Predictors of tuberculosis treatment defaulting in informal dwellers within the eThekwini Municipality, KwaZulu-Natal

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Globally, tuberculosis causes more than 2-million deaths annually. Despite the implementation of the directly observed treatment strategy (DOTS) in South Africa, cure and defaulter rates have not reached World Health Organization (WHO) target rates. This causes concern as it may increase the risks of the development of multiple drug-resistant tuberculosis. Prior to commencement of this study, the eThekwini Municipality reported a defaulter rate of 18.9% in 2007 and 29% in 2009, which is higher than the WHO guideline of 5%. In 2011, eThekwini reported a defaulter rate of 24.3%. Given these statistics and the impact that these high rates may have on susceptible populations and an already overburdened health system, this study aimed to investigate predictors of defaulting in informal dwellers of eThekwini Municipality, KwaZulu-Natal. The study population comprised 102 defaulters and 102 non-defaulters from informal settlements within eThekwini. It was a cross-sectional descriptive study. The Prince Cyril Zulu Communicable Disease Centre electronic tuberculosis register was used to trace defaulters who were interviewed from informal settlements. Demographic data for non-defaulters were matched from the Prince Cyril Zulu Communicable Disease Centre electronic tuberculosis register, but were not physically traced. A questionnaire was administered to all defaulters and retrospective data were obtained from the Prince Cyril Zulu Communicable Disease Centre register for non-defaulters. Multivariate logistic analysis found smoking, alcohol use and having a family member with tuberculosis to be statistically significant predictors of defaulting. Smoking [odds ratio (OR): 2.79, 95% confidence interval (CI): 1.15, 6.77, p-value ≤ 0.005], alcohol consumption (OR: 7.04, 95% CI: 2.96, 16.71, p-value ≤ 0.005), and having a family history of tuberculosis (OR: 4.60, 95% CI: 2.34, 9.04, p-value = 0.01), were all significantly associated with defaulting in informal dwellers. Smoking, alcohol use and having a family member with tuberculosis were predictors that informal dwellers would default from their treatment. These factors should be included in tuberculosis management programmes.

Introduction

Globally, tuberculosis causes more than 2-million deaths annually.[1] Disease susceptibility increases in conditions of poverty as the poor and vulnerable are at greater risk of contracting this disease than the normal population. Numerous studies have identified various predictors of defaulting, including, but not limited to, the side-effects to medication, having to travel a long distance to the clinic,[2] substance abuse,[3] poverty,[4] unemployment[5] and stigma attached to the disease.[6] Despite the directly observed treatment strategy (DOTS) that has been implemented internationally, nationally and locally to control tuberculosis,[7-9] cure rates have still not reached the World Health Organization (WHO) target of 85% and the defaulting rate guideline of 5%. High defaulter rates are responsible for significant treatment failure, drug resistance and eventual death.[10] Defaulting on tuberculosis treatment poses an increased risk of the development of multiple drug-resistant tuberculosis. There is no doubt that patients often take their tuberculosis medication under very difficult conditions and that several mitigating factors influence adherence thereto.[3] Several studies have been conducted to explore socio-economic and demographic factors, such as age, gender, social status, smoking status, alcohol consumption, income and education, and their relationship with treatment outcome.[3,11,12] However, it must be acknowledged that these studies include different populations and varied study designs. The eThekwini Municipality has reported an incidence of 843 cases per 100 000 people. Defaulting rates of 26%, 19% and 24.3% have been reported for 2006, 2007 and 2011, respectively.[13,14] Informal settlements are very common in KwaZulu-Natal and present a number of health-related challenges. People living with tuberculosis in these settlements may face greater challenges regarding treatment

adherence. Therefore, the aim of this study was to determine predictors of defaulting in informal dwellers in eThekwini for the period January 2007 to June 2009.

Method

Setting, study population and study tools

Study areas included Inanda, Ntuzuma and KwaMashu, situated 30 km north of the city centre in the north of eThekwini. Study areas in the south included Cato Manor, Clairwood and Wentworth.

Defaulters and non-defaulters from the six informal areas within the eThekwini jurisdiction were purposively selected from the Prince Cyril Zulu Communicable Disease Centre electronic tuberculosis register for the period January 2007 to June 2009. The Prince Cyril Zulu Communicable Disease Centre is the only facility that utilises the electronic tuberculosis register which includes the socio-economic and demographic information of patients with tuberculosis.

