

Factors Contributing to the Emergence of DR TB in the Northern Cape Province and the Cost of Treatment

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Abstract

Globally, Tuberculosis (TB) burden is quite substantial and a big concern. In recent years, particularly Drug Resistant Tuberculosis (DR TB) has cut many lives short and become a growing threat in many developing countries. South Africa, despite government's comprehensive TB treatment care and support, has an increasing number of new DR TB cases. This study aimed at describing factors contributing to the emergence of DR TB in the Northern Cape Province, South Africa. A cross-sectional, descriptive study design was used on purposively selected DR TB patients who were on treatment in the West End and Dr Harry Surtie Regional Hospitals between 01 October 2014 and 31 December 2015. Both quantitative and qualitative methods were used to gather information from research respondents. Logistic regression analysis was used to compare risk factors related with the emergence of DR TB cases. Out of the 156 DR TB patients, close to one-third (36%) were previous treatment defaulters, while the majority (64%) were newly infected. Average treatment costs per patient at public health facility is about R190,000 (14,179 USD). The logistic regression analysis shows that respondents' residence (OR=0.13; PV = 0.002); client happiness to take medicine (OR = 0.29; PV = 0.021); alcohol consumption (OR = 0.15; PV= 0.036); missed treatment practices (OR = 0.59; PV=0.000); and TB disease information (OR = 0.26; PV= 0.009) are significantly contributed to default of treatment at 5% level of significance, and 95% of confidence intervals. All-inclusive approach is required to effectively tackle several risk factors for emergence of DR TB in a cost-effective ways and reduce the number of TB treatment defaulters.

Keywords

Tuberculosis, Adherence, Drug Resistant Tuberculosis, Co-infection, Northern Cape

1. Introduction

Whilst tuberculosis affects a vast number of the world's population, the largest number of TB cases have been reported from developing countries. According to the World Health Organization (WHO) statistics for 2015, globally an estimated figure of 1.5 million people from all walks of ages including children died due to TB related cases [1, 2]. In most cases TB is more prevalent among the poor than the wealthier people. In the literature it is a well-established fact

that poverty and disease are inextricably linked together, with each factor aiding the other and making it difficult to break the cycle of poverty-poor health trap [3]. Many diseases that primarily affect the poor, serve to deepen poverty level and worsen living conditions [4, 5, 6]. Poverty significantly reduces people's capabilities, making it more difficult to avoid poverty related diseases [7, 8].

South Africa ranks third worldwide on the list of high TB burden countries, next to China and India which are highly populated compared to the former [2]. TB incidence rate in South Africa remains unacceptably higher, with 834 new TB

cases per 100,000 population [9]. TB treatments are provided free of charge to all in public health facilities. Despite almost all TB cases being curable with the available treatment; the new TB incidence rate in relation to its population size is disturbing [10, 11, 12]. Although there is evidence that the rate of new confirmed TB cases in the country is dropping, the progress is not uniform among Provinces. Furthermore, with the current rate achieving Government's vision – better health care for all, and the post-2015 WHO's 90-90-90 goals by 2020; and the 2030 targeted approach to achieve zero deaths, disease and suffering due to TB in the country is a big concern [13]. There is a need to identify the factors that contribute for emergence of and causes of slow progress on treatment outcomes.

In the Northern Cape Province, a large number of both new and previously treated multidrug-resistant and extensively-drug-resistant (MDR and XDR TB) cases have been reported in recent years [14]. Moreover, the trend analysis shows that the prevalence and incidence of DR TB cases are increasing. For instance, the Electronic Data Register (EDR) on DR TB cases shows that between 2009 and 2015 on average, over 150 people were infected with new DR TB each year [15]. Prevalence of more cases of previously treated TB suggests poor treatment outcomes as measured by treatment completion and/or low success rates. Compared to the province's population size (1, 185, 600 from STAT SA 2015 mid-year population estimates), DR TB remains one of the major public health challenges and the drivers of morbidity and mortality in the province. A host of studies indicate that treatment of DR TB is more difficult than the one of drug susceptible TB, and often requires the use of more costly "second line" drugs for a longer period [16, 17, 18]. In many low and middle-income countries where resources are scarce, more cost-effective and innovative strategies are needed to reduce the number of TB defaulters and control the risk factors for defaulting [19, 20].

