

Original Article

Directly observed therapy using home-based supervisors for treating tuberculosis in Vitória, Brazil*

Tratamento supervisionado em pacientes portadores de tuberculose utilizando upervisores domiciliares em Vitória, Brasil

Ethel Leonor Noia Maciel¹, Ana Paula Silva², Waleska Meireles², Karina Fiorotti², David Jamil Hadad³, Reynaldo Dietze⁴

Abstract

Objective: To evaluate the use of family members as supervisors of directly observed therapy (DOT) in patients with tuberculosis. **Methods:** This was a prospective descriptive study involving patients diagnosed with pulmonary tuberculosis. The sample comprised 98 patients. A standardized protocol was implemented in order to train the patient and their families. After the training, the patient was allowed to choose either a family member or a health care worker as a supervisor. Absolute and relative frequencies were used in descriptive data analysis. **Results:** A family member supervisor was chosen by 94 patients (96%). The cure rate was 99%. The partner was chosen by 49% of the patients, and other family members were chosen by 28%. The health care team needed to take over DOT in 3% of the cases. Regular attendance at follow-up appointments was 67%. It was observed that 24% of the problems in this DOT model referred to the family supervisor forgetting to administer the medication or to the patient forgetting to take it; 39% of the patients forgot to take the medication for one day, and 31% forgot to take it for two days. There was change of supervisor in 9% of the sample, medication was lost by the patient sometime during treatment in 9%, and patient drug intolerance occurred in 8%. **Conclusions:** DOT supervised by a family member has proven an effective and low-cost technique. However, compliance is not due to one single factor but to the combination of strategies adopted: bus passes; educational measures and especially the individualized approach.

Keywords: Directly observed therapy; Tuberculosis; Patient compliance.

Resumo

Objetivo: Avaliar a utilização de supervisores domiciliares para dose supervisionada do tratamento(DOT), em pacientes portadores de tuberculose. **Métodos:** Trata-se de um estudo descritivo prospectivo com amostra composta por pacientes com diagnóstico de tuberculose pulmonar. Participaram deste estudo 98 pacientes. Um protocolo de capacitação do paciente e sua família foi implementado. Após este treinamento, o paciente poderia escolher entre um supervisor domiciliar e um profissional de saúde. Os métodos de análise descritiva utilizados foram a frequência absoluta e relativa. **Resultados:** Um supervisor familiar foi escolhido por 94 pacientes (96%). O percentual de cura foi de 99%. O parceiro foi escolhido por 49% e algum outro familiar o foi por 28% dos pacientes. A equipe de pesquisa precisou assumir o DOT em 3% dos casos. O comparecimento regular para a supervisão foi de 67%. Verificou-se que 24% dos problemas encontrados neste modelo de DOT referiram-se ao esquecimento em administrar ou tomar as medicações, por parte do supervisor e do paciente, respectivamente, sendo que 39% dos pacientes deixaram de tomar a medicação por um dia e 31% esqueceram-se de tomá-la por dois dias durante o tratamento. Houve troca de supervisor em 9% da amostra, perda de medicação pelo paciente em algum momento do tratamento em 9% e intolerância do paciente à medicação em 8%. **Conclusões:** O DOT supervisionado pelo familiar mostrou-se eficaz e de baixo custo. No entanto, a adesão ao tratamento não deve a um só fator, mas ao conjunto de medidas adotadas: vale transporte; ações educativas; e, principalmente, a abordagem individualizada.

Descritores: Terapia diretamente observada; Tuberculose; Cooperação do paciente.

* Study carried out at the Infectious Diseases Center of the Federal University of Espírito Santo – Vitória, Brazil.

1. Coordinator of the Clinical Research Center. Cassiano Antônio de Moraes University Hospital, Vitória, Brazil.

2. Nurse at the Clinical Research Center. Cassiano Antônio de Moraes University Hospital, Vitória, Brazil.

3. Clinical Coordinator of the Clinical Research Center. Cassiano Antônio de Moraes University Hospital, Vitória, Brazil.

