

## Associated factors of medication non-adherence for tuberculosis in Moroccan patients

Non-adherence for tuberculosis in Moroccan patients

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### Abstract

**Aim:** In Morocco, tuberculosis is endemic and therapeutic adherence remains unsatisfactory. The objective of our study is to describe the factors influencing therapeutic adherence in tuberculosis patients in Morocco.

**Material and Methods:** In this cross-sectional study, 98 patients were recruited at the Center for Diagnosis and Treatment of Respiratory Diseases (CDTMR) of Beni Mellal, Morocco. Data were collected through face-to-face interview using a pre-structured questionnaire and analyzed with a binary regression model to highlight factors that may lead to poor adherence.

**Results:** Our results showed that 46.9% of the patients had good adherence and 53.1% had poor adherence. In addition, binary regression analysis showed that four factors significantly influenced the break in the continuity of treatment, namely: the communication problems with the healthcare staff, the means of transport used to reach the Health Center, stock-outs of anti-tuberculosis drugs, and the frequent closures of the Health Center.

**Discussion:** In Morocco, therapeutic adherence remains a major challenge in the care of tuberculosis patients. Monitoring programs and patient education are needed to end the major barriers to adherence. In addition, the restructuring of the health establishments to improve proximity and accessibility, and the continuous supply of drugs could help to good therapeutic compliance.

### Keywords

Tuberculosis, Adherence, Morocco

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## Introduction

Tuberculosis is a major public health concern worldwide. According to WHO, 10 million people contracted tuberculosis and 1.5 million died of it in 2018 (including 251,000 infected with HIV), especially in low- and middle-income countries (available at: [https://www.who.int/tb/publications/global\\_report/gtbr2019\\_ExecutiveSummary\\_fr.pdf?ua=1](https://www.who.int/tb/publications/global_report/gtbr2019_ExecutiveSummary_fr.pdf?ua=1)). In Morocco, tuberculosis remains endemic and still a significant public health problem. The epidemiological data for 2016 show a total of 31,542 cases of tuberculosis, all forms combined, corresponding to an incidence of 91 per 100,000 population (available at: [http://www.sante.gov.ma/Documents/2017/03/Lutte%20Antituberculeuse%20au%20Maroc\\_%20progr%C3%A8s%20d%C3%A9fis%20et%20perspectives.pdf](http://www.sante.gov.ma/Documents/2017/03/Lutte%20Antituberculeuse%20au%20Maroc_%20progr%C3%A8s%20d%C3%A9fis%20et%20perspectives.pdf)). The management of tuberculosis is organized within the framework of a new Moroccan National Strategic Plan (PSN 2018-2021) based on WHO recommendations. The aim of this plan is to reduce mortality associated with this disease by strengthening the detection of new cases and improving conditions of treatment and monitoring of patients (available at: <https://www.smmg.ma/publications/documents/1-programme-national-de-lutte-contre-la-tuberculose/file.html>). Despite this plan, several cases of interruption of anti-tuberculosis treatment have been recorded in Morocco [1, 2]. In fact, the consequences of poor adherence to treatment are serious for the individual and for the community, including relapse, prolonged treatment, increased risk of death, prolonged infectious period, and the development of multidrug-resistant strains [3]. Thus, improving adherence has become an important objective in a large number of therapeutic strategies, since non-adherence greatly impacted the effectiveness of the treatments prescribed [4]. Medication non-adherence can be affected by various factors, which can be linked to patient, treatment, healthcare staff, and the organization of health services [5-8]. In Morocco, there is very little data available in the literature on the factors associated with tuberculosis therapeutic adherence. This work aimed to assess the factors related to therapeutic adherence in Moroccan tuberculosis patients.

## Material and Methods

All tuberculosis patients treated at the Center for Diagnosis and Treatment of Respiratory Diseases (CDTMR) of Beni Mellal, Morocco, in 2017 were included in this study. The study was carried out on a sample of 98 patients with sputum smear-positive tuberculosis. Patients with non-tuberculous pneumonia, those with extra-pulmonary tuberculosis, and patients who were on anti-bacillary therapy for less than a month were excluded.

Socio-demographic variables noted were sex, age, level of education, marital status, occupation, urban or rural origin, and the presence or absence of health insurance. Other variables such as tuberculosis cases (new case, relapse, failure) smoking status, associated diseases (diabetes, high blood pressure, etc.), BCG vaccination, and hospitalization were also noted.

Good therapeutic adherence was defined as patients who had completed the treatment with no history of non-adherence.

Data were collected using a semi-structured interview after obtaining informed consent from each participant. The study was approved by the local research ethics committee.