Population and sample

A purposive sampling strategy was used as some of the facilities and clinics did not have access to an electronic tuberculosis register and some defaulters could not be traced, or were not from informal settlements. The non-defaulters were untraceable because of financial and accessibility issues. The study sample included 102 cases of defaulters and 102 controls, e.g. patients who had completed treatment. Patients with tuberculosis who appeared in the electronic tuberculosis register of the Prince Cyril Zulu Communicable Disease Centre from January 2007 to June 2009 (defaulters and non-defaulters) were included in the sample population. Patients who defaulted on treatment, defined as patients who missed a dose of treatment, and those who could be traced via an electronic tuberculosis register, were selected for inclusion in the study. Participants lived in informal dwellings, with either no piped water or electricity, or an absence of both commodities (defaulters and non-defaulters). Non-defaulters were patients who completed their treatment and also lived in informal dwellings. Limited data were available from the Prince Cyril Zulu Communicable Disease Centre Electronic tuberculosis register, but it was possible to perform a comparison of demographic factors, such as age, gender and place of residence. Alcohol, smoking status, a previous tuberculosis history and a family history for defaulters and non-defaulters were also identified. Non-defaulters were matched for the same treatment period, residential status and demographic profiles as that of defaulters.

Collection of data

Administered questionnaires to defaulters were available in English and *isiZulu*. To ensure overall validity and reliability, the questionnaire was pretested and appropriately piloted.

Ethics

The study protocol, including a request for access to confidential tracing forms, and use of the electronic tuberculosis defaulter register, were reviewed and approved by the Faculty of Health Sciences Research Committee at the Durban University of Technology and the eThekwini Municipality: Health Unit. Informed consent in the language of choice was made accessible to participants. Participation was voluntary, with no financial incentives, and withdrawal from the study was possible on request at any point during the study. Collected data were treated as strictly confidential.

Data analysis strategies

Statistical analysis was conducted using Stata® version 11. A p-value of < 0.05 was considered to be statistically significant and 95% confidence intervals (CIs) were calculated. Data pertaining to respondents' demographics, medical history, occupation and living conditions, as well as other data, were captured using Microsoft® Excel® 2003. Descriptive and frequency analysis was followed by bivariate analysis. Multivariate models were carried out with adjustment for age and gender.

Results

The total number of recorded defaulters in the Prince Cyril Zulu Communicable Disease Centre tuberculosis register was 187 for 2007-2009. However, 38 defaulters who were listed in the register were untraceable, four had relocated and 25 deceased. The final sample consisted of 102 defaulters, including 91 African and eight coloured patients, while race was not specified for three defaulters. The mean age of defaulters was 40 years (standard deviation 9.85). Thirty-eight per cent had completed high school (Table I).

Of the 66 respondents, 33 (50%) were unemployed, 3 (5%) self-employed, and 30 (45%) had casual jobs, including employment as domestic helpers. Of the 67 respondents, 37 (55%) earned between R100 and R200 per week, and 30 (45%) between R200 and R600 per week. Of the respondents, 77 (76%) had a family member who was employed. Sixty-two defaulters (63%) received a social grant. The majority of participants (31, 74%) used the grant to pay school fees, while 36 (61%) used it primarily to buy food. Only 10 (15%) of all interviewed defaulters indicated that they were able to survive without the grant.

Of the 98 respondents, 48 (49%) were often stressed, 33 (34%) were stressed sometimes, 14 (14%) stressed very little and 3 (3%) had never been stressed. The history of contact with family members with tuberculosis and the defaulters' health characteristics are presented in Table II. Forty-four (47%) indicated that money was their biggest concern, followed by food (39, 41%), and family life (28, 30%). Forty-five (66%) of employed defaulters admitted that their employers were unaware of their tuberculosis

Table I: Socio-economic, physiological and demographic characteristics of defaulters