TB can affect all people of any age group, but studies indicate that TB disproportionately affect sub groups population [5, 6, 7, 8]. Its prevalence and impacts are most common and more severe on the worse-off population groups compared to the socioeconomically affluent. Several reasons have been mentioned why people at lower levels of socioeconomic status carry the largest burden of the disease and risk of poor health outcomes [21]. For instance, the social and economic injustices including lack of adequate income and unbalanced nutrition [2]; jobs that expose employees to the risks of TB infection [22, 23]; unhealthy living environment including crowded housing [7, 8, 11]; culture and traditional beliefs about illness and treatment as well as harmful practices [21]; and lack of employment [7, 8, 22] have been mentioned as substantial risk factors for TB infection. Poor translation of pro-poor policies and inefficient health systems and services to control the disease, inadequate resources, which include human resources for health and finance; service provider attitude and their relationship with the patient, unfriendly TB patient working hours, and

inadequate supervision have also been mentioned as risk factors associated with health systems [1, 2, 5, 7, 23]. In addition, patient related health seeking behaviour such as knowledge about TB and use of alcohol and cigarette [11] while on treatment have also been mentioned.

A new strategy that has been launched recently aimed to end TB by 2035 and which has set ambitious targets for this to be achieved, requiring a 10% year-on-year reduction in TB incidence rates [9]. To reduce the spread of Drug Resistant TB and obtain the best outcomes from TB control programme treatment, addressing the multitude of risk factors is critical. In response to this call globally, the World Health Assembly in May 2014 adopted Sustainable Development Goals (SDGs) strategy as a blueprint for countries to reduce the impact of the Social Determinants of Health through collectively tackling the risk factors and improving the socioeconomic conditions of the population, particularly the poor. South Africa as a country, adopted zero TB infection strategy goal by 2030. Rapid progress to these goals is significantly dependent on the collaborative efforts among different sectors as well as effective translation of policies into action. Without key role players' effective collaboration to fight the TB disease, the outcomes will be limited and the strategic goals may not be achieved. This study was conducted with the aim of identify factors contributing to the emergence of DR TB in the Northern Cape Province and the cost of treatment.

2. Methods

2.1. Survey Design

The study used a cross-sectional, descriptive study design, on purposively selected cases of DR TB patients who were on treatment in the West End and Dr Harry Surtie Regional Hospitals between 01 October 2014 and 31 December 2015. These facilities accept DR TB patients from the entire province for hospitalization and treatment. Both quantitative and qualitative data collection methods were used to generate information from research respondents. Quantitative methods used include a pre-tested survey questionnaire and secondary data review. Secondary data was obtained from a review of patients' register (Electronic DR TB Register) that captures patients' treatment start date, treatment completion date, cure, failure, defaulter status and death. Data on success rate indicators were then extracted from this database.

Qualitative data were collected using focus group discussions with DR TB patients and healthcare providers. The aim of the focus group discussion was to generate in depth understanding of TB treatment services, other support activities, health system systems challenges, health professionals and patients' relationship, staff attitudes and socioeconomic conditions of discussants. Health system issues were obtained from the TB project manager, facility managers, TB nurses and adherence counsellors. Data was analysed by first reading and re-reading transcripts, followed by coding, then generated categories and themes.

2.2. Survey Population and Sample

The survey population included all DR TB patients who were on treatment in the two DR TB Hospitals during the study period of 01 October 2014 to 31 December 2015. The survey used a purposive sampling method, and all DR TB patients who were on treatment in the two DR TB treatment sites of the province during the study period were eligible and included as part of the study.

2.3. Data Sources and Collection Process and Analysis

Two questionnaires (i) individual (patient) level; and (ii) for service providers on challenges of the health systems were administered in the survey. For individual patient interviews, structured questionnaire was designed based on information obtained from literature and from the key informant (interviews used to assess their knowledge on the importance of adherence as well as the factors that influence poor treatment adherence). Patients were asked about their socioeconomic, demographic status, TB knowledge, practices and behaviour, treatment and advice received, health services utilization and challenges, as well as some key behavioural indicators such as consistency of medicine use as instructed, awareness of their TB status, stigma, and knowledge of TB transmission and prevention strategies to assess their knowledge and practices.

