize enhanced clinical assessment and treatment support for PWH with a previous TB history
- Improve TB and HIV services integration to reduce losses associated with transfers and fragmented care

One in four PWH did not complete TB treatment

- Strengthen adherence support and retention interventions throughout TB treatment
- Implement differentiated follow-up strategies for PWH with previous TB history and men, who may require additional clinical and psychosocial support
- Integrate TB treatment monitoring into existing HIV care platforms to support continuity of care and treatment completion

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