Characteristics, n= 102	n (%)
Gender (n = 102)	
Male	70 (67)
Female	32 (33)
Race (n = 99)	
Black	91 (92)
Coloured	8 (8)
Occupation	
Unemployed	33 (50)
Self-employed	3 (5)
Other (casual jobs)	30 (45)
Residential area	
Inanda	5 (5)
Ntuzuma	13 (13)
KwaMashu	28 (27)
Clairwood	28 (27)
Cato Manor	14 (14)
Wentworth	14 (14)
Income per week (n = 67)	
R100-R200	37 (55)
R200-R600	30 (45)
Family member working (n = 101)	**77 (76)**
Previous defaulter (n = 100)	**35 (35)**
Stress or worried (n = 98)	
Often	48 (49)
Sometimes	33 (34)
Very little	14 (14)
Never	3 (3)
What worries you the most?	
Money	44 (47)
Food	39 (41)
Family life	28 (30)
Employees aware of	
Tuberculosis status (n = 68)	45 (66)
Time off to get to the clinic (n = 83)	**38 (46)**
Smoking (n = 96)	
1 cigarette/day	34 (35)
2-3 cigarettes/day	46 (48)
More than 3 cigarettes/day	16 (17)
Grants (n = 98)	**62 (63)**
Grants used to	
Buy food (n = 59)	36 (61)
Pay school fees (n = 42)	31 (74)
Survive without grant (n = 67)	10 (15)

Table II: The health characteristics of defaulters

Characteristics	n (%)
History of contact with person with tuberculosis (n = 101)	
A week (n = 101)	16 (16)
A month (n = 101)	17 (17)
3 months (n = 101)	14 (14)
6 months (n = 101)	26 (26)
A year (n = 101)	19 (19)
More than a year	47 (36)
Persons over 60 years living with defaulter (n = 99)	**38 (38)**
Family members with tuberculosis presently (n = 56)	
Husband or wife (n = 44)	7 (16)
Boyfriend or girlfriend (n = 44)	20 (45)
Brother (n = 44)	18 (41)
Sister (n = 44)	16 (36)
Child (n = 44)	14 (32)
Tuberculosis in the last two years (n = 47)	**11 (23)**
Medical condition (n = 73)	**72 (98)**
Diabetes (n = 68)	39 (57)
High blood pressure (n = 67)	28 (42)
HIV/AIDS (n = 67)	14 (21)
Asthma (n = 67)	28 (42)
Children who received a tuberculosis injection (n = 96)	**77 (80)**
Medication (besides tuberculosis medication) (n = 100)	**54 (54)**
Regular tuberculosis treatment (n = 96)	**40 (42)**

HIV/AIDS: human immunodeficiency virus/acquired immune deficiency syndrome

status. However, 38 defaulters (46%) received time off from work to go to the clinic.

Defaulters confirmed that the majority of the nurses were helpful (75%), and agreed that the clinic staff explained the treatment regimen to them. At times, initially the nurses were angry because the patient was in a bad condition prior to diagnosis or commencement of treatment, but after consideration, they were very helpful and explained the disease to the patients. There was concern that "doctors did not meet the expectations of the patients and treated them disrespectfully, compared to the nurses who were helpful and respectful". The majority of the respondents (72, 76%) were aware that tuberculosis is a disease caused by a bacterium that can be cured if it is detected early and treated. However, approximately 22% of respondents believed that tuberculosis was similar to flu and that the disease was not contagious. When questioned about their experiences taking tuberculosis medication, 22 (23%) reported feeling more ill and having side-effects, 16 (16%) believed that they would get better faster by taking the medication, and 60 (62%) knew that it was possible to die if the tuberculosis medication was not taken properly (Table III). More than half of all defaulters visited a traditional healer at some point during their diseased state with the expectation of being cured.

Multivariate analysis (Table IV) revealed that there was a significant association between defaulters who smoked, consumed alcohol and had a family history of tuberculosis and defaulting from treatment. Multivariate logistic models showed that smoking (OR: 2.79, 95% CI: 1.15, 6.77, p-value ≤ 0.005), alcohol consumption (OR: 7.04, 95% CI: 2.96, 16.71, p-value ≤ 0.005), and having a family history of tuberculosis (OR: 4.60, 95% CI: 2.34, 9.04, p-value = 0.01), were all significantly associated with defaulting from treatment.

