The prevalence of factors contributing to non-adherence to TB treatment in Lukhanji LSA (Queenstown), South Africa

Kayembe CK, MBChB (UNIKIN)

Frontier Hospital, Eastern Cape

Division of Family Medicine and Primary Care, Stellenbosch University

Correspondence to: Dr Ck Kayembe, email: drckkayembe@gmail.com, P O Box 2118 Komani 5322

ABSTRACT:

Tuberculosis remains a problem in Lukhanji Local Service Area (LSA) where the number of patients notified to authorities is reportedly increasing. This study, undertaken at various clinics in Lukhanji LSA, shows that non-adherence to TB treatment remains a challenge. The aim of this study was to identify the main factors contributing to this situation and to make recommendations.

Methods: This was an unmatched case-control observational study using the data relating to patients undergoing treatment. The collection of data took place from December 2010 to June 2011. Two groups were studied: (i) those who did not adhere and (ii) those who did adhere to the prescribed treatment. The data from these two groups was compared. Prevalence of non-adherence was determined. In addition, the prevalence of factors studied were estimated and odds ratios were used to determine factors significantly associated with non-adherence.

Results: Data was obtained from 195 patients, 98(50.26%) of whom were non-adherent and 97(49.74%) adherent. The following factors were significantly associated with non-adherence to

TB treatment in this community: loss of hope; school or work commitments; patients' marital status; patients' under arrest; lack of support; involvement in drug abuse; TB denial and tablets not available from the clinics. For these factors, the odds ratios were more than one indicating that these factors are more likely to contribute to non-adherence in the non-adherent group

Conclusion: The prevalence of factors contributing to non-adherence to TB treatment in this community is high. This was despite the fact that there is no charge TB drug. There is an urgent need for health authorities in this community to take strong action to improve patients' adherence to TB treatment.

INTRODUCTION

Background:

The greatest problem facing tuberculosis control programmes all over the world is how to ensure that patients complete the prescribed course of treatment[1]. The world Health Organization (WHO) declared tuberculosis (TB) a global public health emergency in 1993 and since then has intensified its efforts to control the disease worldwide. The African region has the highest TB prevalence rate in the world (363/100 000 population) and, within the region, South Africa has the highest rate (998/100 000 population)[2]. Many studies have shown that adherence to the treatment prescribed for tuberculosis cannot be predicted or assumed[3].

From the researcher's clinical experience in Lukhanji LSA, information received from the TB programme, shows that non-adherence to TB treatment is common. However, factors responsible of this have not been yet identified for this community. Knowing the factors that contribute to poor adherence to TB treatment, and knowing their prevalence, will help health workers to offer interventions that might improve adherence and this would lead to higher cure rate of patients with TB. The high rate of default is a crucial factor that prevents the national TB programmes from reaching the desired 85% cure rate [4].

The term 'adherence' has been preferred to 'compliance' as the latter term has the connotation that the patient is docile and subservient to the provider [5.]

Some authors have defined 'default' as missing at least one month of treatment[6], while others use them to refer to treatment that has been interrupted for at least two months [1, 7,11,19,26].

A working definition for adherence in South Africa is linked to the number of drug doses taken as a proportion of the total number of doses prescribed: acceptable adherence applies where 75% or more of prescribed doses have been administered, as shown in patient treatment records (TB Control Programme,2000)[8]. Various methodologies have been used in different studies but the most important were case control [1 ,4, 6, 9, 10, 15, 19, 20, 26, 27, 29]; descriptive analyses [10]; randomised controlled trials[5, 11]. ;before- after design [12] ;explanatory studies [6, 13, 15, 16, 22,28, 30]. ; retrospective studies [4, 14, 18, 21, ,23]; prospective studies [15,30] ;qualitative studies [11,15] ; and observational design [2]. Data was collected by examining the clinical records of all the studies reviewed. Some studies provided interviews or questionnaires used with patients [4, 6,7,13].

Different statistical methods were used to transfer data from one study to another. The size of the sample often varied, ranging from 10 patients (the smallest sample) [13] to 4208 (the biggest sample) [17].