## Statistical Analysis

Results were expressed as frequency and percentage. Categorical variables were analyzed using the Chi-square. Variables with significant p-values ( $p < 0.05$ ) from univariate analysis were included in binary logistic regression analysis using the Forward Stepwise (Likelihood Ratio) method to identify factors predicting medication adherence. SPSS version 20 was used for data analysis.

## Results

### 1. Sociodemographic and clinical characteristics of patients

The study involved 98 patients, 54.1% of them were men ( $n = 53$ ). Patient characteristics are presented in Table 1. The two age groups with the greatest percentage of the tuberculosis cases were 20-45 years old and >45 years old, accounting for 45.9% and 35.7% of total tuberculosis cases, respectively. Regarding marital status, 51% of the patients were married, 49% were single, widowed, or divorced. We also note that 33.7% of the patients were illiterate, 24.5% had reached a primary school level, and 41.8% had reached a secondary level or superior.

The majority of cases lived in urban areas ( $n = 68$ , 69.4%), the rest ( $n = 30$ , 30.6%) lived in rural localities close to Beni Mellal. There were 40 unemployed study subjects (40.8%) and 53 with no health insurance (54.1%).

Clinically, the vast majority of patients (81.6%) were new cases of tuberculosis, and relapses in 13.3% of cases. Only 5 cases were reported as therapeutic failure (5.1%). The majority of patients (65.3%) were already hospitalized for tuberculosis. Also, 17.43% of our patients had comorbidities associated with tuberculosis, including diabetes ( $n = 6$ ), hypertension ( $n = 8$ ), cardiopathy ( $n = 2$ ) and asthma ( $n = 1$ ). Only 24.5% ( $n = 24$ ) did not receive the BCG tuberculosis vaccine and 22.4% ( $n = 22$ ) were smokers.

### 2. Adherence rate

Regarding the therapeutic adherence to therapy, our results showed that more than half of the patients (53.1%) had poor adherence and 46.9% had good adherence. No significant differences were observed between the two categories in terms of sociodemographic and clinical characteristics (Table 1).

### 3. Factors influencing medication adherence

Several reasons have been put forward by patients for non-adherence, including the distance between patient residence and health facilities (Table 2). In fact, 77.6% of the patients declared that they were far from the CDTMR, while 30.6% were far from a nearby health center. This shows that the health center remains more accessible to patients than the CDTMR. To access the health center, 73.5% of the subjects walk, while the rest use public transportation. In addition, patients stated that they had problems with the supply of anti-bacillary medication by the health center either because of the depletion of the stock (50%) or because of its closure (34%).

Communication problems have also been reported. Thus, more than half of the patients (53.1%) were dissatisfied with the reception given to them by the healthcare staff at the health center, and 41.8% of them had difficulty in communication. In addition, 56.1% of patients reported a lack of necessary information and explanations concerning their disease and

**Table 1.** Characteristics of the study patients

Variables	Total % (N)	Poor Adherence % (N)	Good Adherence % (N)	$\chi^2$	df	p
<b>Gender</b>						
Women	45.9 (45)	26.5 (26)	19.4 (19)	0.743	1	0.389
Men	54.1 (53)	26.5 (26)	27.6 (27)			
<b>Age group</b>						
<20	18.4 (18)	8.2 (8)	10.2 (10)	2.2	2	0.333
20 - 45	45.9 (45)	22.4 (22)	23.5 (23)			
>45	35.7 (35)	22.4 (22)	13.3 (13)			
<b>Education</b>						
Illiterate	33.7 (33)	18.4 (18)	15 (15)	0.216	3	0.975
Primary	24.5 (24)	13.3 (13)	11.2 (11)			
Secondary	34.7 (34)	17.3 (17)	17.3 (17)			
University	7.1 (7)	4.1 (4)	3 (3)			
<b>Marital status</b>						
Single	39.8 (39)	21 (21)	18.4 (18)	5.631	3	0.131
Married	51 (50)	26.5 (26)	24.5 (24)			
Divorced	3.1 (3)	0	3 (3)			
Widower	6.1 (6)	5.1 (5)	1 (1)			
<b>Profession</b>						
No occupation	40.8 (40)	20.4 (20)	20.4 (20)	6.835	5	0.233
Housewife	28.6 (28)	17.3 (17)	11			
Worker	10.2 (10)	3 (3)	7.1 (7)			
Functionary	4.1 (4)	4.1 (4)	0			
Liberal function	5.1 (5)	5.1 (5)	2 (2)			
Other	11.2 (11)		6.1 (6)			
<b>Place of residence</b>						
Urban	69.4 (68)	35.7 (35)	33.7 (33)	0.226	1	0.635
Rural	30.6 (30)	17.3 (17)	13.3 (13)			
<b>Insurance</b>						
Yes	45.9 (45)	22.4 (22)	23.5 (23)	0.582	1	0.446
No	54.1 (53)	30.6 (30)	23.5 (23)			
<b>Patient type</b>						
New case	81.6 (80)	39.8 (39)	41.8 (41)	3.419	2	0.181
Relapse	13.3 (13)	9.2 (9)	4.1 (4)			
Failure	5.1 (5)	4.1 (4)	1 (1)			
<b>Smoking status</b>						
Yes	22.4 (22)	41.8 (41)	35.7 (35)	0.107	1	0.744
No	77.6 (76)	11.2 (11)	11.2 (11)			
<b>Associated comorbidities</b>						
Nothing	82.66 (82)	41.8 (41)	40.8 (40)	2.655	3	0.448
Diabetes	6.12 (6)	5.1 (5)	1 (1)			
Arterial hypertension	8.16 (8)	4.1 (4)	4.1 (4)			
Others	3.06 (3)	2 (2)	1 (1)			
<b>BCG Vaccine</b>						
Yes	75.5 (74)	39.8 (39)	35.7 (35)	0.016	1	0.901
No	24.5 (24)	13.3 (13)	11.2 (11)			
<b>Hospitalization</b>						
Yes	34.7 (34)	21 (21)	13.3 (13)	1.583	1	0.208
No	65.3 (64)	31.6 (31)	33.7 (33)			

