BMC Health Services Research

RESEARCH Open Access

Models of integration of TB and HIV services and factors associated with perceived quality of TB-HIV integrated service delivery in O. R Tambo District, South Africa

Ntandazo Dlatu[1], Benjamin Longo-Mbenza[1] and Teke Apalata[2*]

Abstract

Background Tuberculosis is the leading infectious cause of death among people living with HIV. Reducing morbidity and mortality from HIV-associated TB requires strong collaboration between TB and HIV services at all levels with fully integrated, people-centered models of care.

Methods This is a qualitative study design using principles of ethnography and the application of aggregate complexity theory. A total of 54 individual interviews with healthcare workers and patients took place in five primary healthcare facilities in the O.R. Tambo district. The participants were purposively selected until the data reached saturation point, and all interviews were tape-recorded. Quantitative analysis of qualitative data was used after coding ethnographic data, looking for emerging patterns, and counting the number of times a qualitative code occurred. A Likert scale was used to assess the perceived quality of TB/HIV integration. Regression models and canonical discriminant analyses were used to explore the associations between the perceived quality of TB and HIV integrated service delivery and independent predictors of interest using SPSS® version 23.0 (Chicago, IL) considering a type I error of 0.05.

Results Of the 54 participants, 39 (72.2%) reported that TB and HIV services were partially integrated while 15 (27.8%) participants reported that TB/HIV services were fully integrated. Using the Likert scale gradient, 23 (42.6%) participants perceived the quality of integrated TB/HIV services as poor while 13 (24.1%) and 18 (33.3%) perceived the quality of TB/HIV integrated services as moderate and excellent, respectively. Multiple linear regression analysis showed that access to healthcare services was significantly and independently associated with the perceived quality of integrated TB/HIV services following the equation: $Y = 3.72 - 0.06X$ (adjusted $R2 = 23\%$, p-value = 0.001). Canonical discriminant analysis (CDA) showed that in all 5 municipal facilities, long distances to healthcare facilities leading to reduced access to services were significantly more likely to be the most impeding factor, which is negatively influencing the perceived quality of integrated TB/HIV services, with functions' coefficients ranging from 9.175 in Mhlontlo to 16.514 in KSD (Wilk's Lambda = 0.750, p = 0.043).

*Correspondence:
Teke Apalata
ruffinapalata@gmail.com

Full list of author information is available at the end of the article

Conclusion HIV and TB integration is inadequate with limited access to healthcare services. Full integration (one-stop-shop services) is recommended.

Keywords Tuberculosis, HIV, TB/HIV integration, Healthcare services

Introduction

Even though tremendous progress has been made in the fight against the two epidemics over the years, tuberculosis (TB) still ranks as a major cause of mortality and poor health among people with HIV, especially in countries with low resources [1]. The spread of HIV in sub-Saharan Africa led to a sharp rise in the prevalence of tuberculosis in the region [2]. There is substantial evidence regarding the linkages between HIV and TB, with a higher likelihood of mortality among co-infected patients [3, 4]. Despite the high risk of HIV clients developing TB, programmes at the global, national, and local levels started largely with a vertical approach with little or no coordination [5–7]. This has resulted in poorly coordinated management of the two diseases, with damaging effects on clients and operational difficulties for service providers, especially in resource-limited settings [6]. As a response to the intensity of TB-HIV co-morbidity, the World Health Organization (WHO) proposed TB-HIV service integration at least at the facility level [8–10]. There is, however, no consensus regarding the form (whether partial or full) of integration or the levels at which integration should occur [8]. As a result, various models (linkage, collaboration, and full integration) have been implemented with several challenges across various settings [11–13]. For instance, in a linkage model, when a patient is diagnosed with either of the two infections, he/she is referred to another facility or unit to be tested for the other. The collaborated model is concerned with the partial integration of services, whereby a person who has been diagnosed through TB services will also be counselled and tested for HIV and then referred if positive. In a fully integrated model of care, all services for TB and HIV are provided in a single facility by the same service providers. An overwhelming body of evidence, however, suggests that the fully integrated option offers optimum benefits for clients, health systems, and workers [14–16]. Integration of tuberculosis and HIV services, particularly in resource-limited South African provinces such as the Eastern Cape Province, has been far from optimal despite the existence of policy frameworks for integration. Achieving widespread integration of TB-HIV care is still unsatisfactory, regardless of a documented intent toward full integration [17–22]. While this is not the first empirical discourse on TB-HIV integration in the country, this, to the best of our knowledge, marks the first attempt to investigate the operational challenges of TB-HIV integration from the perspectives of service providers and patients at the facility level. We used "complexity theory" as a theoretical framework to guide the conduct of this study [23].

Materials and methods

O.R. Tambo district (see map in Fig. 1 below) is one of the 7 districts of the Eastern Cape province of South Africa. The seat of O.R. Tambo district is in Mthatha. The district has a total area of 12,141 km^2, with a population estimated at 1,514,306 inhabitants at the time of the study. The racial makeup consists of Black-African 90.6%, colored 6.7%, Indian/Asian 1.2%, and white 1.0%, of which, based on language, Xhosa is the most dominant language spoken by 85% of people, followed by English 8.6% [24]. The district is made up of four health sub-districts: the King Sabata Dalindyebo (KSD) sub-district, the Mhlontlo sub-district, Nyandeni sub-district, and Qaukeni sub-district. While the four health sub-districts are deeply rural, the KSD sub-district is considered to be both rural and peri-urban. O.R. Tambo district has been reported to bear the following basic indicators: 64.6% of people are living in poverty, with an estimated unemployment rate of 65.5% and a literacy rate of 42.2%. The average annual income of a black resident is R15,762 [24].

Description of the study areas

Health services are delivered by one central hospital, 1 regional hospital, 12 district hospitals; 11 community health centers, 49 clinics, 52 health posts, and 15 mobile health services. The main economic sectors include Community service (55%), trade (18.5%), finance (16.9%),agriculture (3.5%), transport (3.1%), manufacturing (2.8%) and construction (2.7%) [24].

Study design, population, and data collection approach

This is a qualitative study design using principles of ethnography and the application of the aggregate complexity theory [25]. The researchers were trained by an expert in ethnographic studies before embarking on this study. This was critical for preparing the questionnaire and pretesting the questionnaire and conducting final interviews with participants.

Further ethnographic immersion involved the ability to converse with participants in their native language. As shown in the flow chart below (see Fig. 2), one health post per sub-district was selected following a simple randomization process, except for the KSD sub-district where 2 health posts were selected of which one from the deep rural setting and another one from the peri-urban setting. Although the 5 health posts were selected by