The following factors have been identified in different parts of the world as contributing to non-adherence to TB treatment:

(i) # Patient related factors (cultural beliefs regarding TB [9,18]; ethnicity [2,19]; marital status [7,20]; gender[2 ,9, 19, 20, 21, 22, 23, 29], age [2,9,19,20], alcohol [4, 14, 16, 19]; smoking [4, 9, 16, 19, 22] ; involvement in criminal justice system [2,4,21], school/work commitment[25] ; stigma [13, 25, 28], involvement in drug dealing [14,19] ; mental disorder[2,25]; history of TB [16,22] ; poor understanding [7, 9, 16, 18, 24, 26, 2,]; lack of education [4, 9, 13, 18, 22]; use of traditional healers [25]),

(ii) # Health care team/health system factors (poorly developed health services [2, 10, 11, 13, 17, 24, 27, 28] ; inadequate relationship health care workers and patients [2, 11, 18, 28]; untrained health care workers, overwork , unsupervised workers [2, 6, 12, 19]) ;

(iii) # factors related to the patient's subjective condition (loss of hope[27]; feeling better [1, 23, 27, 28], denial [27]; doctor's advice [27]; complex treatment regimen [2, 13, 24, 28]; side effects of medication and toxicity [2, 11, 19, 26, 28]);

(iv) # socio-economic factors (lack of social support[1, 13, 21, 24, 25, 28] ; distance to clinic [2, 11, 19, 26, 28]; poverty [1, 7, 18, 20 ,25, 28, 30]; living condition [20, 27]; unemployment [2, 4, 29]; migration [1, 9, 21, 25]; high cost

of medicine [2, 10, 17, 20]; high cost of transport.[4, 6, 11, 20, 22, 23, 26, 30])

The prevalence of these factors vary from one study to another, depending on the size of the sample and other variables. In one study, 38.6% on non-adherent patients were feeling better before interrupting treatment, while 11.4% did not have food.[27] In another study, 37% of non-adherent patients interrupted treatment due to lack of income (80% of patients were unemployed.[2]

Setting

This study was conducted in clinics in Lukhanji Local Service Area (Queenstown).

Queenstown is a medium sized town in the Eastern Cape Province, 177 km from East London (to the southeast) and almost 400 km from Bloemfontein (to the west).

The population served by the sub district is largely rural and is estimated to be 223 875. There are 33 fixed clinics, seven mobile clinics, two Community Health Centres, one privately owned hospital and two provincially aided hospitals.

TB control has been one of the priorities of the sub-district.

AIM AND OBJECTIVES

The aim of this study is to identify the factors contributing to non adherence of patients to TB treatment and to its prevalence in the LUKHANJI LSA (Queenstown) and to make appropriate recommendations for improved adherence to TB treatment in this community.

The following are the objectives of this study:

-To identify factors reported by patients as factors contributing to their non-adherence to TB treatment.

-To determine the prevalence of these factors among adherent and non-adherent patients.

- To determine risk factors which are significantly associated with non-adherence by comparing the Odds of reported factors among the non-adherent with those of patients' adherent on TB treatment.

METHODOLOGY:

Study design:

The study design was an unmatched case-control.

Target population:

The main focus here were patients on treatment for pulmonary TB (non-adherent to tuberculosis (TB) treatment in LUKHANJI LSA as well as those adherent so that comparisons could be done.)

Samples and Sampling methods:

A patient who missed seven doses in a month was considered to be non-adherent to the tuberculosis treatment[8].

-For non-adherent group: convenience sampling technique was applied here, where, all the patients who could be accessible and meeting the criteria were put on the list due to the lack of a known objective rate of non-adherence to TB treatment.

-For adherent group: patients were chosen randomly from the same clinics where non-adherent ones were found.

- The criteria used for inclusion were:

 # patient under treatment for TB;

patient recorded in the register;

 # patient receives drugs and directly observed therapy is applied;

 # the patient has a TB treatment card;

 # the patient has an identifiable address;

 # the patient is at the address at the time of study;

In the case of a minor: the parent must fulfil the above criteria;

the patient must be able to read at least isiXhosa

The criteria for exclusion were:

Patients who may have been regarded as compliant (by themselves or by staff at the clinic) but who had missed doses over weekends (because the clinic was closed) were excluded from non-adherent and adherent group.

It was difficult to accurately determine the sample size prior to the collection of data. It was due to the lack of objective and official rate of non-adherence to TB treatment in the area, which help me calculating the sample size and I contacted The Statistician. To ensure representivity, at least 188 patients (number suggested by the Centre of Statistics, Stellenbosch University) needed to be interviewed.

Data collection and measuring tool:

Data was collected between December 2010 and June 2011 starting with the non-adherent patients first.

Designed questionnaire was used for data collection for adherent and non-adherent group respectively (in fact it was the same questionnaire with the statements written in a negative for adherent patient), developed based on factors from review of literature and using "Likert Scale ".It was pre-tested on few patients at the clinics.

Patients (everyone on the list that was drawn up) were met face to face at their respective clinics or located (usually by my co investigator, the social worker at Frontier Hospital) at their houses for interview.

Each questionnaire was filled in anonymously but a code enabled one to identify the hidden name of the patient if the need arose. The reasons for the study were explained to patients and they were given an opportunity to ask questions before reading and signing a consent form in Xhosa or English.