the duration of treatment by healthcare staff. The absence of informative posters on tuberculosis in the health center was reported by the majority of patients (82.7%). The univariate analysis identified six factors that were significantly associated with medication adherence. These were as follows: the proximity of the patient's residence to the health

**Table 2.** Factors associated with adherence status

Variables	Total % (N)	Poor Adherence % (N)	Good Adherence % (N)	$\chi^2$	df	p
<b>Proximity of the patient's residence to the Center for Diagnosis and Treatment of Respiratory Diseases</b>						
Yes	22.4 (22)	8.2 (8)	14.3 (14)	3.176	1	0.075
No	77.6 (76)	44.9 (44)	32.7 (32)			
<b>Proximity of the patient's residence to the Health Center</b>						
Yes	69.4 (68)	29.6 (29)	39.8 (39)	9.673	1	0.002
No	30.6 (30)	23.5 (23)	7.1 (7)			
<b>Means of transport used to reach the Health Center</b>						
Walking	73.5 (72)	30.6 (30)	42.9 (42)	14.147	1	<0.001
Other means of transportation	26.5 (26)	22.4 (22)	4.1 (4)			
<b>Closure of the Health Center</b>						
Yes	34.7 (34)	26.5 (26)	8.2 (8)	11.455	1	0.001
No	65.3 (64)	26.5 (26)	38.8 (38)			
<b>Tuberculosis treatment availability at the Health Center</b>						
Yes	50 (49)	36.7 (36)	13.3 (13)	16.388	1	<0.001
No	50 (49)	16.3 (16)	33.7 (33)			
<b>Quality of reception by the healthcare staff at the Health Center</b>						
Satisfying	46.9 (46)	19.4 (19)	27.6 (27)	4.811	1	0.028
Unsatisfying	53.1 (52)	33.7 (33)	19.4 (19)			
<b>Communication problems with the healthcare staff at the Health Center</b>						
Yes	58.2 (57)	25.5 (25)	32.7 (32)	4.632	1	0.031
No	41.8 (41)	27.6 (27)	14.3 (14)			
<b>Existence of informative posters on tuberculosis at the Health Center</b>						
Yes	17.3 (17)	9.2 (9)	8.2 (8)	0.0001	1	0.991
No	82.7 (81)	43.9 (43)	38.8 (38)			
<b>Providing information and explanations of their illness and the duration of treatment</b>						
Yes	43.9 (43)	19.4 (19)	24.5 (24)	2.423	1	0.120
No	56.1 (56)	33.7 (33)	22.4 (22)			

**Table 3.** Binary logistic regression analysis for factors predicting medication adherence in tuberculosis patients

Variable	B	S.E.	Wald	p-value	Exp (B)	95% CI for EXP(B)
Means of transport used to reach the Health Center (By means of transport -1. By walking-0)	-1.378	0.680	4.111	0.043*	0.252	0.066-0.955
Closure of the Health Center (Yes-1. No-0)	-1.403	0.567	6.116	0.013*	0.246	0.081-0.747
Tuberculosis treatment availability at the Health Center (Yes-1. No-0)	-1.678	0.548	9.386	0.002**	0.187	0.064-0.546
Communication problems with the healthcare staff at the Health Center (Yes-1. No-0)	1.520	0.544	7.809	0.005**	4.573	1.575-13.283

\*. p<0.05; \*\*. p<0.01  
 B: Regression Coefficient; S.E.: Standard Error; Exp (B): Odds Ratio; CI: Confidence Interval.  
 Variables excluded: Proximity of the patient's residence to the Health Center, and Quality of reception by the healthcare staff at the Health Center.

center (p=0.002), the quality of reception by the healthcare staff at the health center (p=0.028), the closure of the health center (p=0.001), the means of transport used to reach the health center (p<0.001), tuberculosis treatment availability at the health center (p<0.001), communication problems with the healthcare staff at the health center (p=0.031).