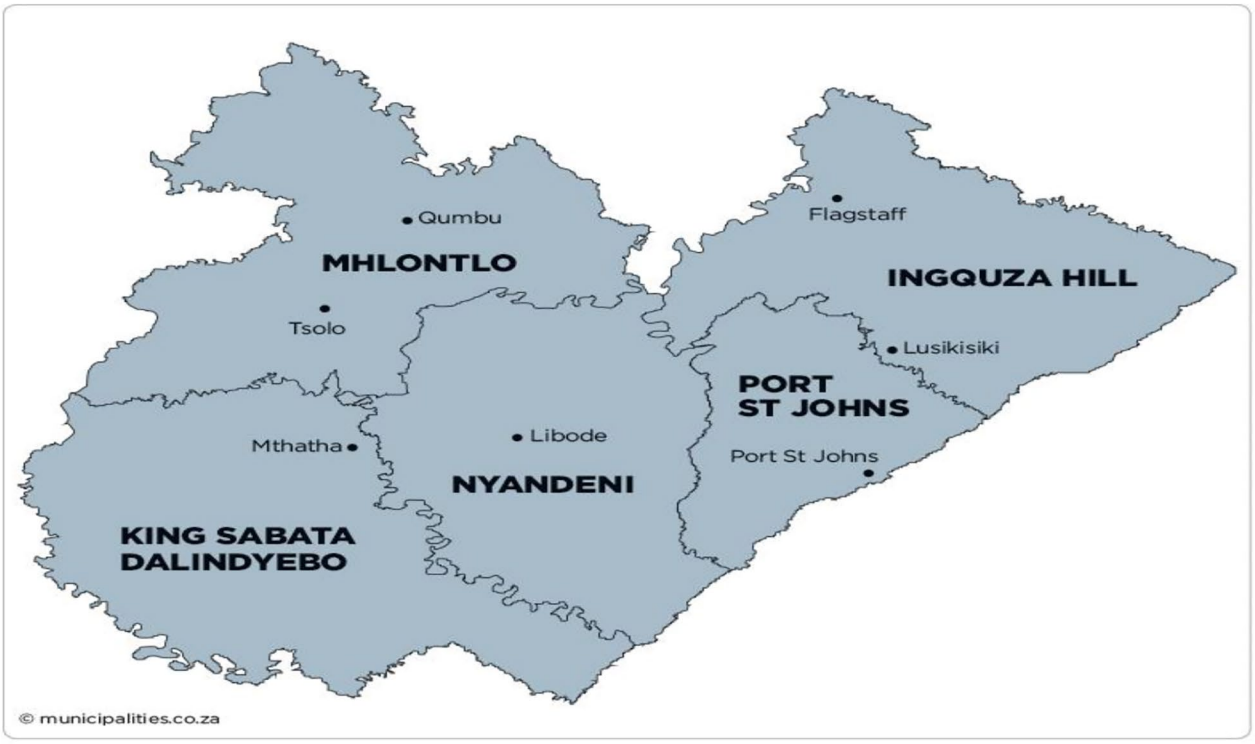

Fig. 1 Map of O.R Tambo District Municipality. Source: http://isrdp.dplg.gov.za/documents/IDP/ISRDP/ OR_ Tambo_IDP.pdf. (open access)

simple randomization, they all have a relatively high burden of TB and HIV in their catchment areas.

Data for the study were drawn from a total of 25 health service providers and 27 TB/HIV patients from 5 selected health facilities across OR Tambo district. The participants were purposively selected based on their long-term direct involvement if they were patients or based on their working experience in the management of TB and or HIV in the selected facilities if they were clinic staff members. Although we can assume that staff members can have a different understanding of the problem than patients, we intentionally chose to combine patients and clinic staff members because, during an initial pilot study, we found that the vast majority of staff were not aware of the integrated TB and HIV policy and guidelines, and were not trained on their implementation. Technically, we hypothesized that these healthcare workers were not different from their patients when it came to TB/HIV integration policy and application. Given the focus of the study, a semi-structured interview guide was developed and used for the data collection. The interviews were based on one-on-one interaction with the participants and were all tape-recorded with their consent. This was done to ensure that we capture reality in the exact words of the individual participants. On average, each interview lasted 45 min.

Theoretical framework: the complexity theory

The underlying assumption in the complexity theory is the general agreement that healthcare delivery has become increasingly complex (see Fig. 3). This theoretical framework is mainly concerned with functionality and changes within a given healthcare system [25]. The same framework has been applied in other disciplines as well, but each of these disciplines provides a unique understanding of the concept. Manson (25) divided complexity theory into three; algorithmic complexity, deterministic complexity, and aggregate complexity [25].

In this study, we adopted the "aggregate complexity" because it considers the relationships between individual components in a complex adaptive healthcare system (i.e., integrated TB-HIV care operating within a wider healthcare system). Aggregate complexity is generally regarded as the qualitative component of the complexity theory [25]. Under this framework, it is estimated that all healthcare facilities, particularly those providing care for chronic diseases, are "complex adaptive systems". The reason is that these healthcare facilities rely on individual agents, and specialized health workers in the field of TB and HIV management, whose actions are interconnected [26], and the interactions among the specialized units are more critical than the discrete actions of individual components [27]. In addition, the complexity theory considers the relationships between entities; internal structures and the surrounding environment;

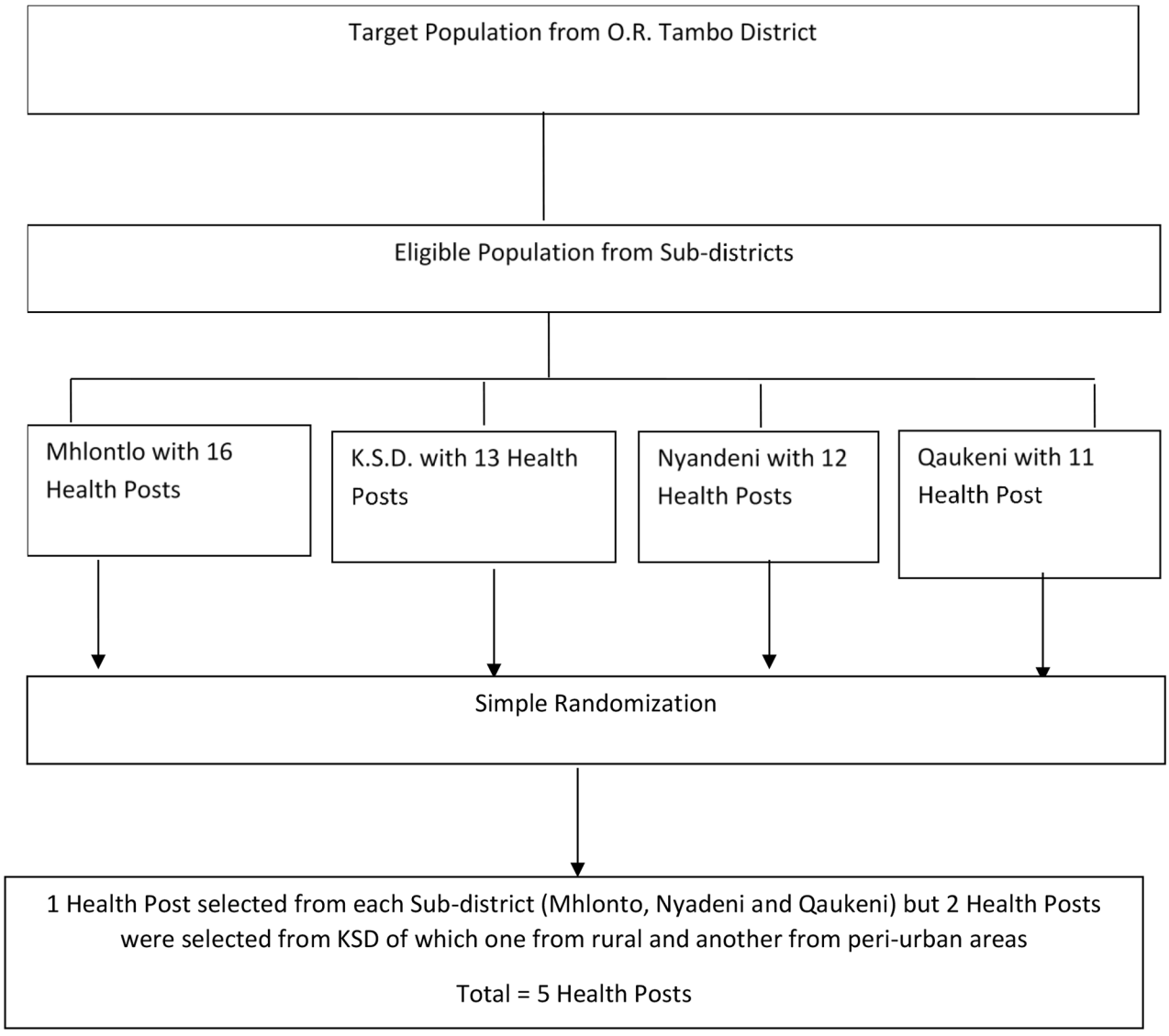

Fig. 2 Flow chart representing the selection of study settings

learning and emergent behaviour, and the various ways by which a complex system can transform and improve [28, 29]. During this study for instance, the concern is about the interactions among TB and HIV service providers, TB and HIV/counseling unit, laboratory, X-ray unit, pharmacy/dispensary, and any other units with a direct or indirect relationship with TB and HIV management and the clients. It is estimated that the actions of the related units should aim at ensuring a better outcome for the integrated healthcare services provided. Another factor to consider in this complex system is the environment, particularly the physical infrastructure for the management of TB and HIV in the health facility. The major strength of the aggregate complexity theory lies in its position that complex systems such as healthcare are constantly changing their internal structure and external environment. The complexity theory provides the researcher an opportunity to understand how a complex system like the integration of TB and HIV services can operate, and what are the impeding factors for scaling up the integration to produce the desired result.