For sixteen factors (lack of job, no accommodation, lack of food, poor salary, drinking alcohol, smoking, conflict in my family, clinic too far, "I moved from where I was living", "too much time to spend at the clinic", too much pills to drink, treatment taking too long, injections too painful, drugs reactions to treatment, ashamed of stigma, use of traditional medicine), patients were asked to answer true or false patients responding true were considered have a positive

6

relation to that factor.

For twelve factors (I don't find tablet at the clinic, workers bad attitudes at the clinic, not explained duration of treatment, lack of money for transport, insecurity on the way to clinics, fees requested at the clinic, clinic not well organized, I denied TB, involved in drug abuse, lack of support, arrested, use of traditional medicines) , the following scale was used when patients were asked how often they had missed(for each factor) tuberculosis treatment:1=never;2=not often;3=sometimes;4=very often;5=Always. Patients responding with scale from 2 to 5 were considered have a positive relation to that factor.

The term "arrested" was used to refer to patients who were arrested by the Police during treatment period.

For the remaining factors (beliefs in use of traditional medicines, feeling better, cultural beliefs, my marital status, education too low, involved in drugs abuse, history of previous TB treatment, felt better, school or work commitment, mental disorder, loss of hope, nurses too busy to attend to us), the following scale was used when patients were asked why they were not adhering to tuberculosis treatment:1=Disagree strongly; 2=Disagree; Neither agree nor disagree; 4=Agree; 5=Agree strongly. Patients with responses 4 or 5 were regarded as positive for factor.

Questions about some factors (such as use of traditional medicines, involved in drug abuses, feeling or felt better) were repeated during the interviews to make sure patients understood what they were asked to answer(see attachments below).
Of 33 clinics of the sub district (all with TB programmes), 24 were visited .Nine clinics could not be visited by researcher for data collection because of the condition of the roads and/or the inaccessibility of the clinic for a small motorcar.
Seven of 24 clinics visited either had no non-adherent patients or they had one or two who met the criteria but could not be found for interview.

Analysis:
Descriptive statistics were used to analyse the data compiled on Microsoft Excel spreadsheets with the help of Centre of Statistics, Stellenbosch University.
The prevalence of factors in non-adherent group and adherent group was calculated together with

odds ratio (OR) for some of the selected factors using the 2x2 table.

	Non-adherent	Adherent
With factor	A	B
Without factor	C	D

The prevalence of factors (contributing to non-adherence) in non adherent patient was: A/(A+C); and in adherent patients: B/(B+D).

To measure association, the odd ratio (OR) is calculated, i.e The odds of those with factors in non-adherent patients (A/C) to the odds of those with factors in adherent patient (B/D)[33] . The ratio being calculated as A/C divided by B/D. Thus an odds ratio of >1 means that the odds were greater and that the particular factor was present in the non adherent group rather than in the adherent group.

Ethical considerations:

The Ethical Committee at Stellenbosch University gave the necessary approval to conduct the research (number:N10/05/151).The ethical committee of the Eastern Cape department of Health, the Chris Hani District Manager: Health and the Sub district Manager: Health, also gave permission for the study.

RESULTS

Of the 195 patients interviewed (121 male and 74 female), 98 were non-adherent (50.25%) and 97(49.75%) adherent. Most of the patients (62.05%) were male, 36.92 % were aged between 36 and 50 years. Seventy-four point thirty-five per cent (74.35 %) considered themselves to be poor and 159 of the patients (81.53%) were unemployed.

One hundred and forty-nine of 195 patients (76.4%) reported that they were single, while only 4.1 % were divorced. Seventeen patients (8.7%) had not attended school at all, while information on the educational status of four patients (2.05%) was missing.

Ninety-one of 195 patients (46.66%) had no children while one patient (0.51%) reported that he/she had seven children. Four patients (2.05%) could not provide information about their number of children at the time of interview.

Most of patients (93%) were black, the rest were coloured who could speak English or isiXhosa

Table 1   Age and Gender distribution of the study population   (n= 195)

Age group (Yrs)	Non Adherence		TOTAL	Adherent		TOTAL
	Male (%)	Female (%)		Male (%)	Female (%)	
<20	3(3.06)	2(2.04)	5	6(6.18)	4(4.12)	10
20-35	21(21.4)	13(13.26)	34	22(22.68)	13(13.82)	35
36-50	24(24.48)	14(14.28	38	21(21.65)	13(13.82)	34
>50	13(13.26	8(8.16)	21	11(11.34)	7(7.25)	18
TOTAL	61(62.24)	37(37.76)	98	60(61.86)	37(38.14)	97

