



Predictive factors of non-adherence to tuberculosis treatment in the metropolitan area of Buenos Aires, Argentina

Factores predictivos de la no adherencia al tratamiento de la tuberculosis en municipios del Área Metropolitana de Buenos Aires, Argentina

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ABSTRACT The aim of this study was to identify the socio-demographic characteristics of patients and the treatment characteristics that influence non-adherence to anti-tuberculosis treatment. A transversal case-control study was carried out in the Metropolitan Area of Buenos Aires. Of the patients interviewed, 38 were non-adherent and 85 were adherent; all were diagnosed during 2007 and resided in and were treated in the hospitals of the selected municipalities. Factors predictive of non-adherence were assessed through logistic regression analysis. The results indicate that patients whose dwellings had no water supply were nearly 3 times more likely to be non-adherent (OR=2.8, 95%CI 1.1-6.9). Patients who had medical check-ups at hospitals were 3 times more likely to be non-adherent than those with check-ups at a primary health care center (OR=3.2, 95%CI 1.1-8.9). These results allow us to identify patients at risk of non-adherence to antituberculosis treatment as those living in poverty conditions and facing barriers to health care access.

KEY WORDS Tuberculosis; Treatment; Medication Adherence; Patient Compliance; Living Conditions; Health Care (Public Health); Argentina.

RESUMEN El objetivo de este estudio fue identificar las características sociodemográficas de los pacientes y las características del tratamiento que influyen en la no-adherencia al tratamiento antituberculoso. Se realizó un estudio de corte transversal, en el Área Metropolitana de Buenos Aires. Se encuestaron 38 pacientes que no adhirieron al tratamiento y 85 pacientes que adhirieron al tratamiento, diagnosticados durante el año 2007, residentes y atendidos en hospitales de municipios seleccionados. El análisis de los factores se llevó a cabo mediante regresión logística. Los resultados indican que los pacientes con viviendas sin agua, tuvieron 3 veces más probabilidad de no adherencia (OR=2,8; IC95% 1,1-6,9). Asimismo, los pacientes que realizaban los controles en un hospital tuvieron 3 veces más riesgo de no adherir que los que los realizaban en centros de atención primaria (OR=3,2; IC95% 1,1-8,9). Estos resultados permiten delinear un perfil de paciente en riesgo de no-adherencia, caracterizado por estar en condiciones de pobreza, y con dificultades de acceso a la atención de su salud.

PALABRAS CLAVES Tuberculosis; Tratamiento; Adhesión a la Medicación; Cooperación del Paciente; Condiciones de Vida; Atención a la Salud; Argentina.

INTRODUCTION

Although tuberculosis is curable and generally preventable, it is one of the main public health problems in Argentina. Each year more than 10,000 new cases are diagnosed and more than 800 people die as a result of this disease (1).

Non-adherence to treatment is considered one of the main obstacles for disease control due to the consequences that arise from the interruption of treatment – disease progression, contagion, and the development of resistant strains (2) – and, in general, non-adherence is related to the social vulnerability of the patients. Indeed, the evidence indicates that those patients living in worse conditions and with a lower socioeconomic level, primarily unemployed and elderly men, are most likely to have difficulty adhering to the treatment (3-12).

During the last years in Argentina, the percentage of patients suffering from bacilliferous pulmonary tuberculosis that abandoned treatment has increased. In 2008, the percentage was 12%, one of the highest percentages seen over the last ten years (13).

In an effort to ensure treatment adherence, the medical-scientific community has developed the method of directly observed therapy (DOT), which consists of the patient taking the anti-tuberculosis medication in the presence of a healthcare worker, in the majority of cases, at the healthcare service (14). The incorporation of DOT currently constitutes one of the main recommendations of the World Health Organization (WHO) for tuberculosis control programs worldwide in the struggle for controlling the disease. DOT also includes a set of actions aimed at other aspects of control (for example, the provision of inputs, surveillance and monitoring, etc.) (14).

The application of DOT and the complete tuberculosis treatment are the two interventions recommended internationally to reduce the problem, and form part of the directly observed treatment, short-course (DOTS) strategy adopted by Argentina. Nevertheless, although Argentina's National Tuberculosis Control Program recommends DOT implementation, its application varies throughout the country and within the different healthcare services. This differential application

of DOT at the health services level could have implications in the results in terms treatment adherence. An evaluation done by the National Institute of Respiratory Diseases Dr. Emilio Coni [*Instituto Nacional de Enfermedades Respiratorias Dr. Emilio Coni*] showed that, in Argentina, 50% of healthcare services do not offer DOT access to the population and at least 1 in 10 cases abandons the treatment before it has been completed (15).