Data management and statistical analysis

At the end of each day of data collection, recorded interviews were transcribed and both old and newly emerging issues and themes through playback of the recorded interviews were noted. This was done to keep track of the issues in the data to identify issues that will require further probing in the subsequent interviews. Participants were enrolled until data reached saturation point, meaning that enough "Information Power" was achieved. Quantitative analysis of qualitative data was used. It

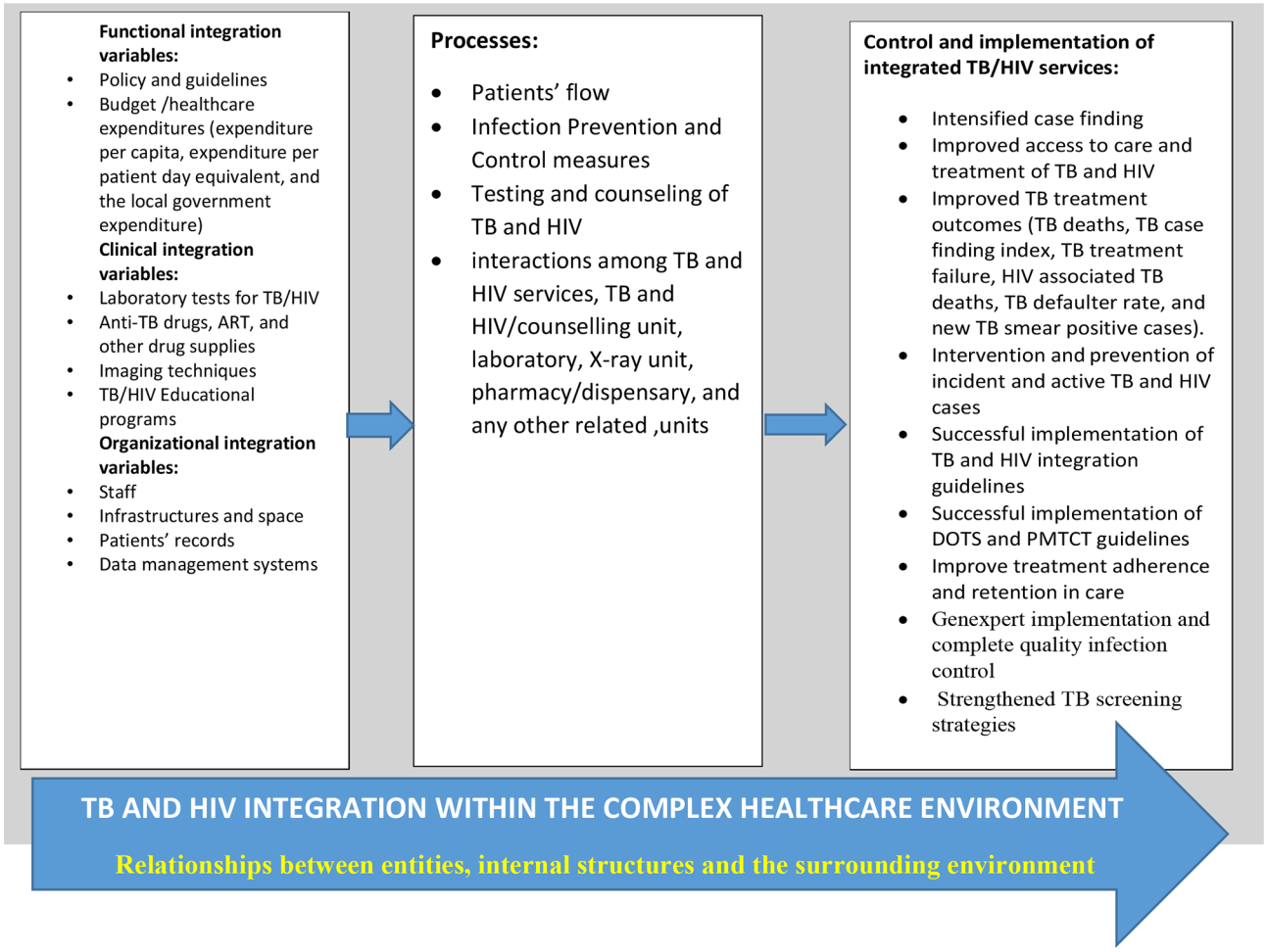

Fig. 3 Theoretical framework: The complexity theory (Modified from Naidoo et al, 2017)

"involved turning the data from words or images into numbers.

Quantification of qualitative data provided a dual benefit including the ease of analysis that quantitative data give us and the depth of meaning that qualitative data provided. When we wanted to quantify data regarding the estimated model of TB and HIV integration, the regression technique was used because from each qualitative answer from the respondents we were able to deduct a reference value of X, which means a model of TB/HIV integration. When we wanted to assess participants' perceptions about TB and HIV integration, a probabilistic approach was used to quantify qualitative data by using different scoring techniques. Hence, the functional form of opinions about the relevant variable X was identified in the form of a score. In practical ways, quantification of qualitative data was done by coding ethnographic or other qualitative data, looking for emerging patterns, and counting the number of times a qualitative code occurs" [25]. When qualitative data was in the form of responses to standardized questionnaire surveys, this data was also quantified. In the end, the generated quantified data from coded qualitative data was used to create a single comprehensive dataset. Simple frequencies and associations between variables were then calculated. A Likert scale was composed of a series of four or more Likert-type items that represent similar questions combined into a single composite score (variable). Likert scale data were analyzed as interval data. For instance, means and standard deviations were used to describe the scale. In addition, the traditional way to report on a Likert scale was used meaning that the values of each selected option were summed and a score for each respondent was created. This score was then used to represent a specific trait-satisfied or dissatisfaction, for example. Another Scoring System consisted of (0 being poor and 6 being excellent). Regression models and canonical discriminant analysis (CDA) were used to explore the associations between the perceived quality of TB and HIV integrated service delivery and independent predictors of interest. During CDA, Fischer's linear functions and Eigenvalues were determined with values

of Wilk's Lambda closer to zero being the evidence for well-discriminated patient groups. Data analysis was performed using SPSS®statistical software version 23.0 (Chicago, IL), considering a type I error of 0.05 as acceptable.

Ethical approval and Consent to Participate

The Research Ethics and Biosafety Committee of the Walter Sisulu University approved the study **(ethical clearance No. 29/2014)** and permission to conduct the study was obtained from the Eastern Cape Department of Health **(EC_2016RP27_242).** The purpose and nature of the study were explained to the study participants and written consent was obtained individually from each participant. Participation was voluntarily, and confidentiality about their names and other identifiers were anonymously kept.

Results

Models of integration of TB and HIV Services

Of the 54 participants, 39 (72.2%) reported that TB and HIV services were partially integrated while 15 (27.8%) participants reported that TB/HIV services were fully integrated as displayed in the Fig. 4, below.

TB/HIV services were partially integrated when tuberculosis and HIV/AIDS service delivery points are in the same health facility, but some HIV/AIDS services are provided in TB clinic, and some TB services are provided in HIV/AIDS clinic. The co-infected patients must still visit two different clinics served by different staff to access the full range of TB and HIV/AIDS services. However, **TB/HIV services were fully integrated when** TB and HIV/AIDS services are provided in the same delivery point in the health facility by the same staff ("One stop shop").

Perceived quality of services in relation to TB/HIV integration.

Using Likert scale gradient, 23 (42.6%) participants perceived quality of integrated TB/HIV services as poor while 13 (24.1%) and 18 (33.3%) perceived quality of TB/HIV integrated services as moderate and excellent, respectively as display in the Fig. 5, below.

When using the scoring system (ranging from 0 to 6 with 0 being poor and 6 being excellent) to measure the perceived quality of integrated TB/HIV services, the mean score for the 54 participants was found to be 2.02 (±1.296 SD) with most participants scoring quality of services below 3 (P<0.0001) as displayed **in** Fig. 6. The relationship between the Likert scale gradient and the scoring system is shown in Fig. 7.