In addition, written material and other documents from TB programme records, memoranda and correspondence, official publications and performance reports were reviewed. Accordingly, the TB programme Electronic Data Record (EDR) for the period 2009 to 2015 was reviewed. Furthermore, DR TB patients, healthcare workers including community healthcare workers participated in the focus group discussion.

2.4. Ethical Considerations

The survey protocol was ethically approved by the Provincial Health Research and Ethics Committee (PHREC) Reference number (NC2015 RP 0022) and gate keeping permission was granted by the Hospital managers to conduct the research.

3. Results

3.1. Descriptive Statistics Analysis

Descriptive statistical analysis was done on a total of 156 DR TB patients in two DR TB treating sites in the Northern Cape Province. Out of which 36% were previous treatment defaulters, while 64% were newly infected. Table 1 presents the socio-economic and demographic characteristics of research respondents. Out of 156 research participants who were interviewed, 87 (55.7%) were males and 66 (42.3%) females. The youngest was 18 while the oldest patient was 76 years old. With respect to age, the prevalence of DR TB was highest (37%) among 30-40 years age group. The majority of previously defaulters were among 40-50 years age group (21%). In the new infection group, the proportion of respondents in the 50-year and above age group accounted for 28%. The literacy level of the respondents shows that more than 50% of respondents had low education levels of which 59 (39%) attended grade 1-7 and 19 (12.5%) didn't attend school. Only 4 respondents had completed matric and attended college and higher level. The majority, 69 (45.7%) of the respondents reported that they had completed secondary level of education.

For 90% of the respondents' monthly average income was below R3,000 (Three thousand Rand) per month. Only 4.73% of the respondents were earning more than R5,000 (Five Thousand Rand). 10% of the respondents were employed, whilst the majority 85.2% of the interviewed people were not working during the study period. The majority (67%) of the respondents in the study described themselves as single, while 7.6% were married and 14% were living together, 3.2% were divorced and 7% were widowed. Individuals who were married and living together had a considerably lower DR TB-incidence rate (22%) compared to those who were single (67%). Disaggregation of the data by race group shows that coloured population groups had the highest DR TB prevalence (56%) compared to all other race groups, followed by Black Africans (41%). Only 3.27% of the respondents were whites, while no case was reported among Indians or Asians. Rural informal area residents had a significantly higher DR-TB prevalence (39.19%), followed by semi-urban areas (29.7%) and urban formal areas (29%).

Table 1. Socio-economic and demographic characteristics respondents.

Variable	Response	Respondents	Previously defaulted	New case
Gender	n	153	56 (36%)	97 (64%)
	Male	87	30 (37%)	57 (63%)
	Female	66	23 (35%)	43 (65%)
Age in years	n	156	54 (34%)	94 (66%)
	< 20	5	3 (60%)	2 (40%)
	≥ 20 & < 30	25	9 (38%)	15 (62%)
	≥ 30 & < 40	58	18 (29%)	40 (70%)
	≥ 40 & < 50	33	21 (65%)	11 (34%)
	≥ 50	35	5 (15%)	28 (85%)
Marital status	n	152	56 (36%)	96 (64%)
	Married	12	5 (45%)	7 (55%)
	Living together	22	7 (33%)	14 (67%)
	Divorced	5	2 (40%)	3 (60%)
	Widowed	11	0	10 (100%)
	Single	102	39 (36%)	61 (64%)

Variable	Response	Respondents	Previously defaulted	New case
Highest education	n	151	52 (36%)	94 (64%)
	None	19	6 (31%)	13 (69%)
	Elementary	59	23 (39%)	35 (60%)
	High school	69	23 (35%)	42 (65%)
	Tertiary	4	0	4 (100%)
Employment status	n	148	52 (34%)	96 (66%)
	Employed	15	5 (33%)	10 (67%)
	Not employed	133	48 (36%)	85 (64%)
Racial group	n	143	53 (33%)	91 (67%)
	Black African	59	15 (25%)	44 (75%)
	White	5	0	5 (100%)
	Coloured	89	39 (45%)	49 (55%)
	Indian/Asian	0		
Total monthly income	n	148		
	< R1000	25	13 (52%)	12 (48%)
	≥ R1000 & < R3000	111	39 (27%)	75 (63%)
	≥ R3000 & < R5000	5	0	5 (100%)
	≥ R5000 & < R7500	3	2 (67%)	1 (33%)
	≥ R7500	4	1 (23%)	3 (75%)
Residential area	n	148		
	Urban	43	25 (60%)	16 (40%)
	Rural	58	20 (36%)	36 (64%)
	Semi-urban	44	6 (14%)	38 (86%)
	Other	3	2 (66%)	1 (33%)