4. Coordinator of the Infectious Diseases Center. Federal University of Espírito Santo, Vitória, Brazil.

Correspondence to: Ethel Leonor Noia Maciel. Núcleo de Doenças Infeciosas/Centro de Ciências da Saúde/UFES, Av. Marechal Campos, 1468, Maruípe, CEP 29040-091, Vitória, ES, Brasil.

TEL 55 27 3335-7210. E-mail: emaciel@ndi.ufes.br

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Introduction

The problem of tuberculosis in Brazil reflects the stage of social development in the country, in which the determinants of poverty (malnutrition; poor sanitary conditions; high population density; weaknesses in the health care system; and poor management) have limited the use of technology and have therefore inhibited any sustained decrease in the incidence of the disease.⁽¹⁻³⁾

The *Programa Nacional de Controle da Tuberculose* (PNCT, National Tuberculosis Control Program), inaugurated by the Brazilian National Ministry of Health in 1999, defines tuberculosis as a priority among health governmental policies and establishes guidelines for related interventions. Efficient control of tuberculosis is based on two pillars: early detection of cases; and treatment, which leads to the cure of patients. Among the strategies stipulated by the PNCT for the control of the disease, directly observed therapy (DOT) is the only strategy that has been proven to be efficacious.⁽³⁻⁵⁾

Brazil was the global leader in the utilization of short-course treatment regimens for tuberculosis in public health programs more than a decade before the use of such regimens was recommended by the World Health Organization (WHO). Not only has the treatment model changed, but one of the aspects of the strategy of tuberculosis control, integrating it into basic health activities, has changed as well. This reorganization of the paradigm has made it possible to reduce treatment duration and simplify treatment, which facilitated the access to diagnostic methods and therapy, increasing the population coverage of the program.⁽⁶⁾

A review published in 1998 identified and included 5 clinical trials, 12 prospective studies without control groups, 7 retrospective studies, 2 case-control studies and a cross-sectional study on DOT.⁽⁷⁾ Among those studies, the completion rate ranged from 86 to 96.5%, and the rate of recurrence ranged from 0 to 11%. Nine of the studies used unsupervised strategies and obtained a completion rate of 41.9 to 82%, with a recurrence rate from 2.1 to 4.5%. Among those 9 studies, there were 2 in which the DOT strategy was found to have a higher cost-effectiveness ratio than did the self-administered treatment.⁽⁷⁾

Places such as Mongolia, Cambodia, the United Republic of Tanzania, the United States, China,

Peru, Bangladesh and Nepal have adopted the DOT strategy. Worldwide, over 1.2 million people have received this kind of treatment, achieving cure at a rate of approximately 80%, thereby improving epidemiological markers. Countries which had presented cure rates below 50% currently present rates between 80 and 95%.^(5,8,9)

Experiences with the DOT strategy in Brazil—in states such as Paraíba, in cities such as Rio de Janeiro and in several cities within the state of São Paulo—have achieved positive results in terms of organization, greater patient compliance with treatment and lower rates of treatment abandonment.⁽⁷⁾

The implementation of DOT proposed by the WHO and by the Brazilian National Ministry of Health aims to guarantee the end of the treatment and, therefore, cure. However, it has encountered some problems, such as patient working hours incompatible with the initiation of activities of the health care facility, incompatible initiation hours of community health agent activities, lack of access to transportation and inadequate number of employees to carry out DOT. The solution to such problems was to adapt the model proposed by the PNCT to the needs of each facility, including members of the family, duly trained in performing DOT, as supervisors.^(7,10,11)

Table 1 – Sociodemographic characterization of individuals with pulmonary tuberculosis included in the study.

Variable	n	%
Education		
None	57	59
Elementary school	24	24
High school	14	14
College	3	3
Age		
18-20	7	7
21-50	82	84
51-60	9	9
Gender		
Male	63	64
Female	35	36
City		
Serra	27	27
Cariacica	25	26
Vila Velha	22	23
Vitória	17	17
Other cities	4	4
Viana	3	3

In view of these facts, the objective of this study was to evaluate whether duly trained members of the community and family members of patients diagnosed with tuberculosis could be home-based supervisors of the DOT strategy.