Table 2: Prevalence of factors contributing to non-adherence to TB treatment

	Factors	Non-adherent 98(%)	Adherent 97(%)	OR
	Factors with odds higher in non-adherent patients			
1	Involved in drug abuse	13(13.3) *	1(1.03)	14.68
2	Tablet not available at the clinic	17(17.3)	2(2.06)	9.969
3	Lack of support	26(26.5)	6(6.18)	5.477
4	School or work commitments &	13(13.4)	4(4.12)	3.555

9

5	Arrested(by police)	6(6.1)	3(3.09)	1.625
6	My marital status	11(11.2)	7(7.22)	1.626
7	Loss of hope	10(10.2)	6(6.18)	1.723
8	Denial of TB	10(10.2)	8(8.24)	1.264
	Factors with odds not higher in either group			
9	Fees requested at clinic^	1(1)	1(1)	0.990
10	Clinic not well organised^	13(13.3)	13(13.40)	0.988
11	Drinking alcohol@	41 (41.8)	44(45.36)	0.866
12	Not explained duration of treatment^	13(13.4)	21(21.64)	0.603
13	Lack of food&	51(52)	63(64.95)	0.586
	Factors with odds higher in adherent group			
14	Use of traditional medicines^	9(9.2)*	17(17.52)	0.48
15	Smoking@	31(31.6)	50(51.54)	0.435
16	No accommodation&	19(19.4)	36(37.11)	0.407
17	Ashamed of stigma@	21(21.4)	43(44.33)	0.342
18	Lack of money for transport&	26(26.5)	50(51.54)	0.339
19	I moved from where I was living(Change of abode) &	25(25.5)	62(63.92)	0.193
20	Beliefs in use of traditional medicines@	1(1.0)	3(30.92)	0.323
21	History of previous TB treatment^	11(11.2)	63(64.94)	0.068

22	Clinic too far^	27(27.6)	62(63.92)	0.214
23	Too much time to spend at the clinic^	25(25.5)	61(62.88)	0.202
24	Too much pills to drink^	37(37.8)	75(77.32)	0.178
25	Conflict in my family@	13(13.3)	50(51.55)	0.144
26	Treatment taking too long^	45(45.9)	83(85.56)	0.143
27	Use of traditional medicine(cross-checked with other statement) @	1(1)	6(6.18)	0.156
28	Reactions to medication^	14(14.3)	61(62.89)	0.098
29	Insecurity on the way to clinics&	3(3.1)	25(25.77)	0.093
30	Poor salary&	48(49)	89(91.75)	0.086
31	Involved in drug abuse@	13(13.3) *	58(59.79)	0.10
32	Cultural beliefs@	2(2)	30(30.93)	0.046
33	Nurses too busy to attend to us^	4(4.1)	37(38.14)	0.070
34	Felt better@	17(17.3)*	78(80.41)	0.051
35	Feeling better@	13(13.3)*	79(81.44)	0.035
36	Lack of job&	49(50)	94(96.91)	0.032
37	Mental disorder@	4(4.1)	65(67.00)	0.021
38	Education too low@	6(6.1)	77(79.38)	0.017
39	Clinic workers' bad attitudes^	2(0.02)	22(22.68)	0.071
40	Injections too painful^	33(33.7)	87(89.69)/	0.058

@: Patient related factors: behavioural factors including subjective conditions.

&: Socio- economic factors

^: Factors related to health system (including treatment related factors)

95% Confidence Interval: $e^{\ln(OR)\pm(1.96)(S.E)}$

S.E.= Standard Error= $\sqrt{(1/a +1/b +1/c +1/d)}$

OR =Odds ratio = ad/bc

1.96 = Constant

Ln =Natural logarithm

*For the same factor, tested with different statements, different answers were received.

Other factors were cited by the patients, who were asked at the end of their interviews to if there are other reasons (not mentioned in the questionnaire) which contributed to non-adherence to TB treatment. The reasons given were:

- Forgetfulness: found in 1 over 98 non-adherent patients (1.02%)
- Laziness: found in 1 over 98 non-adherent patients (1.02%)
- Attendance at funeral ceremonies in the family: found in 1 over 98 non-adherent patients (1.02%)
- No reasons given: for all others

DISCUSSION:

This study shows that there is a high prevalence of factor s contributing to non-adherence to TB treatment in Lukhanji LSA, with "lack of food "being the leading one. But, comparing the two groups of patients, eight keys factors were found to be more significant in contributing to non-adherence to TB treatment .These are:

- **Involvement in drug abuse**: with a prevalence of 13,3 % in non-adherent group, compared to 1.03% in adherent group (OR:14.68;95 % CI:4.88-44.00) .This is similar to other study done elsewhere[14] where drug users are prone to non-adherence. The factor is likely to be found in non-adherent than adherent group but the confidence interval is quite wide that there is uncertainty. This may be due to a smaller sample. The implication of this high prevalence will definitely be the occurrence of resistant strains of mycobacterium tuberculosis, which will be another burden for the community.