It is of vital importance to explore the factors influencing treatment adherence, bearing in mind the specific context of DOT implementation and its differential application in each healthcare service. To our knowledge, in Argentina no studies have been published that analyze in a systematic way the sociodemographic condition of patients with tuberculosis and the way this condition relates to the ability to adhere to treatment, depending on the kind of treatment administered.

The aim of this study was to analyze the sociodemographic characteristics of patients that were determinants of non-adherence in healthcare services of selected municipalities in the Metropolitan Area of Buenos Aires, Argentina. The purpose is to contribute information that may be used to improve the strategies of tuberculosis control in order to achieve better results in the adherence of healthcare services to the norms of the National Program and in the adherence of patients to the disease treatment and cure.

MATERIALS AND METHODS

The study was carried out in selected municipalities of the Sanitary Region VI of the Metropolitan Area of Buenos Aires. This sanitary region contains 13% of the total number of reported cases in the country.

Seven municipalities were selected (Almirante Brown, Avellaneda, Berazategui, Esteban Echeverría, Ezeiza, Lomas de Zamora and Quilmes) and the healthcare establishments providing anti-tuberculosis treatment to patients in each municipality were identified. In these municipalities, the rate of non-adherence to treatment in positive pulmonary cases was 13.46% (5.45%-19.16%) in the year 2007.

Study population

The target population was defined as the reported cases of pulmonary tuberculosis in patients residing in the previously mentioned municipalities, of 18 years of age or over, to whom the treatment would have been prescribed in the healthcare establishments of said municipalities during the year 2007. Patients under 18, patients referred to other healthcare establishments not included in the sample, patients that received most of the treatment while deprived of liberty (imprisoned) and patients with any type of intellectual, mental or physical disability that would impede administration of the survey were excluded.

Study design

A cross-sectional study was conducted using a quantitative methodology for the recollection and analysis of the information.

Through the registries of the National Tuberculosis Control Program and of the Sanitary Region VI, the patients diagnosed with tuberculosis during the year 2007 eligible to participate in the study were identified.

In this study, non-adherent patients were all eligible patients that did not adhere to the prescribed treatment. In accordance with the definition of non-adherence of the WHO and the National Program, a patient that had interrupted treatment for 60 or more consecutive days was defined as a non-adherent case (16-19). Adherent patients were those patients that complied with the treatment on a regular basis (19). Both adherent and non-adherent patients were selected from the notification database of the Sanitary Region VI.

The study protocol was approved by the Ethics Committee of each participating hospital. The healthcare team of each establishment made the first contact with patients via telephone in order to explain the study and to confirm the patient's address. The patients were later interviewed at that address by a survey team using a structured questionnaire, with the aim of collecting data regarding the sociodemographic and socioeconomic characteristics of the patients and their homes, as well as the characteristics of the treatment. During the personal interview, patients were requested to

verify their agreement to participate through an informed consent form. A pilot-test of the questionnaire was conducted with 10 patients (not included in this study) from the region studied.

Statistical Analysis

For data processing and analysis, the statistical package Stata/SE 9.0 was used. Frequency tables were made for each of the variables considered, comparing non-adherent and adherent patients. The Chi² test was used in order to evaluate the associations between variables. Univariate logistic regression was used to evaluate the individual effect of each of the independent variables on treatment adherence or non-adherence. Finally, a multivariate logistic regression analysis was conducted in order to determine if the sociodemographic characteristics and treatment method influence treatment adherence, controlling for the potential confounding effect of these variables. Only variables significant in the univariate analysis ($p < 0.05$) were incorporated in the multivariate analysis (household income level, water provision in the home, employment situation, type of service where the medical check-ups were conducted, type of service where the medication was picked up). Although the variable "type of service where the medications were picked up" was significant in the univariate analysis, it was not included in the final model due to the high level of collinearity with the variable "type of service where the medical check-ups were conducted." Only in two patients did the place where medication was picked up and the place where medical check-ups were conducted not coincide. In the multivariate analysis, a value of $p < 0.05$ was considered statistically significant. Odds ratio (OR) and confidence intervals of 95% (95%CI) were calculated.

Sociodemographic factors that were included in the analysis (both regarding the patient and the head of household) were: age, sex, level of education, occupational status, health coverage plan (yes/no), monthly average family income (up to 123 USD, between 124 and 245 USD, more than 245 USD), water provision inside the home (yes/no), flushing toilet (yes/no) and overcrowded living conditions (yes/no). Occupation was classified as follows: workers with social security

Table 1. Sociodemographic characteristics of patients with tuberculosis (non-adherent and adherent to treatment) from seven municipalities in the Sanitary Region VI. Metropolitan Area of Buenos Aires, Argentina, 2007.