Patients' Knowledge, attitude and Practice

More than three-quarter (77%) of the respondents knew about TB as an infectious disease and that it can be cured with treatment. Almost all the patients (89%) believe that DR TB is curable when patients adhere to treatment. Only less than 7% of patients do not know whether TB is curable or not. 69.7% of the respondents reported knowing the TB transmission mechanisms. 84% of the respondents strongly agree that people with TB should disclose their illness to others. However, a significant number (28.3%) indicated that people with TB are still being discriminated against. 17.5% (26 out of 148) of the respondents indicated that their relationship with friends had changed. 7.6% experienced the same changes in relationship with family. With regard to how their relationship with friends changed, (5.7%) of the respondents indicated that they were not talking anymore, (6.4%) not sitting together,

(1.2%) not eating together and (2.5%) not sharing utensils.

History of smoking and excessive alcohol intake was reported by 77 out of 150 respondents (51%) for smoking and 42% (64 out of 151) for alcohol. 36.4% (54 of 148) of patients had previously defaulted TB treatment. In the survey questionnaire, the respondents gave multiple reasons for quitting their treatment. Of those reported, (21%) indicated that the length of TB treatment was the reason for defaulting. 19% of the respondents indicated excessive alcohol and cigarette use, followed by 14% who blamed poor socio-economic conditions, inadequate knowledge (12%), drugs' side effect (7%), and lack of transport to facility (6.4%), stigma (5.7%) and other diseases (5.1%). Table 2 presents the information obtained from DR TB respondents and used to assess patients' knowledge, attitude, and practices towards treatment adherence and cure rate.

Table 2. Patient's Knowledge, Attitude and Practice.

Variable	Response	No (%)
Knowledge about what TB is	n	151
	Yes	117 (77.4%)
	No	34 (22.6%)
Knowledge about how a person get infected with TB	n	156
	Infection	109 (69.8%)
	Sharing utensils	29 (18.5%)
	Sharing food	5 (3.2%)
Knowledge that TB can be cured	Do not know	29 (18.5%)
	n	149
	Yes	139 (89%)
	No	3 (2%)
Should people with TB illness tell their illness to other people	I don't know	7 (9%)
	n	152
	Yes	128 (84.2%)
Are people with TB being discriminated?	No	24 (15.3%)
	n	141
	Yes	40 (28.3%)
Did relationship with friends changed since you have got TB	No	101 (71.7%)
	n	148
	Yes	26 (17.5%)

Variable	Response	No (%)
How did relationships with friends changed	No	113 (76.3%)
	Not applicable	9 (6%)
	n	156
	Not talking	9 (5.7%)
	Not sitting together	10 (6.4%)
	Not eating together	2 (1.2%)
	Not sharing utensils	4 (2.5%)
	Other	7 (4.4%)
Did relationship with family changed since you have got TB	n	156
	Yes	12 (7.6%)
	No	135 (86.5%)
	Not applicable	2 (1.2%)
Have you smoked cigarettes since you were TB patient	n	150
	Yes	77 (51.3%)
	No	73 (48.7%)
Have you had alcoholic drinks since you were TB patient	n	151
	Yes	64 (42.3%)
	No	87 (57.6%)
Defaulted on TB treatment	n	148
	Yes	54 (36.4%)
	No	94 (63.6%)
Reasons for nonadherence	n	156
	Length of TB treatment	33 (21%)
	Alcohol and cigarette use	30 (19%)
	Low level of income	22 (14%)
	Poor living conditions	20 (12.8%)
	Inadequate knowledge	19 (12%)
	Medicine side effect	11 (7%)
	Lack of transport to facility	10 (6.4%)
Stigma	9 (5.7%)	
Other diseases	(5.1%)	

Patients' satisfaction on healthcare provider services

Most of the interviewed patients (91%) were satisfied about the health care services provided to them. Almost all the respondents (92.6%) positively rated the staff attitude and only 7.3% felt that the support they received was inadequate. The majority of the respondents, 81% (104 of 127) indicated that the waiting time for admission in the facility was less

than they expected, 90% (127 of 140) received enough information and 94.6% (141 of 149) were satisfied with the availability of treatment (drugs). About 14.7% (22 of 149) of the respondents indicated that the doctors provided them with less information than that they wanted to know about their disease. 58.5% (89 of 152) of the respondents reported that they were not visited by a social worker.