Perceived quality of integrated TB/HIV services by characteristics of the study participants

As shown in Table 1 below, participants perceived equally the integrated TB and HIV services as inadequate whether they were healthcare professionals or patients and whether they were males or females. However, marital status of the participants (p=<0.0001), level of education of the HCWs (p=<0.0001), participants' home language (p=0.049), and the municipality or health subdistrict where the study was conducted (p=0.003) have

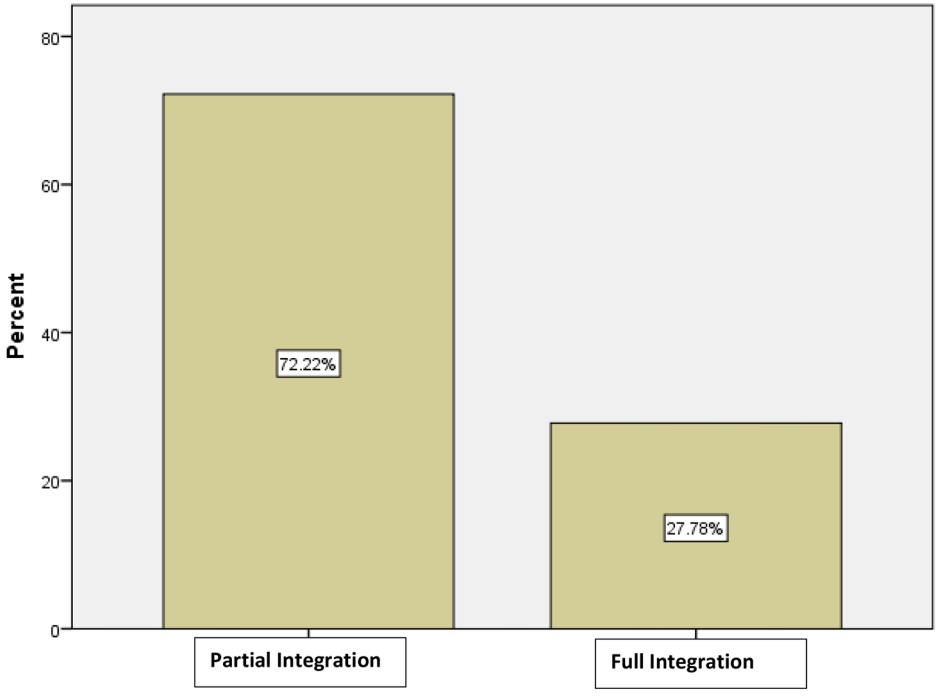

Fig. 4 Models of Integration of TB and HIV Services in O.R Tambo district

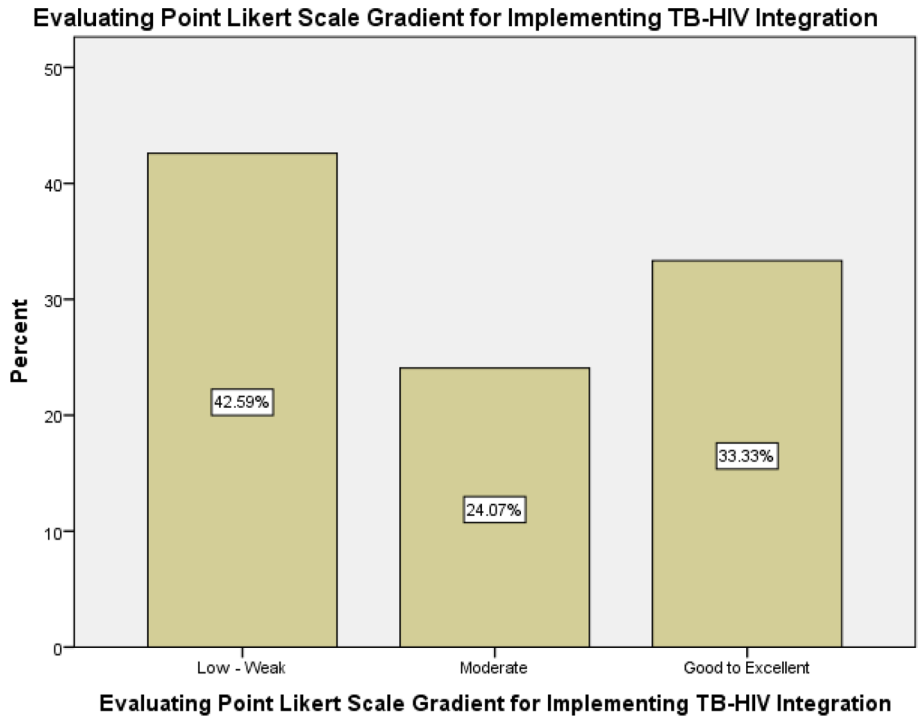

Fig. 5 Perceived Quality of TB-HIV integrated Service Delivery in OR Tambo District using Likert scale gradient

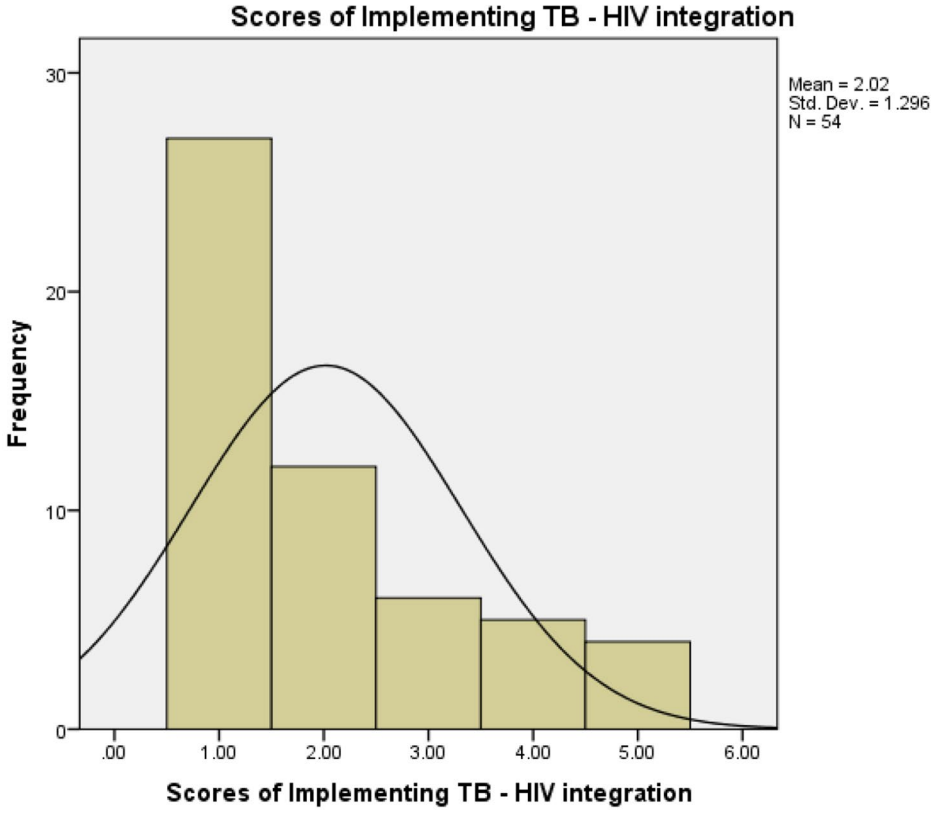

Fig. 6 Perceived Quality of TB-HIV integrated Service Delivery in OR Tambo District using the Scoring System (0 being poor and 6 being excellent)

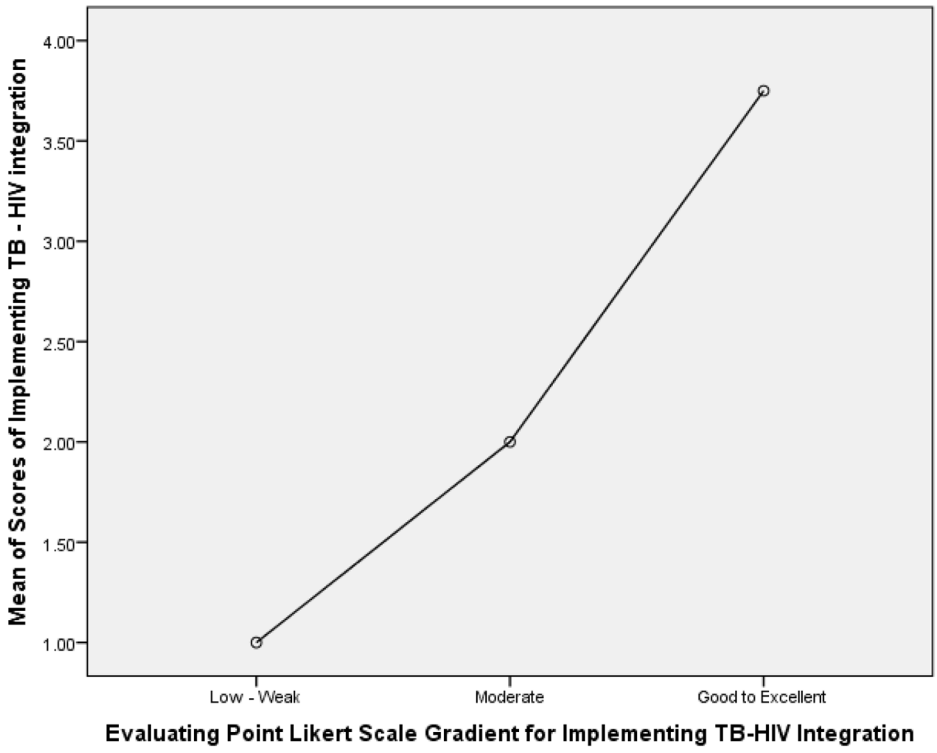

Fig. 7 Relationship between Likert scale gradient and scoring system

shown significant statistical differences on the participants perceived quality of TB/HIV integrated services.