Sociodemographic Characteristics	Non-adherent		Adherent		Total		p-value
	n	%	n	%	n	%	
SEX							
Female	17	44.7	40	47.1	57	46.3	
Male	21	55.3	45	52.9	66	53.7	
Total	38	100.0	85	100.0	123	100.0	NS
AGE							
18-24	11	28.9	18	21.2	29	23.6	
25-34	12	31.6	32	37.6	44	35.9	
35-64	13	34.2	24	28.2	37	30.1	
65 or over	2	5.3	11	12.9	13	10.6	
Total	38	100.0	85	100.0	123	100.0	NS
EDUCATIONAL LEVEL							
No schooling / incomplete primary school	8	21.1	25	29.4	33	26.8	
Complete primary school	12	31.6	20	23.5	32	26.0	
Complete secondary school	18	47.4	40	47.1	58	47.2	
Total	38	100.0	85	100.0	123	100.0	NS
HEALTH COVERAGE PLAN							
No	32	84.2	66	77.6	98	79.7	
Yes	6	15.8	19	22.4	25	20.3	
Total	38	100.0	85	100.0	123	100.0	NS
OCCUPATIONAL STATUS							
Active							
Employed	25	65.8	58	68.2	83	67.5	
Unemployed	4	10.5	7	8.2	11	8.9	
Inactive							
Housewife	3	7.9	9	10.6	12	9.8	
Retired	2	5.3	2	2.4	4	3.3	
Other	4	10.5	9	10.6	13	10.6	
Total	38	100.0	85	100.0	123	100.0	NS

Source: Own elaboration.

NS = Not significant.

benefits, workers without social security benefits (including self-employed workers) and inactive/unemployed. The characteristics of the treatment included in the analysis were: DOT (yes/no), type of healthcare establishment where the medical check-ups were conducted (primary healthcare center/hospital), type of healthcare establishment where the medication was picked up (primary healthcare center/ hospital).

RESULTS

In the year 2007, there were a total of 193 cases of tuberculosis in eligible patients residing

in the selected municipalities and treated in healthcare facilities located in the municipality where patients reside. Of these cases, 78 (40%) did not adhere to the anti-tuberculosis treatment whereas 115 (60%) did adhere to the treatment.

In total, 123 (64%) patients were surveyed, distributed in 38 non-adherent patients (31%) and 85 adherent patients (69%) (40 non-adherent patients and 30 adherent patients could not be located, mainly because of difficulties related to the record of their place of residence).

The sociodemographic characteristics of non-adherent and adherent patients and their homes can be observed in Table 1 and Table 2, which show that the differences in sociodemographic characteristics between non-adherent and

Table 2. Sociodemographic characteristics of the heads of household and of the homes of patients with tuberculosis (non-adherent and adherent to treatment) from seven municipalities in the Sanitary Region VI. Metropolitan Area of Buenos Aires, Argentina, 2007.

Sociodemographic Characteristics	Non-adherent		Adherent		Total		p-value	
	n	%	n	%	n	%		
HOUSEHOLD WATER SUPPLY								
Inside the home	22	57.9	68	81.0	90	73.8	0.007	
Outside of the home	16	42.1	16	19.0	32	26.2		
Total	38	100.0	84*	100.0	122	100.0		
TYPE OF BATHROOM								
Indoor flushing toilet	21	55.3	57	67.1	78	63.4	NS	
Waterless toilet or outhouse	17	44.7	28	32.9	45	36.6		
Total	38	100.0	85	100.0	123	100.0		
OVERCROWDED CONDITIONS								
Yes	4	10.5	6	7.1	10	8.1	NS	
No	38	89.5	79	92.9	113	91.9		
Total	38	100.0	85	100.0	123	100.0		
HOUSEHOLD INCOME LEVEL								
Up to 123 USD	17	44.7	16	19.3	33	27.3	0.014	
Between 124-245 USD	13	34.2	44	53.0	57	47.1		
More than 245 USD	8	21.1	23	27.7	31	25.6		
Total	38	100.0	83**	100.0	121	100.0		
HEALTH COVERAGE OF HEAD OF HOUSEHOLD								
Yes	32	84.2	57	67.1	89	72.4	0.049	
No	6	15.8	28	32.9	34	27.6		
Total	38	100.0	85	100.0	123	100.0		
OCCUPATIONAL STATUS OF HEAD OF HOUSEHOLD								
Active								
Employed	33	86.8	78	92.8	111	91.0	NS	
Unemployed	2	5.3	2	2.4	4	3.3		
Inactive								
Housewife	0	0.0	2	2.4	2	1.6		
Retired	2	5.3	2	2.4	4	3.3		
Others	1	2.6	0	0.0	1	0.8		
Total	38	100.0	84*	100.0	122	100.0		
EMPLOYMENT SITUATION								
Worker with social security benefits	2	5.3	16	18.8	18	14.6		NS
Worker without social security benefits	31	81.6	63	74.1	94	76.4		
Inactive or unemployed	5	13.2	6	7.1	11	9.0		
Total	38	100.0	85	100.0	123	100.0		

Source: Own elaboration.