Table 3. Patient satisfaction on service providers.

Variable	Response	Respondents	Previously defaulted	New case
Service provided	n	151		
	Satisfied	138	46 (34%)	88 (66%)
	Not satisfied	13	8 (61%)	5 (39%)
Healthcare provider supportiveness	n	150		
	Supportive	139	45 (34%)	89 (66%)
	Not supportive	11	7 (63%)	4 (37%)
Satisfaction with staff attitude	n	149		
	Satisfied	138	46 (35%)	87 (65%)
	Not satisfied	11	5 (46%)	6 (34%)
Availability of treatment (drugs)	n	141		
	Satisfied	141	49 (36%)	87 (63%)
	Not satisfied	8	3 (37%)	5 (62%)
Waiting time to be admitted to the facility	n	127		
	Satisfied	104	43 (42%)	57 (58%)
	Not satisfied	13	7 (54%)	6 (46%)
Received enough information	n	149		
	Yes	127	48 (40%)	74 (60%)
	No	22	5 (23%)	17 (77%)
Supported by social worker	n	152		
	Yes	63	19 (31%)	41 (69%)
	No	89	35 (40%)	60%

3.2. Binary Logistic Regression Analysis

The logistic regression analysis shows that respondents' residence (OR=0.13; PV=0.002); client happiness to take medicine (OR=0.29; PV=0.021); alcohol consumption (OR=0.15; PV=0.036); missed treatment practices (OR=0.59;

PV=0.000); and TB disease information (OR=0.26; PV=0.009) are significantly contributed to default of treatment at 5% level of significance, and 95% of confidence intervals. The estimates obtained from binary logistic regression analysis are presented in table 4.

Table 4. Estimates obtained from binary logistic regression analysis.

Dependent Variable: Status of default (1, 0)			
Variables	Odds Ratio	P-value	95% Confidence interval
Gender	0.10	0.884	0.147 - 0.126
Marital status	0.029	0.222	-0.018 - 0.077
Race group	0.001	0.969	-0.075 - 0.072
Level of income	0.009	0.997	-0.062 - 0.062
Residence area	0.134	0.002	0.051 - 0.216
Happiness	0.291	0.021	-0.538 - 0.045
cigarette	0.062	0.391	-0.205 - 0.081
alcohol	0.150	0.036	0.010 - 0.290
Delay	0.074	0.347	-0.230 - 0.081
Electricity	0.004	0.959	-0.162 - 0.170
Missed treatment	0.595	0.000	0.468 - 0.722
Education	0.030	0.497	-0.057 - 0.117
Information	0.262	0.009	0.067 - 0.456
public	0.195	0.303	-0.179 - 0.571
Number of observations	127		
R-Square	0.5677		
Prob > chi2	0.0000		

3.3. Focus Group Discussions

In addition to the survey's questionnaires, a focus group discussion (with small groups of patients and health service providers) were conducted to know how patient feel about DR TB and factors contributing to its emergence and the supply side bottlenecks. Regarding knowledge about TB transmission and consequences of defaulting, there is appropriate information. According to the patient respondents "TB transmits though infection but could be cured. If you are drinking alcohol, smoking cigarettes and discontinued treatment you will be at high risk for defaulting.

To the question why TB patients default, the majority of respondents mentioned the need to have adequate meals to be strong to take TB treatments. "If you don't take balanced diet, you will not be strong. Lack of adequate food, is one of the contributing factors for defaulting. The doctor insisted that we finish the pills but sometimes taking the pills on an empty stomach leaves you feeling worse than before the treatment, particularly the yellow drug."

Some others stated "If you are a DR TB patient, you need to be strong, because DR TB requires strong commitment for cure. But if you fail, there will be no chance for life." One participant raised his concern regarding the curability of TB co-infection with HIV. He said "If you take drugs for TB and HIV your body can not tolerate it. It is too much. That is why many patients who are TB/HIV co-infected can't commit for longer to the treatment."