- **Tablets not available at the clinic**, this was seen in 17.3 % of non-adherent patients compared to 2.06 % in adherent group with OR: 9.969(95 % CI=2.238 to 44.4023).This is not the case in Vietnam[13] but in Zambia, where there is a decentralized budget for drug procurement [10].

Again, the Confidence Interval here is too wide be certain of the implication of this factor. The possible reasons of non-availability of drugs at the clinics are: poor coordination of activities and budgeting in the health system.

Lack of support is revealed to be a problem for patients in Lukhanji LSA.

26.5 % of non-adherent compared to only 6.18 % of adherent patients with OR of 5.477(95 % CI=2.202 to 13.6167).The Confidence Interval is narrowed than it was for the two factors above, giving some indications of precise estimates.

The same problem was also found in the Western Cape[24] where patients needed social and emotional support. Families, Social workers, community health workers have an important role to play.

School or work commitment: 13.4 % of non-adherent compared to 4.12 % of adherent patients was found to have this problem. The OR=3.55 (CI= 1.115 to 11.325).

The CI is narrowing, but one might increase the sample size for a similar study to be more certain.

This remains also a problem in Western Cape [25]. People are putting work and school activities first, forgetting to show up the clinics for collecting drugs.

Arrested by the Police: 6.1 percent in non-adherent compared to 3.09 percent in adherent group reported the problem, OR= 1.625 (95 % CI= 1.658- 4.375) . This is quite narrow confidence interval to rely on. Probably, the system is not well maintained at the SAPS to allow prisoners to have access to their drugs while in custody.

In the Netherlands, very high rates of non-compliance were observed among prisonners[21].

Marital status: 11.2 percent of non-adherent compared to 7.22 percent of adherent patients could not comply because of their marital status .OR = 1.626(95 % CI =1.658-4.4.383).

However, in a study done in Nepal[20], the rate in the non-adherent group was almost the same as that in adherent group.

Although one could be confident with these results, more should be done as to go in detail to find out why and how the marital status affects the compliance of patient to TB treatment. There was no sufficient time to put more questions to the patients and that could need another study.

 Loss hope: 10.2 % of patients in non-adherent group gave this reason to justify why they could not comply with TB treatment, compared to 6.18 % of patients in opposite group with OR=1.73(95 % CI=1.664 to 4.940). The prevalence here is less than what is reported in a study

in Zambia[27]. Lack of support, anxiety and depressive disorders might have contributed to this factor.

Denial of TB: 10.2 percent of non-adherent and 8.24 percent of adherent patients reported having denial to TB, with in turn poor compliance to TB treatment .The OR=1.264(95 % CI=2.096 to 3.34).This in fact one of the narrowest confidence intervals in this study and it is more likely that the factor is found in non-adherent patients.

The prevalence is almost twice the rate reported in a similar study in Zambia.[27] Health workers are currently powerless to overcome denial in the patients.

LIMITATIONS OF THE STUDY:

- I was not given an official and objective documentation from the local TB programme showing the rate on non-adherence to TB treatment so that attempt could be done to calculate the sample of study.

- Questionnaire for each group of patients was designed using "Likert Scale". Patients might have avoided using extreme response, agreed with statements as presented, or tried to portray them in a more favourable light.

- The study did not explore the clinical and radiological factors or whether the type of TB is new strain of TB, re-treatment TB or Extra-pulmonary TB, to determine whether this influenced patient adherence to treatment.

- The involvement of health professionals (nurses) in the interviewing of study participants might have influenced some of the responses obtained and these may therefore not present a true reflection of a particular factor. For example, the response to the question about the attitude of healthcare workers could have been affected by the fact that it was the health care worker who was asking this question.

- Due to the limitation of both time and resources it was impossible to interview patients in the most inaccessible clinics I cannot extrapolate the results to these clinics.

CONCLUSION:

This study established that there was a high prevalence of factors contributing to non-adherence to TB treatment in this community. This study identified the factors that were most important in influencing TB patients who were non-adherent to treatment, the most common factor being:

14

lack of food .The most important factors were: Involvement in drug abuse; unavailability of tablets at the clinic; lack of support; school or work commitments; arrested by the police; marital status; loss of hope; and denial of TB and this cannot be overlooked as it is a serious threat for our community and the nation generally.

RECOMMENDATION:

To improve adherence to TB treatment, the following steps should be taken:

-Local and provincial authorities need to implement interventions to prevent and treat drug abuse in the community.