Methods

This was a descriptive prospective study involving a sample of patients diagnosed with pulmonary tuberculosis.

The study was conducted at the Cassiano Antônio de Moraes University Hospital, in the *Centro de Pesquisa Clínica* (CPC, Clinical Research Center), in the city of Vitória, located in the state of Espírito Santo.

A total of 98 patients with an initial diagnosis of pulmonary tuberculosis were eligible and started treatment in the period from January of 2003 to June of 2005.

This sample comprises patients who agreed to participate in the study protocol and gave written informed consent. The study protocol was approved by the Ethics in Research Committee of the Federal University of Espírito Santo Health Sciences Center. To be included in this study, patients had to be willing to receive the supervised anti-tuberculosis treatment. They could choose from the open regimens offered by the center, which means that doctors and patients alike would know which medications would be used. Patients who were eligible for the study could choose between two regimens: regimen I (the supervisor would be a family member or someone from the community); and regimen II (the supervisor would be a member of the CPC team).

All patients received a monthly kit with medication (after weight was determined), a card on which to record the medication taken, transportation passes, barrier protection (for women) and a pen with which to mark the card.

In addition to the monthly visits, weekly visits were scheduled for each of the patients and their respective supervisors. On weekly supervision follow-up evaluations, the objectives were to look for evidence of noncompliance with treatment, defined in this study as not taking the medication, and to identify adverse effects of the medication. The medications were also checked, and the daily kits were counted. A 14-day form was prepared,

with space for the signatures of the home-based supervisor and of the patient. Therefore, it was necessary to fill out two cards per month (the form used to check the medication; and the DOT card).

The medications were separated into 28 daily kits and sealed. The tuberculostatic drugs were to be taken in a single dose, with water, on an empty stomach. The fast was to be maintained for 2 h after ingestion.

The DOT protocol comprised 3 steps, as follows:

- Step 1 – Patient approach, explanation regarding tuberculosis, dose schedule of the medication, choice of the DOT regimen and home-based supervisor, according to the case
- Step 2 – Confirmation of patient eligibility, scheduling of follow-up visit for patient and supervisor for the day of treatment initiation
- Step 3 – Explanation regarding tuberculosis, dose schedule of tuberculostatic drugs and DOT routine, as well as instructions to the home-based supervisor on how to fill out the card and reinforcement of counseling previously given to the patient

The information collected was codified and stored in an Excel spreadsheet, and the data were later analyzed using the STATA 9 program (StataCorp LP, College Station, TX, USA).

All variables studied were categorical. The descriptive analysis included absolute and relative frequencies.

Table 2 – Characterization of regimens and treatment result of individuals with pulmonary tuberculosis.

Variable	n	%
Type of regimen		
Regimen I – home-based supervisor	94	96
Regimen II - health care worker as supervisor	0	0
Other	4	4
Total	98	100
Treatment result		
Cure	97	99
Treatment abandonment	0	0
Death during treatment	0	0
Transfers requested by the patient	0	0
Cure without compliance with DOT	1	1
Total	98	100

DOT: directly observed therapy.

Results

The analysis of the distribution of level of education showed that 59% of the patients had no schooling. Analysis of age brackets showed that the incidence of the disease is highest among individuals between 21 and 50 years of age, and that it predominantly affects males (67%). As can be seen in Table 1, the cities of patient residence accounting for the greatest proportions of the sample were Serra (27%), Cariacica (26%) and Vila Velha (23%).

Regimen I was chosen by 94 patients (96%). The cure rate was 99%. Only one patient did not comply with the DOT. There were no cases of treatment abandonment, death, patient request for transfer or patient request to be dismissed from the study (Table 2).

In relation to the characterization of the home-based supervisor, 49% of the patients chose partners or children, and 28% chose another family member. Another 20% of the patients chose other members of the community, such as neighbors and friends, as their home-based supervisors. In 3% of the cases of patients who chose regimen I, the CPC team had to take over the DOT after the initiation of treatment.