For the question "Should a TB patient inform his/her illness to a friend or family member?" or should they keep it as a secret?" The majority of respondents expressed positive attitude towards stigma questions. They mentioned that "You

have to disclose your status to family and friends because disclosing the status will help us get the necessary support. However, some others mentioned "In some communities there is still stigma attached to tuberculosis." One respondent indicated that "after I disclosed my disease status some of my friends didn't want to talk to me as much as before, and they do not want to sit or eat with me.

With regards to the cost of treatment, almost all of the patients mentioned that the treatment they get at public health facilities are free of charge. In addition, they also mentioned that the social grant and nutritional support is very helpful. One of the respondents indicated that "I don't work. I don't have resources to pay for my illness. The support that we are getting from SASSA is helping us to live although it is inadequate.

The majority of DR TB patients in the focus group discussion were happy about the way health professionals received and treated them at the facility. According to one respondent "The doctors and nurses are very good to us, although they get angry sometimes. They told me what drugs to take, at what time and I have always had access to them any time if I have any problem." They also explained to me about my type of disease, the drugs and potential side effects."

4. Discussion

Findings from this study indicated that the number of new DR TB cases reported in the province has increased in recent years. Out of the 156 DR TB patients who were research respondents, a little more than one-third (36%) were previous treatment defaulters, while the majority (64%) were newly infected. TB treatment completion and cure rates provide

evidence of treatment success, which in turn is largely dependent on the effectiveness of TB control programme to provide quality health services based on socioeconomic status of patients, individual health seeking behaviours and societal factors. On the other hand, a low cure rate suggests that infectious patients may not be receiving adequate treatment and/or not taking medicine as prescribed. Whatever the reason, in resources limited settings, as the costs of treatment for DR TB patients is significantly large [15, 17, 20] addressing the risk factors to adherence to TB treatment and barrier factors [17, 15, 19] is critical.

Previous studies, elsewhere indicated numerous factors that affect adherence to TB treatment. Health systems issues such as availability of effective and coordinated health services, the pill burden, side effects and the lengthy duration of treatment [1, 24, 25] have been highlighted. Accordingly, to mitigate the challenge, incentives such as free treatment [3, 26] and support to TB patients were mentioned as important factors to achieve cure [24, 27]. The action of individual patients such as failing to keep a pre-arranged appointment, and compliance with TB treatment prescriptions [28] have been also documented. Generally, there is a consensus in the literature on the need to design innovative strategies that encourage a positive move towards completion of treatment as prescribed. Our study results showed that despite the Government policy of free TB services in all public health facilities, out of the 151 research respondents 36% of them were previously defaulters [13]. This is a big public health concern because these patients may infect other people who have never been on TB treatment before and transmit the resistant strain of mycobacterium tuberculosis.

In this study 91.3% of DR TB patients were satisfied with the services they received at Public Health facilities and staff attitude as well. However, some of the respondents described how a shortage of food affects their treatment adherence, and requested for a long term support even after treatment completion. The fact that close to 90% of the respondents total amount of monthly income was less than R3,000 (Three thousand per month), and more than three-fourth of the respondents are living in rural and semi-urban areas, shows that TB disease put more burden on the socioeconomically disadvantaged population groups. Fast socioeconomic growth which trickledown the economic benefits to inclusive is critical to tackle health inequalities. This suggests that there is a need to integrate other sectors outside the health systems in tackling the TB burden and improve adherence rates [13, 27].

Almost all research respondents reported that the treatment observer, the tracer team and ward based outreach team (WBOT) members were very helpful to keep them motivated and remind them to keep pre-arranged appointments. Similarly, community support was mentioned as positive and motivated them to be on treatment. However, few patients mentioned the fear of stigma, and they prefer not to wear protective mask in the community, even while waiting on the queue at clinics. Studies suggest that stigmatization causes

underutilization of services, delay in seeking diagnosis, and poor treatment adherence [27]. While education of communities about TB is important, this raises important question: would it be possible for health facilities to arrange flexible and favourable working hours for TB patients? Studies indicate that unhappiness with health services as one of the causes of treatment default [28]. In our study, the odds ratio of having a patient who is unhappy with TB services was estimated at 0.29, which is high and leads to the risk of defaulting compared to the happy patient.