Table III: Reported side-effects of tuberculosis medication in defaulters

Characteristics, n = 102	n (%)
Side-effects (n = 92)	
Vomiting	40 (42)
Nausea	56 (58)
Diarrhoea	21 (22)
Pain	11 (12)
Itchy skin	29 (32)
Status quo when taking medication? (n = 88)	
Healthy	17 (19)
Relaxed	31 (35)
Sick	41 (47)
Symptoms that caused the most discomfort (n = 96)	
Vomiting	11 (11)
Nausea	38 (40)
Pain	47 (49)
Ate before taking medication (n = 83)	**49 (59)**
Presence of a DOTS supporter (n = 99)	**77 (78)**
Family member (n = 74)	46 (62)
Community member (n = 70)	12 (17)
DOTS supporter from the clinic (n = 70)	16 (23)
Clinic nurse (n = 70)	9 (13)

DOTS: directly observed treatment strategy

Discussion

In our study, it was found that smoking, alcohol use and having a family member with tuberculosis were significant predictors of defaulting in informal dwellers. Defaulting on treatment is one of the most important challenges facing any tuberculosis control programme. It is important to investigate the risks of defaulting, particularly in a susceptible population, such as informal dwellers. Reports indicate that eThekwini had defaulter rates of 24.3% in 2011, which was significantly above the WHO target of 5%, despite the implementation of DOTS.[14] Many defaulters provided incorrect addresses which made tracing impossible. A possible reason for incorrect addresses may have been mistrust and even defiance towards the health team on first contact. In this study, smoking (OR: 2.79, 95% CI: 1.15, 6.77, p-value ≤ 0.005), alcohol consumption (OR: 7.04,

95% CI: 2.96, 16.71, p-value ≤ 0.005), and having a family history of tuberculosis (OR: 4.60, 95% CI: 2.34, 9.04, p-value = 0.01), were identified as significant predictors of defaulting (Table IV).

Most defaulters had contact with a person with tuberculosis in the previous six months. A family history of tuberculosis was significantly associated with defaulting (p-value ≤ 0.005). Patients who live in overcrowded informal dwellings with very poor ventilation are at increased risk of spreading infection. With respect to environmental exposure, a high percentage of defaulters (47, 48%) used wood for cooking, which has been associated with adverse respiratory illnesses[15] and has been known to exacerbate tuberculosis.[16] A serious consequence of defaulting from treatment is that defaulters are more likely to contract multiple drug-resistant tuberculosis and extensively drug-resistant tuberculosis.[17,18] According to the South African National Tuberculosis Control Programme,[19] it was reported that there are 6 000 new cases of multiple drug-resistant tuberculosis in South Africa each year. Treatment is more than 25 times the cost of conventional tuberculosis treatment.

Gender was not a significant risk factor for defaulting (p-value 0.52). Since 89% of all reported defaulters were African, it would imply that race was a predictor for defaulting. This may be because of poor socio-economic conditions and limited access to health care in this population. Other studies have not shown any significant association between age, ethnicity and defaulting.[20] While it was evident that the age group 20-30 years had a greater risk of defaulting in this study, a significant association with age was not found. Stress over finance and lack of food was common in defaulters. The high unemployment rate contributed to this stress and may be linked to patients' noncompliance with medication. Very low incomes were reported. Fifty-five per cent and 45% of defaulters received monthly incomes of R100-R200 per week and R200-R300 per week respectively.

In 1943, Maslow suggested that people will satisfy the need for food and shelter before that for health care, so it is unsurprising that adherence to treatment was given a lower priority than basic survival needs by this group of

Table IV: Predictors of defaulting in informal dwellers (n = 102)

Variable	Defaulters (n/N)	Non-defaulters (n/N)	OR	95% CI	p-value
Gender					
Male	70/102	65/102	0.84	(0.38,1.88)	0.68
Female	32/102	36/102			
Tuberculosis in the family	45/101	15/101	2.96	(1.29, 6.81)	0.01*
Alcohol consumption	78/99	20/102	7.04	(2.96, 16.71)	< 0.005*
Smoking	72/102	19/102	2.79	(1.15, 6.77)	< 0.005*

CI: confidence interval, OR: odds ratio

*: p value ≤ 0.05 was considered to be statistically significant
Logistic regression models adjusted for gender and race

participants.[21] This finding is similar to that reported in the study carried out in Ghana,[22] which indicated that low monthly income was significantly associated with defaulting (p-value 0.03).