Table 2 shows that participants from the KSD municipality (both rural and peri-urban) poorly perceived the quality of TB and HIV-integrated services. There was an inverse relationship between the age of the study participants and the perceived quality of integrated TB and HIV services. People living under higher poverty conditions perceived better quality of TB/HIV integrated care.

Multiple linear regression analysis showed that the access to healthcare services was significantly and independently associated with the perceived quality of integrated TB/HIV services following the equation: $Y=3.72–0.06X$ (adjusted $R^2=23\%$, p-value=0.001).

Canonical discriminant analysis (CDA) (Tables 3 and 4) showed that in all 5 municipal facilities, long distances to healthcare facilities leading to reduced access to services were significantly more likely to be the most impeding factor which is negatively influencing the perceived quality of integrated TB/HIV services with functions' coefficients ranging from 9.175 in Mhlontlo to 16.514 in KSD (Wilk's Lambda=0.750, p=0.043).

Discussion

This study was conducted to examine the integration of HIV/AIDS, Tuberculosis, and patients' services into the general health care systems. The study revealed that neither health professional staff nor TB/HIV co-infected clients are satisfied with the current model, which presents several constraints to the vision of a continuum of care. O.R Tambo District Municipality has embarked on integrating TB and HIV services with the expected outcome that patients "have access to a continuum of care and support services for TB and HIV/AIDS diagnosis, in all health care facilities and community-based care services". Our study found that the currently used model of care at O.R Tambo district health facilities is the partially integrated model, of patient-centered care and prevention. Traditionally, national AIDS- and TB-control programs have functioned separately and are mirrored by distinct service delivery structures with little coordination of HIV and TB services for individual patients [17]. To improve the diagnosis, treatment, and outcomes for patients with both diseases, the World Health Organization (WHO) developed a framework of strategic collaborative activities to be performed as part of the health sector response to control HIV infection-related TB. The collaborated model is concerned with the partial integration of services whereby a person who has been diagnosed through TB services will also be counseled and tested for HIV and then referred if positive [17]. WHO [17], proposed a fully integrated model of care, where all services for TB and HIV are provided in a single facility and by the same service providers. An overwhelming

Table 1 Association between Perceived quality of integrated TB/HIV services and characteristics of the study participants

Variables of interest	Perceived quality of integrated services as inadequate	Perceived quality of integrated services as adequate	p-value
Category of participants			**0.26**
Health professionals	16(64.0%)	9(36.0%)	
Patients	22(75.9%)	7(24.1%)	
Gender			**0.09**
Males	13(68.4%)	6(31.6%)	
Females	25(71.4%)	10(28.6%)	
Living with			**0.29**
alone	29(82.9%)	6(17.1%)	
spouse	9(47.4%)	10(52.6%)	
Marital Status			**< 0.0001**
Single	10(100.0%)	0(0.0%)	
Married	9(47.4%)	10(52.6%)	
Widowed	11(64.7%)	6(35.3%)	
Divorced	8(100.0%)	0(0.0%)	
Qualification of HCWs			**<0.0001**
High School	8(66.7%)	4(33.3%)	
Bachelor's Degree	2(50.0%)	2(50.0%)	
Undergraduate Diploma	3(75.0%)	1(25.0%)	
Postgraduate Diploma	3(60.0%)	2(40.0%)	
Population Group			**0.08**
African	36(69.2%)	16(30.8%)	
White	2(100.0%)	0(0.0%)	
Home Language			**0.049**
English	3(100.0%)	0(0.0%)	
Xhosa	34(68.0%)	16(32.0%)	
Zulu	1(100.0%)	0(0.0%)	
Other	1(100.0%)	0(0.0%)	
Province of upbringing			**0.29**
Eastern Cape Province	37(69.8%)	16(30.2%)	
KwaZulu Natal Province	1(100.0%)	0(0.0%)	
Working			**0.32**
No	21(80.8%)	5(19.2%)	
Yes	17(60.7%)	11(39.3%)	
Municipality			**0.003**
KSD peri -urban Informal Mthatha Gateway	5(83.3%)	1(16.7%)	
Nyandeni small town Libode	5(38.5%)	8(61.5%)	
Mhlontlo - Mhlakulo small town	9(75.0%)	3(25.0%)	
Mhlontlo - Qumbu small town	8(66.7%)	4(33.3%)	
KSD Mbekweni rural areas	11(100.0%)	0(0.0%)	

body of evidence, however, suggests that the fully integrated option offers optimum benefits for clients, health systems, and workers [17, 18]. The majority of countries have overwhelmingly used a partial model of integrated TB-HIV services [19]. This model refers patients to services providing HIV testing, with or without subsequent HIV care [26, 30]. It is the most common model of TB-HIV service integration in most highly TB-HIV prevalent countries and settings [27, 31, 32]. This model is appropriate at the hospital or health center level where TB and HIV services are both available but full integration is not possible [28, 33–37]. Studies in Malawi have shown achievements on increase in HIV testing of TB patients from 59 to 83%; in addition, cotrimoxazole preventive therapy (CPT) and antiretroviral (ART) provision to HIV–TB co-infected patients improved from 88 to 100% and 18–25%, respectively, when using partial model [30, 32, 38–44]. Similarly, in Kenya, there were higher percentages of HIV testing of TB patients and CPT and ART provision than the prior implementation of integration [45, 46].

Our study participants perceived the quality of TB and HIV/AIDS integrated services as inadequate in O.R Tambo District, however, the participating municipality

Table 2 Association between Participants' perceptions of quality HIV/TB integrated services and local health municipality, age of participants, accessibility to healthcare facilities and poverty gap

Likert Scale Gradient	Variables of interest	Mean	Std. Deviation	P-value
Low – Weak				**< 0.0001**
	Age years	48.33	15.29	
	Access to services (Km)	29.89	6.25	
	Extent area (Km2)	2883.52	177.27	
	Poverty gap (%)	55.52	3.60	
Moderate				**0.001**
	Age years	44.55	15.17	
	Access to services (Km)	26.27	6.02	
	Extent area (Km2)	2816.18	192.87	
	Poverty gap (%)	56.23	4.59	
Good to Excellent				**0.001**
	Age years	41.25	14.52	
	Access to services (Km)	25.75	3.79	
	Extent area (Km2)	2661.19	201.45	
	Poverty gap (%)	59.78	5.91	

Table 3 Wilks' Lambda with test of functions and statistical significance from DA

Step		Tolerance	Min. Tolerance	Sig. of F to Enter	Wilks' Lambda
0	Age years	1.000	1.000	0.328	0.957
	Access to services km	1.000	1.000	0.043	0.884
	Extent area km2	1.000	1.000	0.002	0.783
	Poverty Level %	1.000	1.000	0.016	0.850
1	Age years	0.840	0.840	0.941	0.781
	Access to services km	0.756	0.756	0.342	0.750
	Poverty Level %	0.248	0.248	0.669	0.770

has displayed statistical differences (Table 1). Integrating HIV and TB services (hereafter written HIV-TB services) is a key strategy in reducing TB-related deaths among people living with HIV as studies elsewhere reported [31, 47–50]. Study findings demonstrated associations between age, accessibility to services, and poverty gap which had a major influence on the perceived quality of TB and HIV integration. In trying to understand why age could influence participants' perception of the quality of integrated TB/HIV services: participants in the study, who had a short distance to the facility, perceived TB and HIV services as integrated (young participants), while the majority of those participants staying far apart from the services or facility, perceived services as not integrated at all (adults' participants). Studies by Doward et al. [51] demonstrated that patients aged 15–24 years were least likely to initiate ART and believe that services were integrated [52] while Kadia et al. (58) reported that age 36 years and more were associated with not initiating ART and were far from facilities reported that services were not integrated. Similarly, in many resource-limited settings in Africa, health systems are still struggling in achieving full integration of TB-HIV integration, regardless of documented intents towards full integration. Studies reported that the majority of adult patients believed that TB and HIV services were not fully integrated especially those who are staying far from the health facilities whilst those that are nearby believe that in their health facilities, TB and HIV are integrated [18]. In Zambia and Sudan, observational studies of TB patients reported geographical location (distance) also influences perception about TB-HIV integrated services with participants who are far from the health facilities reporting that services are not integrated [53, 54]. These studies concur with the WHO study which proposed that services must be available where people live and work to achieve greater accessibility and quality [16]. Overwhelming literature has highlighted that distance to the facilities still does not promote equity, accessibility, and availability of services to where people are and is perceived as not an integrated model [54–57]. The district facilities in low-income countries still struggle to achieve service excellence and greater accessibility of integrated TB and HIV because of the distance to the facilities [58]. Studies elsewhere have observed that the lack of access to treatment