Non-adherence to treatment often results from inadequate knowledge about the disease and its treatment [27]. Close contact is another well described risk factor for TB transmission [19, 29]. According to the literature, if patients do not have adequate knowledge, the situation leads to them defaulting treatment and they can infect others with new infection [30]. Our study results showed that close to two-third DR TB patients were newly infected. The logistic regression analysis results showed that patients who didn't have adequate knowledge regarding their disease type and treatment had a 0.26 times higher probability risk of non-adherence.

Regarding individual patient risk behaviour, the odds ratio of having alcohol abuse and non-adherence to treatment was investigated among patients in this study. It shows that the odds of those patients using alcohol while treatment to default is 0.15 times higher than those who did not drink alcohol during treatment. Our result is in agreement with previous studies that documented the influence of alcohol on TB treatment adherence, where most TB patients who took alcohol while on treatment failed to complete it [27, 29, 31]. During the focus group discussions some the respondents indicated that they smoked cigarette and drunk alcohol while they were previously on treatment.

Studies indicate HIV infection remains the leading risk factor for developing TB, while the latter is also the foremost cause of death among people living with HIV [2]. Furthermore, TB and HIV co-infections place an immense burden on the delivery of health care services and pose particular diagnostic and therapeutic challenges [32, 33, 34]. Although South Africa has made progress in implementing collaborative TB-HIV activities, there is need for strengthening the collaboration more in order to mitigate the dual burden of TB and HIV. In this study, close to half of the DR TB patients were co-infected.

The estimated average cost for treating a single DR TB patient in a Northern Cape public health facility is about R 189, 898.00 (One hundred eighty-nine thousand eight hundred ninety-eight Rand). The cost includes different aspects of healthcare services such as: tests (laboratory testing and X-ray), costs for second line treatment injections (6 months) and drugs (18 months), hospitalisation, labour costs related to inpatient care by doctors/nurses for 18-24-month regimen; costs for support services such as nutritional care and hospital bed utilization, and managing DR TB inpatients with other medical conditions. PHC programme effectiveness to provide care and support for the patient at

home and promote a healthy lifestyle is critically important for its success.

Figure 1 shows factors that are important to influence treatment adherence among TB patients and reduce its burden on health system. Programme identification and treatment of DR TB cases, availability of patient friendly services, health systems improvement, better collaboration

with stakeholders and other government sectors, proper monitoring of the activities and patients' positive health seeking behaviour are critical to making progress in tackling the TB/HIV burden and improving treatment adherence among patients. This is critical in reducing the amount of resources that will be needed for DR TB treatment and avail more resources for other health services.