- TB drugs should be readily available at clinics whenever patients keep their appointments.

-Social and community health workers should intensify   home visits to TB patients to improve support and if possible implement a tracing system of those suspected or known to be non-adherent to treatment.

- A clear defined policy should be put in place together with South African Police Service to assist TB clients who are under arrest.

-Support should be given to these patients so that they can receive regularly food parcels from South African Social Security Agency while they are under TB treatment.

- Sessions should be organised with patients to improve communication and to help them regain hope, and to focus on the present and on specific goals rather than offering vague promises about the future.

- Health-care workers should use a gentle, empathic and non-judgemental approach during the consultation with patients diagnosed with or suspected of having tuberculosis; this will help to reduce the number of patients who are in TB denial.

The Department of Health in this Province should appoint family physicians who are able to mentor and instruct health workers in the clinics.

REFERENCE LIST:

1**.** Dodor EA, Afenyadu GY. Factors associate with tuberculosis treatment default and completion at the Effia-Nkwanta Regional Hospital in Ghana. Trans R Soc Trop Med Hyg 2005; 99(11): 827-832

2. Govender S, Mash R. What are the reasons for patients not adhering to their anti-TB treatment in a South African district hospital? SA Fam Pract 2009; 51(6): 512-516

3.MacIntyre CR, Goebel K, Brown GV. Patient knows best: blinded assessment of non adherence with anti tuberculosis therapy by physicians, nurses and patients compared with urine drug levels. Prev Med 2005; 40(1): 41-45

4.Jakubowiak WM, Bogorodskaya EM, Borisov SE, Danilova ID, Kourbatova EV. Risk factors associated with default among new pulmonary TB patients and social support in six Russian regions. Int J Tuberc Lung Dis 2007; 11(3): 353-4

5.Volmink J, Garner P. Systematic review of randomised controlled trials of strategies to promote adherence to tuberculosis treatment. BMJ 1997; 315(7120):1395-6

6.Lönnroth K, Thuong LM, Lambregts K, Quy HT, Diwan VK. Private tuberculosis care provision associated with poor treatment outcome: comparative study of a semi private lung clinic and the NTP in two urban districts in Ho Chi Minh City, Vietnam. Int J Tuberc Lung Dis 2003;7(2):165-71.

7.Volmink J, Matchaba P, Garner P. Directly observed therapy and treatment adherence. Lancet 2000; 355:1345-50

8.Foundation for Professional Development. Course on the Management of Tuberculosis 1st ed. Pretoria, South Africa: Foundation for Professional Development; 2004:144-145

9.Comolet TM, Rakotomalala R, Rajaonarioa H. Factors determining compliance with tuberculosis treatment in an urban environment, Tamatave, Madagascar. Int J Tuberc Lung Dis 1998; 2(11): 891-897

10.Bosman MC. Health sector reform and tuberculosis control: the case of Zambia Int J Tuberc

Lung Dis 2000; 4(7): 606-614

11.Wares DF, Singh S, Acharya AK,Dangi R. Non adherence to tuberculosis treatment in the Eastern Tarai of Nepal. Int. J Tuberc Lung Dis 2003; 7(4):327-33

12.Kelly PM. Local problems, local solutions: improving tuberculosis control at the district level in Malawi. Bull of the WHO 2001; 79(2):111-7

13.Johansson E, Diwan VK, Huong ND, Ahlberg BM. Staff and patient attitudes to tuberculosis and compliance with treatment: an exploratory study in a district in Vietnam. Int. J Tuberc Lung Dis 1996; 77(2):178-183

14.Pablos-Méndez A, Knirsch CA, Barr RG, Lerner BH, Frieden TR.Non-adherence in tuberculosis treatment: predictors and consequences in New York City. Am J Med. 1997;102(2):164-70.

15.Tulsky JP, Hahn JA, Long HL, Chambers DB, Robertson MJ, Chesney MA, et al. Can the poor adhere? Incentives for adherence to TB prevention in homeless adults. Int. J Tuberc Lung Dis 2004; 8(1): 83-91

16.Santha T, Garg R, Frieden TR, Chandrasekaran V, Subramani R, Gopi PG, et al. Risk factors associated with default, failure and death among tuberculosis patients treated in a DOTS programme in Tiruvallur District , South- India, 2000 Int. J Tuberc Lung Dis 2002; 6(9): 780-788

17.Buu TN, Lonnroth K, Quy HT.Initial defaulting in the national tuberculosis program in Ho Chi Minh City, Vietnam: a survey of extent, reasons and alternative actions taken following default. Int. J Tuberc Lung Dis 2003; 7(8):735-741

18.Greene JA. Ethnography of non-adherence: culture, poverty, and tuberculosis in urban Bolivia. Cult med psychiatry 2004; 28(3): 401- 425

19.Chang KC,Leung CC, Tam CM. Risk factors for defaulting from anti tuberculosis treatment under directly observed treatment in Hong Kong. Int. J Tuberc Lung Dis 2004, 8(12): 1492-1498

20.Misha P, Hansen EH,Sabroe S, Kafle K.K .Socio-economic status and adherence to tuberculosis treatment: a case-control study in a district of Nepal. Int. J Tuberc Lung Dis 2005; 9(10): 1134-1139.