Table 4 Classification of Function Coefficients on Municipality From: Fisher's linear discriminant functions in O.R Tambo Municipality

	Municipality				
	KSD peri - urban Informal Mthatha Gateway	Nyandeni small town Libode	Mhlontlo - Mhlakulo small town	Mhlontlo - Qumbu small town	KSD Mbekweni rural areas
Age years	0.373	0.272	0.274	0.257	0.420
Access to services km	14.297	11.468	9.175	13.761	16.514
(Constant)	-234.608	-150.362	-98.863	-212.858	-311.798

centers especially when patients had to be accompanied considering the high cost of living and transportation is a challenge [59, 60]. Integrated TB/HIV care, in which the same healthcare team provides services to patients with HIV-associated TB, offers potential advantages over standard approaches and quality care for both TB and HIV patients [51, 52, 61]. Studies elsewhere observed that poor patients can only accept services as they have no option since they are desperate and in need of healthcare services; due to their socioeconomic status and desperation, they will believe that TB and HIV services are integrated [53, 54, 58, 62, 63]. Literature demonstrated that there is a positive correlation between poverty and Mycobacterium tuberculosis, primarily through (1) its influence on living conditions, such as people living in overcrowded and poorly ventilated homes, (2) prolonged diagnostic delay, and (3) increased vulnerability due to malnutrition and/or HIV infection especially partial integrated model [58, 64–66].

TB-HIV integrated services exist when TB and HIV services are provided by the same trained healthcare provider at the same visit, a 'one-stop service', the TB clinic provides HIV treatment and the HIV clinic provides TB treatment [17]. This model is considered the most efficient and effective way to provide comprehensive TB–HIV services, and it is appropriate for settings with high TB and HIV prevalence [18]. Results in Malawi have shown an increase of 12% in HIV testing of TB patients, from 85 to 97%, as well as an increase of 19% in ART uptake, from 44 to 63% [19] by using this model. In addition, the integrated services were acceptable among patients. Similarly, in Kenya, the integration of HIV–TB services demonstrated improvements in HIV testing of TB patients and the provision of CPT and ART [17, 18]. Other studies demonstrated that integrated services in rural clinics can ensure a faster and sustained uptake of HIV-positive clients accessing treatment services and a much lower rate of client drop-out compared with larger specialized HIV/AIDS treatment hospitals. Studies linked this observation to the fact that integrated clinics offered a multiple range of services and HIV/AIDS clinic services were integrated into general consultation [18–20]. Studies elsewhere reported similar findings, where patients who visited integrated HIV Care (IHC) clinics were more likely to achieve viral suppression [67]. Proponents of the integrated HIV clinic model also talk of the potential for improvements in the quality of care provided to patients in integrated care clinics [66, 67]. Another study suggested that the quality of care is observably better in integrated care clinics when compared to standalone facilities (probably because the clinicians were also spending more time interacting with their clients) [67]. Also, there was a report on the improvement in the uptake of non-HIV services (testing for syphilis) when antenatal care (ANC) was integrated with HIV services [62]. Integration led to similar positive outcomes among TB patients and among diabetics in chronic care. Integration may also have a positive influence on healthcare workers and hospital operations because they are maybe better trained in both TB and HIV management [61]. A study by Charles et al. [68], in their report on the midterm evaluation of the integrated management of adolescent and adult illness in Ethiopia, concluded that the integration of services at health facilities has been beneficial to both HIV-positive clients and hospital workers since HIV positive patients get TB services while health worker gets training on management of both diseases. They have highlighted significant improvements in hospital utilization and increased access of clients to quality HIV services. Hospital workers felt that they were better trained and motivated by what they perceived to be an increase in their credibility as clinical care providers in the eyes of the community [68]. It is possible that older patients who had other comorbidities that contributed to unfavorable outcomes through fully integrated management can turn to favorable treatment outcomes [52 62, 63].

Limitations of the study

This study could have been done at a large scale but due to very limited funding and time, we had to choose the five clinics and their patients. The time constraint was also a limitation as these clinics and staff were very busy with their daily activities. When using probabilistic and regression techniques during the quantification of qualitative data, limitations include the fact that estimation can be flawed by multicollinearity and numerical convergence problems. Also, the treatment of polychotomous questions may be complicated. Despite these limitations, the combination of both probabilistic and regression approaches minimized some of these issues, and we capitalized on the use of discriminant analysis, a powerful research analysis tool, to investigate how variables of interest contributed to group separation, and to what degree.

Conclusion and recommendations

Overall, participants are not happy with the current model and type of services rendered by their facilities in O.R Tambo district. They are coming from impoverished communities and not having social protection; majority of them on grant dependent and lack health insurance. After traveling long distances to reach the healthcare facilities, they cannot get optimal quality integrated TB/HIV services since the district is still implementing partial integration model of TB and HIV care. The study recommends that O.R Tambo should strive for service excellency to achieve the fully integrated TB and HIV

services for continuum of care. TB and HIV services should be equally accessible, acceptable and reach every client in the district, young and old, irrespective of gender, race, and ethnicity.

Abbreviations

HIV	Human Immunodeficiency Virus
TB	Tuberculosis
O.R Tambo	Oliver Reginald Tambo
ART	Antiretroviral
CDA	Canonical Discriminant Analysis
CPT	Cotrimaxozole Preventive Therapy
IPT	Isoniazid Preventive Therapy
UNAIDS	Joint United Nations Programme on HIV/AIDS
KSD	King Sabata Dalindyebo
MDR TB	Multiple Drug Resistance
XDR TB	Extreme Drug Resistance

Acknowledgements
We would like to thank the staff and colleagues in the Department of Public Health for their support during the collection of data used in this study. The University of KwaZulu-Natal, Research Department and School of Nursing Department Public Division with their support.

Author Contributions
N.D.: designed the study, collected data from various data sources, contributed in data analysis and interpretation of findings, and drafted the manuscript. B.L.: revised the study design and analysed data. T.A.: contributed in data analysis and interpretation of findings, and also edited the final version of the manuscript.

Funding
The University of KwaZulu-Natal Research Department funded the study.

Data Availability
The data generated and/or analysed during this study is available from the corresponding author on reasonable request.

Declarations

Competing interests
The authors declare no competing interests.

Ethics approval and consent to participate
The Research Ethics and Biosafety Committee of the Walter Sisulu University approved the study **(ethical clearance No. 29/2014)** and permission to conduct the study was obtained from the Eastern Cape Department of Health **(EC_2016RP27_242).** The study was performed in accordance with the Declaration of Helsinki. Information about the purpose and processes of the study were provided to all participants, who provided informed consent before participating in the study.

Consent for publication
Not applicable.