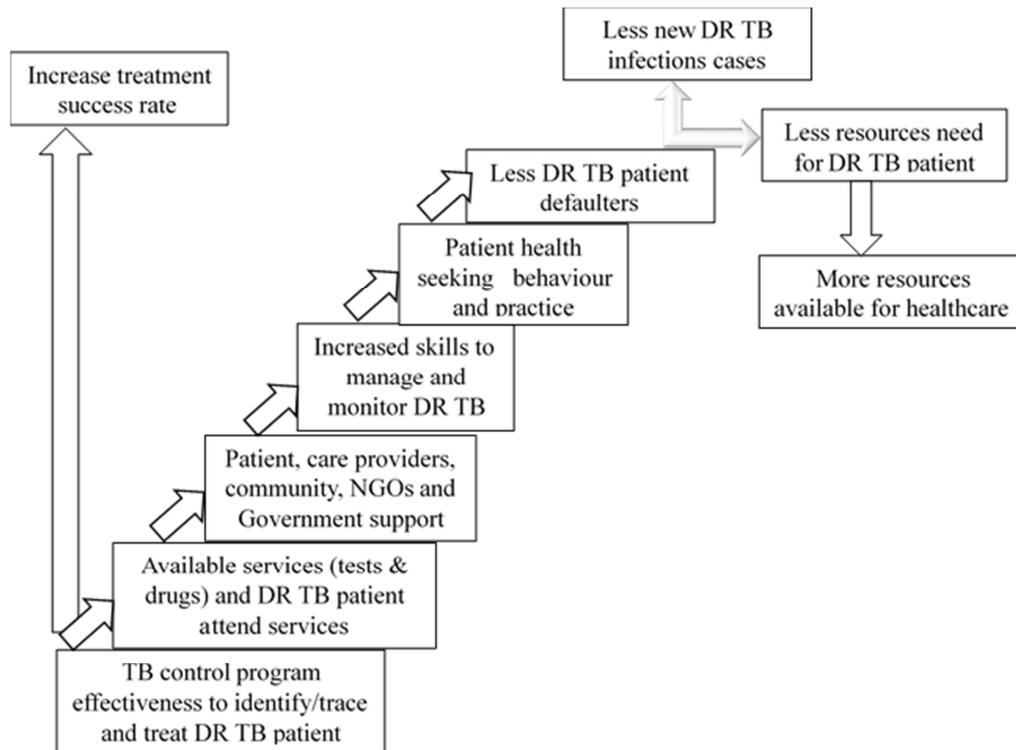


Figure 1. Factors that influence DR TB treatment success rate.

Limitation of the study

Facility based patients' data were not verified or cross-checked. We assume that some data quality problem exists. The data may not represent the accurate figures. There were some cases where patients were treated in a facility but without the recorded outcome. It would have been best to check the start date and the reported one per patient to confirm the outcome of treatment. In addition, these facilities may under or over report, which might have a bearing on the number of defaulters or mortality rates.

5. Conclusion and Recommendations

5.1. Conclusion

Findings from this study indicate that defaulting from TB treatment is on the rise and contributed to the emergence of DR TB (36%) but the majority of cases were due to primary transmission of resistant strains of Mycobacterium Tuberculosis (64%) and it's a big concern in the Province. Furthermore, there were high TB/HIV co-infections and the associated mortality was significant. In order to win this battle, adherence to TB treatment is crucial. Nationally, the recent development of the real-time, online TB Surveillance

Dashboard provides a quick and easy way to visualise and track trends in TB incidence and identify geographic hotspots. This is important to support the new National HIV, TB and STI Strategic Plan (2017-2021) which emphasises the need for a data driven and targeted approach to end TB. However, addressing the socio-economic conditions (poor living and working conditions, unemployment, low-level of income and education); promoting individual positive healthy lifestyle and behaviour through closing knowledge gaps; creating vibrant health systems; and social support is equally important to positively support adherence to treatment. Furthermore, patients complain about the pill burden (number of drugs/pills) and the lengthy duration of treatment which must logically get adequate attention from clinical researchers. Since the cost of DR TB treatment is significantly high (R189,000) per patient and given the limited resources, TB control programme needs to be more effective and efficient.

5.2. Recommendations

- (1) Promoting primary health care education and counselling for improving healthy life seeking behaviour. Basic health education to patients, family and community about DR TB, its symptoms and the

medications being prescribed to treat the disease may support good adherence, while reducing the possibility of new infection, stigma and discrimination. A disease that can be prevented, managed or cured causes significant suffering due to lack of basic knowledge.

- (2) Tackling the root determinants of the disease and ill-health: Poverty is a powerful determinant of tuberculosis and there is a need to reduce food insecurity. Reducing the crowded and poorly ventilated living conditions and poor working environments through interdepartmental collaboration.
- (3) Strengthening of the ongoing collaborative initiatives between TB and HIV programmes. Studies indicate that HIV is a risk factor for developing tuberculosis. People living with HIV are more likely to develop TB; and patients suffering from TB are more likely to be people living with HIV. This suggests that TB control will not make much headway unless there is more synergy between TB and HIV programmes' collaborative efforts.
- (4) Addressing health facility level constraints and creating patient friendly environment. This is important to help motivate patients to stay in the facility and continue taking their treatment.
- (5) Promote programme cost-effectiveness. Because most of the DR TB cases happen when medications are discontinued or taken irregularly, it is therefore critical for the TB control programme to design innovative strategies to help TB patients adhere to their treatment. Sticking to treatment consequently improves adherence, success rates and programme effectiveness.
- (6) Closer monitoring of the data quality through verification at facility level of patient files (it would help to prevent data problems; incorrect and/or inconsistent).

Authors' Contribution

EBW conceived the idea, designed the study, analysed the data. MJN critically reviewed the paper for important intellectual contents. Both authors have read and approved the final manuscript.

Competing Interests

The authors have declared that no competing interests exist.

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