21.Borgdorff MW, Veen J, Kalisvaart NA, Broekmans JF, Nagelkerke NJ. Defaulting from tuberculosis treatment in the Netherlands: rates, risk factors and trend in the period 1993-1997. Eur Respir J 2000; 16(2): 209-213

22. Al-Hajjaj MS,Al-Khatim LM. High rate of non-compliance with anti-tuberculosis treatment despite a retrieval system: a call for implementation of a directly observed therapy in Saudi Arabia. Int. J Tuberc Lung Dis 2000; 4(4): 345-349.

23 Dodor E.A: Tuberculosis treatment default at the communicable diseases. Unit of Effia-Nkwanta Regional Hospital: a 2-year experience. Int J Tuberc Lung Dis 2004; 8(11): 1337-1341

24 Dick J, van der Walt H, Hoogendoom L, TobiasB. Development of a health education booklet to enhance adherence to tuberculosis treatment. Int J Tuberc Lung Dis (1996) ; 77(2):173-177

25. Naidoo P, Dick J, Cooper D. Exploring tuberculosis patient's adherence to treatment regimens and prevention programs at a public health site .Qual Health Res 2009; 19(1): 55-70

26. Tekle B, Mariam DH, Ali A. Defaulting from DOTS and its determinants in these districts of Arsi zone in Ethiopia. Int. J Tuberc Lung Dis 2002; 6(7): 573-579

27. Kaona F, Tuba M, Siziya S, Sikaona L. An assessment of factors contributing to treatment adherence and knowledge of TB transmission among patients on TB treatment. BMC Public health 2004, 4:68

28.Widjanarko B, Gompelman M, Dijkers M, Van der Werf M J. Factors that influence treatment adherence of tuberculosis patients living in Java, Indonesia, Patience Prefer Adherence 2009; 3:231-238

29. Van Der Werf TS, Dade GK, Van Der Mark TW. Patient compliance with tuberculosis treatment in Ghana: factors influencing adherence to therapy in a rural service programme. Int. J Tuberc Lung Dis 1990; 71(4):247-252

30. Hill PC, Stevens W, Hill S, Bah J, Donkor SA, Jallow A., Lienhardt C. Risk factors for defaulting from tuberculosis treatment: A prospective cohort study of 301 cases in the Gambia. Int. J Tuberc Lung Dis 2005; 9(12): 1349-1354

31. Armstrong D, Grace J. Research Methods and Audit for General Practice 3rd Edition; Oxford University Press,2000

ADDENDUM

NON-ADHERENCE TO TB TREATMENT QUESTIONNAIRE   Respondent code

We are studying the factors contributing to non-adherence to tuberculosis treatment and we would be grateful for your help.
All your answer will be treated in the strictest confidence. Thanking you in advance for your help.
Please start giving us the following information about yourself:
Age:
Gender:
Social class:
Job:
Single, Married or divorced:
Level of education:
Family:
Race/ethnicity:

Please tick in the appropriate box, true or false:
The following factors could contribute that you become non-adherent to tuberculosis treatment you were taking:

	Factors	true	false
1	Lack of job		
2	No accommodation		
3	Lack of food		
4	Poor salary		
5	Drinking alcohol		
6	Smoking		
7	Conflict in my family		
8	Clinic too far		
9	I moved from where I was living		
10	Too much time to spend at the clinic		
11	Too much pills to drink		
12	Treatment taking too long		
13	Injections too painful		
14	Drugs reactions during treatment		
15	Ashamed of stigma		
16	Use of traditional medicines		

Below are numbers of statements regarding reasons of not adhering to tuberculosis treatment, for each statement, tick one box corresponding to a number 1= Never; 2= Not often; 3= Sometimes; 4=Very often; 5= Always

		1	2	3	4	5
17	I don't find tablets at the clinic					
18	Workers bad attitude at the clinic					

19	Not explained the duration of treatment					
20	Lack of money for transport					
21	Insecurity on the way to the clinic					
22	Fees requested at the clinic					
23	Clinic not well organized					
24	I denied TB					
25	Involved in drug abuse					
26	Lack of support					
27	Arrested					
28	Use of traditional medicines					

Below are numbers of statements regarding reasons of not adhering to tuberculosis treatment, for each statement, tick one box corresponding to a number 1= Disagree strongly; 2= Disagree; 3= Neither agree nor disagree; 4= Agree; 5= Strongly agree.