Author details
[1]Division of Public Health, Department of Community Medicine, Faculty of Health Sciences, Walter Sisulu University, Mthatha, South Africa
[2]Division of Medical Microbiology, Department of Laboratory Medicine and Pathology, Faculty of Health Sciences, Walter Sisulu University and National Health Laboratory Services, Mthatha, South Africa

Received: 17 September 2022 / Accepted: 24 June 2023
Published online: 27 July 2023

References

1. World Health Organization. Global tuberculosis report. Geneva. : 2019. https://www.who.int/tb/publications/global_report/en/.
2. Getahun H, Gunneberg C, Granich R, Nunn P. HIV infection-associated tuberculosis: the epidemiology and the response. Clin Infect Disease. 2010;50(3):201–07.
3. Silva Escada RO, Velasque L, Ribeiro SR, Cardoso SW, Spindola Marins LM, Grinsztejn E et al. Mortality in patients with HIV-1 and tuberculosis co-infection in Rio de Janeiro, Brazil—associated factors and causes of death. BMC Infect Dis. 2017; 17(373).
4. Rossetto M, Brand EM, Rodrigues RM, Serrant L, Teixeira LB. Factors associated with hospitalization and death among TB/HIV co-infected persons in Porto Alegre, Brazil. PLoS ONE. 2019;14(1):e0209174. pmid:30601842.
5. Legido-Quigley L, Montgomery CM, Khan P, Atun R, Fakoya A, Getahun H, et al. Integrating tuberculosis and HIV services in low- and- middle-income countries: a systematic review. Trop Med Int Health. 2013;18(2):199–211. pmid:23217030.
6. Kerschberger B, Hilderbrand K, Boulle AM, Coetzee D, Goemaere E, De Azevedo V, et al. The Effect of Complete Integration of HIV and TB Services on Time to initiation of antiretroviral therapy: a before-after study. PLoS ONE. 2012;7(10):e46988. pmid:23071690.
7. The Global Fund. TB Testing in 2020 Dropped Drastically due to COVID19., 2021a. Accessed 14th January 2022 from https://www.theglobalfund.org/en/news/2021-03-24-tb-testing-in-2020-dropped-drastically-due-to-covid-19.
8. Saunders MJ, Evans CA. COVID-19, tuberculosis and poverty: preventing a perfect storm. Eur Respir J. 2020;56(1). https://doi.org/10.1183/13993003.01348-2020. Published 2020 Jul 9.
9. Inzaule SC, Ondoa P, Loembe MM, Tebeje YK, Ouma AEO, Nkengasong JN. COVID19 and indirect health implications in Africa: impact, mitigation measures, and lessons learned for improved disease control. PLoS Med. 2021;18(6). https://doi.org/10.1371/journal.pmed.1003666. PMID:34161318; PMCID: PMC8266084.
10. World Health Organisation. The Global tuberculosis report. Geneva: World Health Organization. Licence: CC BY-NC-SA 3.0 IGO. 2020, Available: https://apps.who.int/iris/bitstream/handle/10665/336069/9789240013131-eng.pdf [31 March 2022].
11. National Department of Health. A practical guide for TB and HIV service Integration at Primary health care facilities. Pretoria: National Department of Health; 2012.
12. Pai M, Temesgen Z, Quality. The missing ingredient in TB care and control. J Clin tuberculosis other Mycobact Dis, 14, 12–3. https://doi.org/10.1016/j.jctube.2018.12.001.
13. Rucşineanu O, Stillo J, Ateş V. Assessing the satisfaction level of tuberculosis patients in regard to medical services and community support during treatment. The Moldovan Society Against Tuberculosis, 2018. ISBN 978-9975-3235-1-2.
14. Naidoo P, Theron G, Rangaka MX, Chihota VN, Vaughan L, Brey ZO, et al. The south african tuberculosis care cascade: estimated losses and methodological challenges. J Infect Dis. 2017;216:702–13.
15. Okeke NL, Ostermann NM, Thielman. Enhancing linkage and retention in HIV care: a review of interventions for highly resourced and resource-poor settings Curr HIV/AIDS Rep, 11 (4) (2014), pp. 376–92.
16. Handbook for national quality policy. and strategy: a practical approach for developing policy and strategy to improve quality of care. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO.
17. World Health Organization. WHO Policy on collaborative TB/HIV activities: guidelines for national programmes and other stakeholders, 2012. Geneva: WHO.
18. Anku PJ, Amo-Adjei J, Doku DT, Kumi-Kyereme A. Integration of tuberculosis and HIV services: exploring the perspectives of co-infected patients in Ghana. Glob Public Health. 2018. https://doi.org/10.1080/17441692.2017.1385823. PMID: 28984493.
19. Torpey K, Agyei-Nkansah A, Ogyiri L, Forson A, Lartey M, Ampofo W, Akamah J, Puplampu P. Management of TB/HIV co-infection: the state of the evidence. Ghana Med J 2020, 54(3), 186–96. https://doi.org/10.4314/gmj.v54i3.10.
20. Cazabon D, Alsdurf H, Satyanarayana S, Nathavitharana R, Subbaraman R, Daftary A, Pai M. Quality of tuberculosis care in high burden countries: the urgent need to address gaps in *the care cascade*. Int J Infect Dis 2017 Mar; 56:111–6.https://doi.org/10.1016/j.ijid.2016.10.016. Epub 2016 Oct 26. PMID: 27794468; PMCID: PMC5346036.