NS = Not significant.

*1 No data, **2 No data.

adherent patients – 57 women (46%) and 66 men (54%) in all – were not statistically significant. The median age of non-adherent patients was 37 years old (SD=2.3) while the median age of adherent patients was 41 years old (SD=1.8), without statistically significant differences. Regarding the occupational status, most of the interviewed patients were working at the time that tuberculosis was

diagnosed (91%); nevertheless, only a minority of patients and employed heads of household had a job with social security benefits (14.6%). The majority of the interviewed patients (80%) did not have a health coverage plan. This percentage was 84% among non-adherent patients and 78% among adherent patients, but the differences were not statistically significant.

Table 3. Treatment and healthcare characteristics in patients with tuberculosis (non-adherent and adherent to treatment) from seven municipalities in the Sanitary Region VI. Metropolitan Area of Buenos Aires, Argentina, 2007.

Treatment and healthcare characteristics	Non-adherent		Adherent		Total		p-value
	n	%	n	%	n	%	
TREATMENT METHOD							
Self-administered treatment	37	97.4	84	98.8	121	98.4	
Directly Observed Treatment	1	2.6	1	1.2	2	1.6	
Total	38	100.0	85	100.0	123	100.0	NS
TYPE OF SERVICE WHERE MEDICATION WAS PICKED UP							
Hospital	31	81.6	52	61.2	83	67.5	
Primary Healthcare Center	7	18.4	33	38.8	40	32.5	
Total	38	100.0	85	100.0	123	100.0	0.026
TYPE OF SERVICE WHERE CHECK-UPS WERE CONDUCTED							
Hospital	31	81.6	51	60.0	82	66.7	
Primary Healthcare Center	7	18.4	34	40.0	41	33.3	
Total	38	100.0	85	100.0	123	100.0	0.022

Source: Own elaboration.

NS = Not significant.

Regarding the treatment characteristics of the 123 patients included in the study (Table 3), 98% received self-administered treatment. Only two patients (one non-adherent and one adherent) received DOT. Sixty-eight percent of the patients picked up the medication at the hospital and 33% at a primary healthcare center, with statistically significant variations between non-adherent and adherent patients (82% and 61%, respectively; $p < 0.05$). A similar distribution was observed with respect to the type of service where the patients had their medical check-ups.

In Table 4, the results of the univariate and multivariate analysis are shown. In the univariate analysis, the risk of non-adherence was greater for patients whose monthly income was less than 500 ARS (equivalent to 123 USD) (OR=3.1; 95%CI 1.1-8.7), and where the head of household had a job without social security benefits (OR=3.9; 95%CI 0.9-18.2) or was inactive or unemployed (OR=6.7; 95%CI 1.1-44.1). The risk of non-adherence to the treatment was greater in patients whose homes did not have an indoor water source than in those who had water provision within their homes (OR=3.1; 95%CI 1.3-7.1). Finally, the risk of non-adherence was greater in those patients that picked up the medication from the hospital than in those patients that picked it up from a primary

healthcare center (OR=2.8; 95%CI 1.1-7.1). An even greater risk was observed in those patients that had their medical check-ups at a hospital than in those who had it at a primary healthcare center (OR=3.7; 95%CI 1.3-9.0).

Only the variables significant in the univariate analysis were incorporated into the multivariate analysis (household income level, household water supply, occupational status, type of service where the medical check-ups were conducted, type of service where the medication was picked up).

In the multivariate analysis (Table 4), the variables that presented a statistically significant association with non-adherence to the treatment were: household water supply and type of healthcare facilities where the patient received medical check-ups. Patients whose homes did not have an indoor water supply were almost three times more likely to be non-adherent to treatment than those who lived in houses that did have an indoor water supply (OR=2.8; 95%CI 1.1-6.9). Additionally, those patients that had their medical check-ups at a hospital had a risk of not adhering to the treatment three times greater than those who had the check-ups at primary healthcare centers (OR=3.2; 95%CI 1.1-8.9).