Approximately 46% of employed defaulters had informed their employers of their tuberculosis status in order to be granted time off work to collect their medication, while others were reluctant to divulge their status to their employers for fear of losing their jobs. This insecurity, coupled with the associated stigma of having tuberculosis, has been previously reported in other studies.[23-26] Some participants could not afford the transport cost to visit the clinic. Others indicated that family members, friends, neighbours and even employers assisted them with costs.

Malnutrition and lowered immunity are known risk factors for tuberculosis[27] and may be assumed to influence treatment adherence. Most defaulters took their treatment after consuming food. They were aware that this was necessary to minimise the side-effects of the medication and that good nutrition increased immunity. The diet of defaulters comprised biscuits, sweets and cakes. These items are cheaper to buy than staple items and have little nutritional value. Additionally, in this study, tolerance to taking tuberculosis medication may have been problematic, particularly for defaulters who were already on chronic medication for diseases such as diabetes, high blood pressure and asthma. The presence of a DOTS supporter is considered to be pivotal in ensuring that defaulters adhere to their treatment regimen. In this study, 77 of the 102 defaulters were observed, and yet still defaulted. However, 74 defaulters were mostly supervised by a family member, and at some point in their treatment, were supported by community members, a supporter from the clinic and/or a nurse. This leads to questions about the effectiveness of different DOTS supporters, and whether or not it is productive to have so many diverse supporters observing the same patient throughout his or her treatment. It may be preferable to allocate this responsibility to one observer throughout the patient's treatment.

Defaulters indicated that nurses were more helpful than doctors, who were disrespectful towards patients. However, health personnel reported that a major challenge was that all health facilities were short-staffed. This caused a poor rapport with defaulters. Some side-effects (Table III), a known predictor of defaulting,[28] emerged strongly in this study, and included vomiting, nausea, feeling more sick than usual, diarrhoea, pain and itchy skin.[2] Approximately 47% of defaulters reported "feeling sick" after taking their medication. This clearly demonstrates a lack of knowledge on defaulters' part, which implies that the health education was ineffective. Previous work has shown that a lack of information or insufficient health education strongly predicted defaulting.[29,30] Defaulters should be have been made aware that during the intensive phase they might experience such symptoms, and should have been encouraged to adhere to the treatment regimen, in spite of the adverse effects.[31]

In this study, factors relating to the provision of healthcare services emerged strongly. Patients had to obtain time off from work to access DOT at a healthcare facility. Most defaulters used public transport and the long distances to the clinics, as well as affordability of treatment, were challenging. Many defaulters were breadwinners, with the responsibility of providing for the family, and chose not to take time off from work to prioritise treatment. More than 50% of defaulters waited for an hour at the health facility. For a clinic such as the Prince Cyril Zulu Communicable Disease Centre, which services a high number of patients daily, this waiting period was adequate. Defaulters may have consulted with traditional healers before going to the clinic. However, it was uncertain as to whether or not this occurred before or after diagnosis. In this study, 59 defaulters sought treatment from traditional healers. Hence, traditional healers should be involved in tuberculosis management. In a study conducted in Hlabisa, in northern KwaZulu-Natal, it was found that defaulters who were supervised by traditional healers were content with the care received. However, treatment completion was not significantly higher in defaulters who were supervised by traditional healers than it was in those supervised by DOTS supporters.[32]

A limitation of this study was the uncertainty with respect to smoking information and human immunodeficiency virus (HIV) status. Although only 31% of defaulters indicated that they smoked, only 67% answered questions as to the number of cigarettes smoked daily. This implies a reluctance to divulge smoking habits. This may be attributed to the health education given at healthcare facilities on the impact of smoking on tuberculosis. The lack of data on HIV status was also a limitation, given the high HIV/tuberculosis co-infection rate in eThekwini.

Conclusion

Informal dwellers living with tuberculosis face many challenges with regard to daily survival, notwithstanding their adherence to tuberculosis treatment. In this study, it was found that smoking, alcohol consumption and having a family history of tuberculosis were significant predictors of defaulting in informal dwellers. It seems that the risk of defaulting was greatest when there was an interplay of social, economic, environmental and healthcare factors. Tuberculosis patients from informal areas are a susceptible population who need additional support to ensure adherence to treatment.

Declaration

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