We observed that 67% of the patients presented regular attendance at the outpatient clinic for weekly supervision. Only 2% of the patients opted for supervision out of the outpatient clinic or presented conditions that made supervision in or out of the facility impossible (Table 3).

As can be observed in Table 4, 23 (24%) of the patients evaluated in this DOT model presented problems due to the supervisor forgetting to administer the medications or to the patient forgetting to take the medications. Of these 23 patients, 9 (39%) missed one day of medication and 7 (31%) missed 2 days.

There was a change of supervisors in 9 cases (9% of the sample), and another 9 patients (9%) lost their medication at some point during the treatment period. Only 8 patients (8%) presented drug intolerance. Misunderstandings with the supervisor were observed in 45% of the study sample, and supervisors were changed in 33%.

The principal complaints reported by the patients were as follows: pruritus (16%); headache (12%); nausea/queasiness (10%); acne/chest pain (7%); abdominal pain/arthralgia (6%); and vomiting/dizziness (5%).

Table 3 - Characterization of the compliance with weekly supervision.

Variable	n	%
Regular attendance at medical appointments (two to three appointments)	65	67
Irregular attendance at medical appointments	20	21
Outpatient supervision interspersed with family supervision	4	4
No supervision/DOT conducted by the team	4	4
Weekly supervision at home or at work	2	2
Outpatient supervision not possible	2	2
Total	98	100

DOT: directly observed therapy.

We observed that 50 out of 97 sputum smear microscopies were negative before treatment initiation, although cultures were positive em 100% (Table 5).

Negative conversion of positive sputum smear microscopies occurred in decreasing order, 100% of all samples being positive at treatment onset, 21% being positive in month 2 and 0% being positive in the month 3. However, 2% of all sputum smear microscopies were positive in the months 5 and 6. Cultures converted from positive to negative in 47% after one month of treatment and in 6% from the month 1 to month 2. However, subsequent cultures, for all patients, were negative.

Discussion

The social situation becomes evident when we analyze the level of education in the population studied, indicating that the incidence of tuberculosis continues to be higher in the underprivileged population.⁽¹⁰⁾

In a longitudinal study involving 800 children undergoing outpatient treatment, compliance with treatment was not found to be associated with level of education or socioeconomic level.⁽¹²⁾ In our study, this factor was also not fundamental to compliance.

The highest incidence of the disease was observed in the younger, economically productive age bracket (between 21 and 50 years), and males predominated, both of which are findings that are in agreement with those of other studies.^(10,13)

In addition, nationwide studies conducted in Brazil, as well as international studies, have shown that the incidence of treatment abandonment is

Table 4 – Characterization of the problems encountered during the treatment of individuals with pulmonary tuberculosis.

	n	%
Forgetting to administer the medication (supervisor) or forgetting to take the medication (patient)	23	24
Change of home-based supervisor	10	10
Loss of medication during treatment	9	9
Drug intolerance	8	8
Marking the card without taking the medication	4	4
DOT taken over by the staff due to patient emotional instability, lack of a supervisor or inability of the family members	4	4

lower among tuberculosis patients in supervised treatment programs.^(9,10,12) The proposal of the supervised treatment strategy is to ensure compliance with the treatment, since it requires that patients be supervised when they take antituberculosis drugs.⁽¹⁴⁾ The great advantage of supervised treatment is that it identifies the problem of treatment abandonment at its inception, which creates the opportunity to take immediate corrective action. In contrast, when treatment is unsupervised, treatment abandonment typically becomes apparent only when patients fail to collect their medications, miss their medical appointments or admit to not taking the prescribed medication, which results in a delay in intervention by the health care team.

Surveys conducted in order to determine whether family members would be good choices for supervising the patient during treatment were shown to be satisfactory and increased patient compliance with treatment. The utilization of home-based supervisors in Thailand resulted in an improvement in cure rates from 60%, in 1995, to 80.4%, in 1996.^(15,16)

In one study, it was reported that the participation of the family was important to the patient, thanks to the connection and support during treatment, and this was a fundamental factor for compliance with treatment.⁽¹⁷⁾

Despite the advantages offered by the participation of the family member as a home-based supervisor, difficulties were found in some cases, which resulted in changing the previously chosen home-based supervisor.