Table 4. Sociodemographic characteristics of patients with tuberculosis and characteristics associated with non-adherence to the treatment. Univariate and multivariate logistic regression. Seven municipalities in the Sanitary Region VI, Metropolitan Area of Buenos Aires, Argentina, 2007.

Sociodemographic and treatment characteristics	Univariate Analysis			Multivariate Analysis		
	OR	95%CI	p-value	OR	95%CI	p-value
HOUSEHOLD INCOME LEVEL						
More than 245 USD	1	-	-	1	-	-
Between 124-245 USD	0.8	(0.3; 2.3)	NS	-	-	NS
Up to 123 USD	3.1	(1.0; 8.7)	0.038	2.4	(0.9; 8.7)	0.05
WATER SUPPLY WITHIN THE HOME						
Yes	1	-	-	1	-	-
No	3.1	(1.3; 7.1)	0.009	2.8	(1.1; 6.9)	0.031
HEALTH COVERAGE OF HEAD OF HOUSEHOLD						
Yes	1	-	-	-	-	-
No	2.6	(0.9; 6.9)	0.05	-	-	-
EMPLOYMENT SITUATION						
Worker with social security benefits	1	-	-	-	-	-
Worker without social security benefits	3.9	(0.9; 18.2)	NS	-	-	NS
Inactive or unemployed	6.7	(1.1; 44.1)	0.04	-	-	NS
TYPE OF SERVICE WHERE THE MEDICATION WAS PICKED UP						
Primary Healthcare Center	1	-	-	-	-	-
Hospital	2.8	(1.1; 7.1)	0.029	-	-	0.5
TYPE OF SERVICE WHERE CHECK-UPS WERE CONDUCTED						
Primary Healthcare Center	1	-	-	1	-	-
Hospital	3.7	(1.3; 9.0)	0.014	3.2	(1.3; 8.9)	0.028

Source: Own elaboration.

NS = Not significant. OR = Odds ratio. 95%CI = 95% Confidence Interval

DISCUSSION

To our knowledge, this is the first time the sociodemographic condition of patients with tuberculosis, and the way in which this condition influences their ability to adhere to treatment, has been analyzed in a systematic way in Argentina. The main result of this study is that in the population analyzed, the water supply in the patients' households and the establishment in which medical check-ups regarding the treatment are carried out are determinants of adherence. The patients that live in households without an indoor water supply, and those who have medical check-ups at hospitals (in contrast to those who have them at primary healthcare centers) are the patients with greater risk of not adhering to the treatment. An important finding of our study is that, although in Argentina the administration of DOT is recommended, 98% of the analyzed population received self-administered treatment

and only two patients (one non-adherent and one adherent) received DOT.

In Argentina, the lack of an indoor water supply is considered an indicator of structural poverty and is one of the essential services that a household must have according to the National Institute of Statistics and Censuses [*Instituto Nacional de Estadísticas y Censos*] (20). The association found in our study between the lack of an indoor water supply, as an indicator of poverty, and adherence to the treatment, is supported by the fact that patients with lower income were two times more likely to not adhere to the treatment. The fact that this increase in the risk of non-adherence for patients of lower income was not statistically significant could have been due to the small size of the sample. These results overall would indicate that the deficient living conditions of the patients negatively influence their ability to adhere to the treatment. The relationship between the socioeconomic level and non-adherence to tuberculosis treatment has been analyzed in a variety of studies conducted

Table 5. Comparison of the sociodemographic characteristics of patients with tuberculosis (adherent and non-adherent to treatment) according to their participation in the study. Seven municipalities in the Sanitary Region VI, Metropolitan Area of Buenos Aires, Argentina, 2007.

Sociodemographic characteristics	Non-adherent patients (n=78)		Adherent patients (n=115)		p-value
	Surveyed (n=38)	Not surveyed (n=40)	Surveyed (n=85)	Not surveyed (n=30)	
Median age (standard deviation)	37 (2.3)	36 (2.5)	41 (1.8)	35 (2.3)	NS
SEX					
Female	31.6%	25.0%	50.6%	60.0%	NS
Male	68.4%	75.0%	49.4%	40.0%	

Source: Own elaboration.