		1	2	3	4	5
29	Belief in use of traditional medicine for tuberculosis					
30	Feeling better					
31	Cultural beliefs					
32	My marital status					
33	Education tool low					
34	Involved in drug abuse					
35	History of previous TB treatment					
36	Felt better					
37	School or work commitment					
38	Mental disorder					
39	Loss of hope					
40	Nurses too busy to attend to us					
41	Other: which one?					

Explanations have been given on pages 7 and 8 above.

ADHERENCE TO TB TREATMENT QUESTIONNAIRE   Respondent code

We are studying the factors contributing to non-adherence to tuberculosis treatment and we would be grateful for your help.
All your answers will be treated in the strictest confidence. Thanking you in advance for your help. Please start giving us the following information about yourself.
Age:
Gender:
Social class:
Job:
Single, Married or divorced:
Level of education:
Family:
Race/ethnicity:

Please tick in the appropriate box, true or false:
The following factors could contribute that you are successfully taking your tuberculosis treatment:

	Factors	true	false
1	Having job		
2	Having accommodation		
3	Having enough food		
4	Sufficient salary		
5	Not drinking alcohol		
6	Not smoking		
7	No conflict in my family #		
8	Clinic not too far		
9	I didn't move from where I was living		
10	Not too much time to spend at the clinic		
11	Not too much pill to drink		
12	Treatment taking short enough(time)		
13	Injections not too painful		
14	No drug reactions during treatment		
15	Not ashamed of stigma		
16	No use of traditional medicines		

Below are number of statements regarding reasons of adhering to tuberculosis treatment, for each statement, tick one box corresponding to a number 1=Never; 2=Not often; 3=Sometimes; 4=Very

often; 5=Always

		1	2	3	4	5

17 I find tablets at the clinic

18 Workers good attitude at the clinic

19 Explained the duration of the treatment

20 Having of money for transport

21 Safe to go to the clinic

22 Fees not requested at the clinic

23 Clinic well organized

24 I didn't deny TB

25 Not involved in drug abuse

26 Adequate support

27 Not arrested

28 Not using of traditional medicines

Below are number of statements regarding reasons of adhering to tuberculosis treatment, for each statement, tick one box corresponding to a number 1=Disagree strongly; 2=Disagree;3=Neither agree nor disagree; 4=Agree; 5=Strongly agree

		1	2	3	4	5

29 Belief in use of traditional medicine for tuberculosis

30 Not feeling better

31 Cultural beliefs

32 My marital status

33 Well educated

34 Not involved in drug abuse

35 History of previous TB treatment

36 Didn't feel better

37 School or work commitment

38 No mental disorder

39 Having of hope

40 Nurses not too busy to attend to us

41 Other: which one?

PRINCIPAL INVESTIGATOR: DR CK KAYEMBE

For the following 16 factors: patients responding false were considered have a positive relation to the corresponding opposite factor (listed in non-adherence questionnaire).They are:

- having job,
- having accommodation,
- having enough food,
- sufficient salary,
- not drinking alcohol,
- not smoking,
- no conflict in my family,
- clinic not too far,
- I didn't move from where I was living,
- not too much time to spend at the clinic,
- not too much pills to drink,
- treatment taking short enough(time),
- injections not too painful,
- no drug reactions during treatment,
- not ashamed of stigma, no use of traditional medicines;

For the 12 factors: patients responding never were considered have a positive relation to the corresponding opposite factor (listed in non-adherence questionnaire), they are:

- I find tablets at the clinic,
- workers' good attitude at the clinic,
- explained the duration of treatment,
- having money for transport,
- safe to go to the clinic,
- fees not requested at the clinic,
- clinic well organized,
- I didn't deny TB,
- not involved in drug abuse,
- adequate support,
- not arrested,

- not using traditional medicine;

For other factors, patients with responses disagree or strongly disagree were regarded as have positive relation to the same factor as listed in non-adherence questionnaire. They are:

- belief in use of traditional medicine for tuberculosis,
- culture beliefs,
- my marital status,
- history of previous TB treatment,
- School or work commitment.

For the remaining factors, patients with responses disagree or strongly disagree were responded as positive for factor as listed in non-adherence questionnaire. These are:

- not feeling better,
- well educated,
- not involved in drug abuse,
- did not better,
- no mental, having hope,
- Nurses not too busy to attend to us.