#### 4. Factors predicting medication adherence

The variables that were significantly related to high adherence in univariate analysis were entered into binary regression analysis with a forward stepwise (Likelihood Ratio) method. Table 3 shows the results of the binary logistic regression analysis identifying significant factors that predict medication adherence. Six significant factors from the univariate analysis were included in the binary logistic regression model. Only four variables (closure of the Health Center, means of transport used to reach the Health Center, tuberculosis treatment availability at the Health Center, communication problems with the healthcare staff at the Health Center) of all six variables entered, remained after Forward Stepwise (Likelihood Ratio) method. Our model was statistically significant ( $\chi^2(4) = 39.4$ ,  $p < 0.001$ ) and explained 44.2% of the variation in medication adherence level (Nagelkerke  $R^2 = 0.442$ ). Significant factors that were independently associated with medication adherence were as follows: tuberculosis treatment availability at the health center [OR 0.187 (95% CI: 0.064-0.546);  $p=0.002$ ], communication problems with the healthcare staff at the health center [OR 4.573 (95% CI: 1.575-13.283);  $p=0.005$ ], closure of the health center [OR 0.246 (95% CI: 0.081-0.747);  $p=0.013$ ], and the means of transport used to reach the health center [OR 0.252 (95% CI: 0.066-0.955);  $p=0.043$ ].

#### Discussion

The aim of the current study was to determine factors related to medication adherence in Moroccan tuberculosis patients. In our sample, we note that 46.9% of patients were able to correctly observe their anti-tuberculosis treatment, which remains very low compared to other studies; 76% in South Africa [9], 73% and in Nigeria [10]. In addition, none of the socio-demographic (such as age, gender, education level, place of residence, marital status, and profession) or clinical (smoking habit, associated comorbidities, BCG vaccine, hospitalization) characteristics significantly affected the level of medication adherence.

According to univariate analysis, six independent factors significantly affect adherence. Some factors were linked to the organization of the health system such as the shortage of anti-tuberculosis drugs and the frequent closure of the health center have shown a significant influence on medication adherence, which is in line with the results of other studies carried out in other African countries [8, 11]. These results suggest that for good adherence to treatment, it is essential to ensure the supply of health centers with the necessary anti-tuberculosis drugs and to ensure continuity of services there even during strikes and holidays.

Moreover, the distance between the Health Center and the patient's home and the means of transport used to reach the health center emerged as significant factors for good adherence to treatment, which suggests that providing transportation for those who live far from health centers would be beneficial for good adherence. Consistent with these findings, studies conducted in many countries showed that there was an association between the distance to health facility and the level of medical adherence [12-14]. Thus, the health facilities should be structured to reconcile proximity and accessibility and thus ensure the quality and continuity of care

for tuberculosis patients.

Moreover, therapeutic adherence has been shown to be associated with the quality of the relationship between the healthcare staff and the patient [15]. This is supported by our results showing that the quality of the reception of patients by the staff of the Health Center and the communication problems affect therapeutic adherence. In fact, an adequate healthcare staff-patient relationship implies mutual trust and the capacity for mutual listening in order to guarantee good adherence and avoid therapeutic failure. Patients should also be educated and informed about the different aspects of their disease in order to improve adherence to treatment.

In this study, the binary logistic regression model using forward stepwise based on the Likelihood Ratio had good predictive ability for medication adherence. In this model, the closure of the health center, the means of transport used to reach the health center, tuberculosis treatment availability at the health center, and communication problems with the healthcare staff at the health center were found to be independent predictors of medication adherence.

#### Limitations of the study

This study has some limitations that should be mentioned. In particular, the limited sample size and the use of a face-to-face interview to assess adherence, which may therefore overestimate the prevalence of medication adherence. The final limitation is that the study is only for the Beni Mellal region and questions can be raised over how representative this would be for other regions in Morocco and other countries.

#### Conclusion

Poor adherence to anti-tuberculosis treatment is a recurring problem in third world countries [16-18]. Specifically, tuberculosis remains endemic in Morocco, and medication adherence remains unsatisfactory. There is a clear need for intervention programs aimed at monitoring medication adherence. These programs must deal with the different causes and factors that generate medication non-adherence.

#### Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

#### Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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#### Conflict of interest

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