NS = Not significant.

in different countries and regions (5,6,21-24). In a study conducted in Spain in a group of seropositive patients with tuberculosis, it was observed that residing in an area with a low socioeconomic level implied 1.6 times higher risk of non-adherence to the treatment (21). For Cáceres and Orozco (23), who analyzed in Colombia a cohort of patients under DOT, that risk is even greater: according to these authors, patients with a low socioeconomic level are almost four times more likely to abandon anti-tuberculosis treatment than patients with higher socioeconomic levels. Galiano and Montesinos (24) found, in a study conducted in Chile, that the risk of abandoning treatment is almost two times higher in patients without an income. In a study conducted in Nicaragua (6), other factors indicative of a precarious socioeconomic situation such as being homeless or undergoing frequent changes in place of residence were found to be associated with treatment dropout. In a study by Mishra *et al.* (5), in Nepal, patients with a low annual income were five times more likely not to adhere to the treatment than those with middle or high incomes. In these studies, the authors found that even though the treatment is free, a low socioeconomic level negatively influences treatment adherence due to the cost of transportation to the healthcare center and the cost in income due to the lost workday (5,6,20).

In our study, the fact that the treatment for tuberculosis is free suggests that factors other than the cost of treatment are influencing the greater non-adherence in patients with a low socioeconomic level. A study conducted in Argentina (25) regarding treatment adherence in patients with cancer showed that one of the main factors

reducing adherence was the loss of income resulting from the interruption of work activities during the treatment when workers lack social security benefits. As a consequence, the household income level is reduced, and the patient has difficulties affording transportation costs to the hospital and other treatment-related costs (25). Therefore, in the context of great informality in employment and low household income levels, without social security benefits, the ability to comply with the treatment is reduced, because for the patient it implies the loss of workdays and consequently, the loss of basic income, as is also shown in the study by Balasubramanian *et al.* (26). In our study, the fact that workers lacking social security benefits had a probability almost four times greater of non-adherence to the treatment (a result not statistically significant) suggests that the vulnerability to the economic impact of the disease could be influencing non-adherence, especially in patients with a low socioeconomic level. Indeed, the study by Mishra *et al.* (5) highlights the influence of unemployment as well as of precarious employment in non-adherence, along with low income and the cost of transportation. In that regard, the authors mention that these difficulties are deepened by the cost implied in attending healthcare centers, especially in relation to income loss. This coincides with the results found in O'Boyle's study (11) regarding the transportation time required to attend healthcare services. The authors mention that the time it takes to reach the healthcare services could imply taking time out of the workday, with the consequent loss of income, which may explain the greater number of employed people among non-adherent patients (11).

Our study found that despite the National Tuberculosis Control Program's suggestions regarding the administration of DOT, in the selected healthcare services the administration of DOT is low (2%). The results show that in a context of mostly self-administered treatment, the patients that pick up medication and receive medical check-ups at hospitals have a higher risk of non-adherence to the treatment. This coincides with the results of a study conducted in Sudan that found greater treatment adherence among the patients receiving treatment at primary healthcare centers in comparison to those being treated in hospitals (27). The main conclusion was that the closer the patient's home to the healthcare center, the better the adherence to the treatment (27). Other studies have also shown that the more the patient has to travel in order to receive treatment, the less likely he or she is to keep up the treatment continuously (11,28-31). In Argentina, primary healthcare centers constitute the first link in the chain of care. The importance of these centers is that their distribution facilitates the population's access to primary healthcare services, thus reducing some of the geographical barriers to healthcare access (32,33). The proximity of the centers to the patients' place of residence could therefore be one of the factors explaining the greater adherence among those receiving medical check-ups in that type of healthcare establishment. Nevertheless, it is important to highlight that the studies that have found a relationship between adherence and distance to the healthcare facility have been implemented in DOT contexts, in which the patient has to travel every day in order to take the medication under the supervision of the healthcare professional. The difficulties related to the organization of higher complexity hospitals (high demand, insufficient staff, long waits, less personalized care) could also be playing a role in the lower adherence observed at higher complexity hospitals.

Although we consider it crucial to analyze how DOT influences the ability to adhere to treatment within the context of the healthcare system in Argentina, it was not possible to conduct this analysis in our study due to the low percentage of patients under DOT (2%). Our data shows that in the selected healthcare services, belonging to one of the main sanitary regions of the province of Buenos Aires, the national

recommendations regarding DOT administration are not followed in full (34). The results of this study indicate that the obstacles impeding the programmatic implementation of DOT in these services should be defined and analyzed.

We consider this study to have some methodological limitations that are important to mention. First, our study may be affected by a greater nonresponse rate in non-adherent than in adherent patients, which would imply a selection bias. Indeed, 51% of the cases and 26% of controls could not be interviewed due to problems related to the lack of information regarding their address and 17% of the patients could neither be found personally nor by phone. This coincides with other studies that have also shown greater difficulty in tracking down patients that did not adhere to the treatment (11,29). In our study, the sociodemographic characteristics of adherent and non-adherent patients were compared based on their participation in the study, and the differences were not significant (Table 5).