21. IHI partners with South Africa National Department of Health on initiative. To improve tuberculosis care and outcomes [press release]. Institute for Healthcare Improvement; 2017.
22. Chakaya J, Castro JL, Jensen PM, Fujiwara PI. A new era for global tuberculosis: holding leaders accountable for promises. Int J Tuberc Lung Dis. 2018;22:1387. [CrossRef].
23. Padayatchi N, Daftary A, Naidu N, Naidoo K, Pai M. Tuberculosis: treatment failure,or failure to treat? Lessons from India and South Africa. BMJ Glob Health. 2019;4(1):e001097.
24. Statistics South Africa. Census 2011 Statistical release – P0301.4, 2012.
25. Manson S. Simplifying complexity: a review of complexity theory. Geoform. 2001;32(2):405–14.
26. Duarte R, Lönnroth K, Carvalho C, Lima F, Carvalho ACC, Muñoz-Torrico M, et al. Tuberculosis, social determinants and co-morbidities (including HIV). Pulmonology. 2018 Mar;24(2):115–9.
27. Loveday M, Padayatchi N, Wallengren K, Roberts J, Brust JCM, Ngozo J, et al. Association between Health Systems performance and treatment outcomes in patients co-infected with MDR-TB and HIV in KwaZulu-Natal, South Africa: implications for TB programmes. PLoS ONE. 2014;9(4):e94016. https://doi.org/10.1371/journal.pone.0094016. [PMC free article].
28. Makgopa S, Madiba S. 2021. Tuberculosis knowledge and delayed Health Care seeking among New Diagnosed Tuberculosis Patients in Primary Health Facilities in an Urban District, South Africa. Health services insights,2021, 14, 11786329211054035. https://doi.org/10.1177/11786329211054035.
29. Matos R, Fonseca KL, Mereiter S, et al. Mycobacterium tuberculosis infection up regulates Sialyl Lewis X expression in the lung epithelium. Microorganisms. 2021;9:99. https://doi.org/10.3390/microorganisms9010099.
30. Kalonji D, Mahomed OH. Health system challenges affecting HIV and tuberculosis integration at primary healthcare clinics in Durban, South Africa. Afr J Prim Health Care Family Med. 2019;11(1):a1831.
31. Uyei J, Coetzee D, Macinko J, Weinberg SL, Guttmacher S. Measuring the degree of integrated tuberculosis and HIV service delivery in Cape Town. South Afr Health Policy Plan. 2014;29(1):42–55.
32. World Health Organization. WHO Policy on collaborative TB/HIV activities: guidelines for national programmes and other stakeholders, 2012. Geneva: WHO.
33. World Health Organisation. The Global tuberculosis report. Geneva: World Health Organization. Licence: CC BY-NC-SA 3.0 IGO. 2020, Available: https://apps.who.int/iris/bitstream/handle/10665/336069/9789240013131-eng.pdf [31 March 2022].
34. Tagaro M, Harries AD, Kool B, et al. Tuberculosis case burden and treatment outcomes in children, adults and older adults, Vanuatu, 2007–2011. Public Health Action. 2014;4:14–8.
35. Saunders MJ, Evans CA. COVID-19, tuberculosis and poverty: preventing a perfect storm. Eur Respir J. 2020;56(1). https://doi.org/10.1183/13993003.01348-2020. Published 2020 Jul 9.
36. Kweza PF, Van Schalkwyk C, Abraham N, Uys M, Claassens MM, Medina-Marino A. Estimating the magnitude of pulmonary tuberculosis patients missed by primary health care clinics in South Africa. Int J Tuberc Lung Dis. 2018;22:264–72. [CrossRef].
37. UNAIDS. Rights in a pandemic: lockdowns, rights and lessons from HIV in the early response to COVID-19. Geneva: UNAIDS; August 2020.67. UNAIDS. Tuberculosis and HIV UNAIDS. Joint United Nations Programme on HIV/ AIDS; 2019 [accessed 20 March 2022].
38. Suthar AB, Lawn SD, del Amo J, Getahun H, Dye C, Sculier D, Sterling TR, Chaisson RE, Williams BG, Harries AD, et al. Antiretroviral therapy for prevention of tuberculosis in adults with HIV: a systematic review and meta-analysis. PLoS Med. 2012;9:e1001270. [CrossRef].
39. Trébucq A, Schwoebel V, Kashongwe Z, Bakayoko A, Kuaban C, Noeske J, Hassane S, Souleymane B, Piubello A, Ciza F, et al. Treatment outcome with a short multidrug-resistant tuberculosis regimen in nine african countries. Int J Tuberc Lung Dis. 2018;22:17–25. [CrossRef].
40. Tafess K, Beyen TK, Abera A, et al. Treatment outcomes of tuberculosis at Asella Teaching Hospital, Ethiopia: ten years' retrospective aggregated data. Front Med (Lausanne). 2018;5:38.
41. Uplekar M, Weil D, Lonnroth K, Jaramillo E, Lienhardt C, Dias HM et al. *WHO's new end TB strategy*. Lancet. 2015; 385(9979):1799–801. https://doi.org/10.1016/S0140-6736(15)60570-0 PMID: 25814376.
42. Kyi MS, Oo WM, Mya KM. Factors influencing adherence to TB treatment among TB/HIV co-infected patients attending TB clinic at Mingalardon specialist hospital, Myanmar. Bull Prev Soc Med. 2015;1:35–40.
43. Reid SE, Harris J, Besa S, Morse J, Smith HJ, Herce ME, et al. Integrating HIV care and treatment into tuberculosis clinics in Lusaka, Zambia: results from a before-after quasi-experimental study. BMC Infect Dis. 2018;18:1–12.
44. Holtzman CW, Godfrey C, Ismail L, et al. PEPFAR's role in protecting and leveraging HIV Services in the COVID-19 response in Africa [published online ahead of print, accessed 2022 March 20]. Curr HIV/AIDS Rep. 2022;1–11. https://doi.org/10.1007/s11904-021-00587-6.
45. de Vries SG, Cremers AL, Heuvelings CC, Greve PF, Visser BJ, Belard S, et al. Barriers and facilitators to the uptake of tuberculosis diagnostic and treatment services by hard-to-reach populations in countries of low and medium tuberculosis incidence: a systematic review of qualitative literature. Lancet Infect Dis. 2017;17(5):e128–e43.
46. Pai M, Temesgen Z, Quality. The missing ingredient in TB care and control. J Clin tuberculosis other Mycobact Dis, 14, 12–3. https://doi.org/10.1016/j.jctube.2018.12.001.
47. Sinshaw Y, Alemu S, Fekadu A, Gizachew M. 2017. Successful TB treatment outcome and its associated factors among TB/HIV coinfected patients attending Gondar University Referral Hospital, Northwest Ethiopia: An institution based crosssectional study. BMC Infect Dis 2017;17:1–9.
48. Secretary of Sahyoga JS, Lauxa TS, Patila S. Predictors of tuberculosis treatment outcomes among a retrospective cohort in rural, central India. J Clin Tuberc Other Mycobact Dis. 2018;12:41–7.
49. South African National Department of Health. Let Our Actions Count: South Africa's National Strategic Plan on HIV, AIDS, and STIs 2017–2022 [Internet]. 2017. Available: http://sanac.org.za/wp-content/uploads/2017/05/NSP_Full-Document_FINAL.pdf.
50. World Health Organization (WHO). The end TB strategy. Global strategy and targets for tuberculosis prevention, care and control after 2015. Geneva: WHO; 2015. p. 2.
51. Dorward J, Khubone T, Gate K, et al. The impact of the COVID-19 lockdown on HIV care in 65 south african primary care clinics: an interrupted time series analysis. Lancet HIV. 2021;8(3). https://doi.org/10.1016/S2352-3018(20)30359-3. e158–65 Epub 2021 Feb 4. PMID: 33549166; PMCID: PMC8011055.
52. Herce ME, Morse J, Luhanga D, et al. Integrating HIV care and treatment into tuberculosis clinics in Lusaka, Zambia: results from a before-after quasi-experimental study. BMC Infect Dis. 2018;18:536. https://doi.org/10.1186/s12879-018-3392-2.
53. Cremers AL, de Laat MM, Kapata N, Gerrets R, Klipstein-Grobusch K, Grobusch MP. Assessing the consequences of stigma for tuberculosis patients in urban Zambia. PLoS ONE. 2015;10:e0119861.
54. Compendium of WHO guidelines and associated standards: ensuring optimum delivery of the cascade of care for patients with tuberculosis, second edition. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO 61.
55. Harries AD, Lin Y, Kumar AMV, Satyanarayana S, Takarinda KC, Dlodlo RA, Zachariah R, Olliaro P. What can National TB Control Programmes in low- and middle-income countries do to end tuberculosis by 2030? F1000Research 2018, 7, 1011. [CrossRef].
56. Hughes J, Osman M. Diagnosis and management of drug-resistant tuberculosis in South African adults. S Afr Med J. 2014; 104(12). Available from: https://www.ajol.info/index.php/samj/article/view/113922https://doi.org/10.7196/SAMJ.9097 [accessed 14 April 2022].
57. UNAIDS. Rights in a pandemic: lockdowns, rights and lessons from HIV in the early response to COVID-19. Geneva: UNAIDS; August 2020.67. UNAIDS. Tuberculosis and HIV UNAIDS. Joint United Nations Programme on HIV/ AIDS; 2019 [accessed 20 March 2022].
58. Dlatu N, Longo-Mbenza B, Apalata T. Predictors of tuberculosis incidence and the effects of multiple deprivation indices on tuberculosis management in OR Tambo district over a 5-year period. PLoS ONE. 2022;17(3):e0264811. https://doi.org/10.1371/journal.pone.0264811.
59. Obaromi D, Ndege J, Yongsong Q. Disease mapping of tuberculosis prevalence in Eastern Cape Province, South Africa. J Public Health volume. 2018;27:241–8.
60. WHO. Global tuberculosis report in Geneva. World Health Organization; 2018. CC BY-NC-SA 3.0 IGO.
61. Kadia BM, Takah NF, Dimala CA, Smith A. Barriers to and enablers of uptake of and adherence to antiretroviral therapy in the context of integrated HIV and tuberculosis treatment among adults in sub-saharan Africa: a protocol for a systematic literature review. BMJ Open. 2019;9:1–7.
62. Enane LA, Eby J, Arscott-Mills T, Argabright S, Caiphus C, Kgwaadira B, Steenhoff AP, Lowenthal ED. TB and TB-HIV care for adolescents and young adults.

Int J Tuberc Lung Dis. 2020 Feb 1;24(2):240–249. https://doi.org/10.5588/ijtld.19.0416. PMID: 32127110; PMCID: PMC7307717.
63. Shamu S, Kuwanda L, Farirai T, Guloba G, Slabbert J, Nkhwashu N. Study on knowledge about associated factors of tuberculosis (TB) and TB/HIV co-infection among young adults in two districts of South Africa. PLoS ONE. 2019;14(6):e0217836. https://doi.org/10.1371/journal.pone.0217836.
64. Floyd K, Glaziou P, Zumla A, Raviglione M. The global tuberculosis epidemic and progress in care, prevention, and research: an overview in year 3 of the end TB era. Lancet Respir Med Apr. 2018;6(4):299–314.
65. Day C, Gray A. Health and related indicators. In: Padarath A, Barron P, editors. South African Health Review, 2017. Durban: Health Systems Trust; 2017. pp. 217–339.
66. Dlwati LV, Mavundla TR, Mbengo F. Facilitators for and barriers to the implementation of National Tuberculosis Management Guidelines. Afr J Nurs Midwifery. 2018;19(3):13. https://doi.org/10.25159/2520-5293/2862.
67. Makgopa S, Madiba S. 2021. Tuberculosis knowledge and delayed Health Care seeking among New Diagnosed Tuberculosis Patients in Primary Health Facilities in an Urban District, South Africa. Health services insights,2021, 14, 11786329211054035. https://doi.org/10.1177/11786329211054035.
68. Charles MK, Lindegren ML, Wester CW, Blevins M, Sterling TR, Dung NT, et al. Implementation of tuberculosis intensive case finding, isoniazid preventive therapy, and infection control ("three I's") and HIV-tuberculosis service integration in lower income countries. PLoS ONE. 2016;11(4):e0153243.

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