However, although 64% (n=123) of eligible patients (n=193) were interviewed, the population of eligible patients in our study only constitutes 32% of the total number of patients with tuberculosis in these municipalities. This is due to the high percentage of patients that receive treatments in hospitals located in other jurisdictions of the Metropolitan Area of Buenos Aires. Consequently, our results cannot be generalized to all patients with tuberculosis in the selected municipalities. Lastly, only one patient did not agree to participate in our study, which resulted in a rate of participation close to 100%.

We consider that our study contributes to the identification of factors related to the sociodemographic characteristics of patients that influence adherence to treatment. As a conclusion, our results show that the decentralization of the treatment to the first level of healthcare would contribute to increasing patient adherence to treatment, probably by reducing healthcare access barriers in the services where the treatment and the check-ups are provided. Social security benefits protecting the most vulnerable patients should be considered a priority within the strategies of disease control, in order to reduce the obstacles to treatment adherence.

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BIBLIOGRAPHIC REFERENCES

1. Instituto Nacional de Enfermedades Respiratorias "Dr. Emilio Coni". Notificación de casos de tuberculosis en la República Argentina: Período 1980-2009. Buenos Aires: Ministerio de Salud, Presidencia de la Nación; 2010.
2. Center for Diseases Control. Core curriculum on tuberculosis: What the clinician should know. 4th ed. Atlanta: US Department of Health & Human Services; 2000.
3. Comolet T, Rakotomalala R, Rajaonarivoa H. Factors determining compliance with tuberculosis treatment in an urban environment, Tamatave, Madagascar. *International Journal of Tuberculosis and Lung Disease*. 1998;2(11):891-897.
4. 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* [Internet]. 2004;4(68) [cited 12 Aug 2012]. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC545081/>.
5. Mishra P, Hansen E, Sabroe S, Kafle K. Socio-economic status and adherence to tuberculosis treatment: a case-control study in a district of Nepal. *International Journal of Tuberculosis and Lung Disease*. 2005;9(10):1134-1139.
6. Sosa Pineda N, Pereira S, Barreto M. Abandono del tratamiento de la tuberculosis en Nicaragua: resultados de un estudio comparativo. *Revista Panamericana de Salud Pública*. 2005;17(4):271-278.
7. Shargie E, Lindtjørn B. Determinants of treatment adherence among smear-positive pulmonary tuberculosis patients in southern Ethiopia. *PLoS Medicine* [Internet]. 2007;4(2) [cited 12 Aug 2012]. Available from: <http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.0040037>.
8. Hasker E, Khodjikhonov M, Usarova S, Asamidinov U, Yuldashova U, van der Werf M, Uzakov G, Veen J. Default from tuberculosis treatment in Tashkent, Uzbekistan; Who are these defaulters and why do they default? *BMC Infectious Diseases* [Internet]. 2008 [cited 12 Aug 2012];8(97). Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2492865/>.

9. Sumartojo E. When tuberculosis treatment fails: A social behavioral account of patient adherence. *American Review of Respiratory Disease*. 2003;147(5):1311-1320.
10. Farmer P. Social scientists and the new tuberculosis. *Social Science & Medicine*. 1997;44(3):347-358.
11. O'Boyle S, Power J, Ibrahim M, Watson J. Factors affecting patient compliance with anti-tuberculosis chemotherapy using the directly observed treatment short-course strategy (DOTS). *International Journal of Tuberculosis and Lung Disease*. 2002;6(4):307-312.
12. Singh V, Jaiswal A, Porter J, Ogden J, Sarin R, Sharma PP, Arora VK, Jain RC. TB control, poverty, and vulnerability in Delhi, India. *Tropical Medicine & International Health*. 2002;7(8):693-700.
13. Instituto Nacional de Enfermedades Respiratorias "Dr. Emilio Coni". Resultado del tratamiento de la tuberculosis pulmonar ED (+) en la República Argentina. Período 1980-2009. Buenos Aires: Ministerio de Salud, Presidencia de la Nación; 2010.
14. World Health Organization. The stop TB strategy: Building on and enhancing DOTS to meet the TB-related millennium development goals (WHO/HTM/TB/2006.368). Geneva: WHO; 2006.
15. Instituto Nacional de Enfermedades Respiratorias "Dr. Emilio Coni". Evaluación de tratamiento de los casos de tuberculosis pulmonar Examen Directo positivo en la República Argentina. Buenos Aires: Ministerio de Salud, Presidencia de la Nación; 2006.
16. World Health Organization. WHO Tuberculosis Programme: Framework for effective Tuberculosis control (WHO/TB/94.179). Geneva: WHO; 1994.
17. World Health Organization. Treatment of tuberculosis: guidelines for national programmes (WHO/CDS/TB/2003.313). 3th ed. Geneva: WHO; 2003.
18. World Health Organization. WHO Report 2007 Global tuberculosis control: surveillance, planning, financing (WHO/HTM/TB/2007.376). Geneva: WHO; 2007.
19. Zerbini EV, Darnaud RMH, Prieto VG. Programa Nacional de Control de la Tuberculosis: Normas Técnicas 2008. 3ra ed. Santa Fe: Instituto Nacional de Enfermedades Respiratorias "Dr. Emilio Coni"; 2008.
20. Instituto Nacional de Estadísticas y Censos. Vivienda, hogares y hábitat [Internet]. Buenos Aires: INDEC [cited 12 Aug 2012]. Available from: http://www.indec.gov.ar/principal.asp?id_tema=75.
21. Galdós-Tangüis H, Caylá JA, García de Olalla P, Jansá JM, Brugal MT. Factors predicting non-completion of tuberculosis treatment among HIV-infected patients in Barcelona (1987-1996). *International Journal of Tuberculosis and Lung Disease*. 2000;4(1):55-60.
22. Culqui D, Grijalva C, Reategui S, Cajo J, Suárez L. Factores pronósticos del abandono del tratamiento antituberculoso en una región endémica del Perú. *Revista Panamericana de Salud Pública*. 2005;18(1):14-20.
23. Cáceres F, Orozco L. Incidencia y factores asociados al abandono del tratamiento antituberculoso. *Revista Biomédica*. 2007;27(4):498-504.
24. Galiano M, Montesinos N. Modelo predictivo de abandono del tratamiento antituberculoso para la región Metropolitana de Chile. *Enfermería Clínica*. 2005;15(4):192-198.
25. Arrossi S, Matos E, Zengarini N, Roth B, Sankaranarayanan R, Parkin M. The socio-economic impact of cervical cancer on patients and their families in Argentina, and its influence on radiotherapy compliance: Results from a cross-sectional study. *Gynaecologic Oncology*. 2007;105(2):335-340.
26. Balasubramanian R, Garg R, Santha T, Gopi PG, Subramani R, Chandrasekaran V, Thomas A, Rajeswari R, Anandakrishnan S, Perumal M, Niruparani C, Sudha G, Jaggarajamma K, Frieden TR, Narayanan PR. Gender disparities in tuberculosis: report from a rural DOTS programme in south India. *International Journal of Tuberculosis and Lung Disease*. 2004;8(3):323-332.
27. El-Sony A, Mustafa S, Khamis A, Enarson D, Baraka O, BJune G. The effect of decentralization on tuberculosis services in three states of Sudan. *International Journal of Tuberculosis and Lung Disease*. 2003;7(5):445-450.
28. Farmer P, Robin S, Ramilus SL, Kim J. Tuberculosis, poverty, and "compliance": lessons from rural Haiti. *Seminars in Respiratory Infections*. 1991;6(4):373-379.
29. Naing N, D'Este C, Isa A, Salleh R, Bakar N, Mamad M. Factors contributing to poor compliance with anti-TB treatment among tuberculosis patients. *Southeast Asian Journal of Tropical Medicine and Public Health*. 2001;32(2):369-382.

30. Thomas C. A literature review of the problems of delayed presentation for treatment and non-completion of treatment for tuberculosis in less developed countries and ways of addressing these problems using particular implementations of the DOTS strategy. *Journal of Management in Medicine*. 2002;16(4-5):371-400.
31. Mateus-Solarte J, Carvajal-Barona R. Factors predictive of adherence to tuberculosis treatment: Valle del Cauca, Colombia. *International Journal of Lung Disease*. 2008;12(5):520-526.
32. Maceira D, Olaviaga S, Kremer P, Cejas C. Centros de Atención Primaria de la Salud: radiografía de su distribución en la Argentina (Serie Políticas Públicas Análisis N° 30). Buenos Aires: CIPPEC; 2006.
33. Bascolo E, Yavich N, Urquía M. Capacidades locales de gestión como factor predictivo de la utilización y accesibilidad a los servicios de primer nivel para la obtención de cuidados prenatales. *Gerencia y Políticas de Salud*. 2006;6(12):119-195.
34. Ministerio de Salud de La Nación. Programa Nacional de Control de la Tuberculosis: normas técnicas 2009. 3ra ed. Buenos Aires: Ministerio de Salud; 2009.

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