In the study conducted in Thailand, in addition to using a family member for the conduction of DOT, a member of the team made home visits to the patient and to the patient supervisor. Visits were made once a week in the initial stage of the treatment and once a month until the end of the treatment, with satisfactory results.⁽¹⁶⁾

In the present study, patient follow-up was not made at home; it was conducted weekly at an outpatient clinic. This model proved efficient and decisive in identifying problems regarding adverse effects of medication and problems resulting from the interaction between patient and supervisor. Therefore, the necessary changes could be made without compromising the treatment or the progress of the study.

Although there was a 21% rate of irregular attendance at the health care facility for the weekly supervision, this did not affect compliance with treatment.

The daily kits were counted during the weekly supervision at the outpatient clinic, which allowed us to determine compliance with treatment. One longitudinal multicenter study carried out in Brazil tested the efficacy of the daily and intermittent treatment regimen in a group of 544 patients with tuberculosis and concluded that it is possible to monitor compliance with treatment through pill counting in patients with prescribed medication.⁽¹⁸⁾

The medication lost, as was determined in the counting, was immediately replaced, and the surplus of daily kits revealed that forgetfulness was the reason most often given for not taking the medications. One study conducted in Bauru, São Paulo, determined that forgetfulness correlates with improvement of the initial profile, resulting in decreased self-care on the part of the patient.

Upon the early identification of interruptions during the weekly visitations, the medical team reinforced the instructions previously given to the patient on the importance of not forgetting to take the tuberculostatic drugs and on the consequences of this interruption.

The side effects presented by the patients resulted in extra visits to the sector aiming at the resolution of their complaints. The most common complaints were as follows: pruritus; symptoms related to the gastrointestinal tract (nausea, vomiting and abdominal pain); chest pain; arthralgia; and dizziness. All

Table 5 – Characterization of sputum smear microscopy and sputum culture results of patients with pulmonary tuberculosis during the 6 months of treatment.

	Initial	Mo. 1	Mo. 2	Mo. 3	Mo. 4	Mo. 5	Mo. 6
Negative sputum smear microscopy	50	87	94	96	96	96	96
Positive sputum smear microscopy	47	10	3	0	0	1	1
Not performed	0	0	0	1	1	0	0
Other	0	3	0	0	0	0	0
Negative culture	0	49	91	96	96	97	97
Positive culture	97	46	6	0	0	0	0
Contaminated culture	0	2	0	1	1	0	0
Culture in progress	0	0	0	0	0	0	0
Total	97	97	97	97	97	97	97

Mo.: month.

of these are among the expected side effects of tuberculostatic drugs.

Symptoms such as dizziness, visual disorders and depression led the medical team to recommend that the patient withdraw from hazardous professional activities, to refer the patient to an ophthalmologist (within two weeks, at most) and to recommend psychotherapy, respectively. There are no reports in the literature of complaints of alopecia and common acne, which occurred in our study after tuberculostatic drugs were initiated. In these cases, patients were referred to a dermatologist, as were the female patients who presented sun-sensitive skin.

The prescribed medications that could not be obtained via the public health care network were purchased and provided to the patient upon presentation of a medical report linking the symptom(s) to the use of tuberculostatic drugs. In addition, all of the tests requested in order to determine the extent of adverse effects were provided.

When a change of supervisor was required, the CPC team took over the DOT supervision only where there was no other person (family member or otherwise) who could do so.

The cure rate achieved in the proposed model demonstrates that the DOT strategy using home-based supervisors is efficient, feasible and affordable, providing results similar to those of the studies carried out in China, the United States and Tanzania.⁽⁸⁾

Of the patients who completed the treatment at the CPC, 99% completed the supervised treatment proposed and 100% presented negative cultures by month 6.

The sputum smear microscopies that were positive in months 5 and 6 were attributed to sample

contamination, since the patients did not present clinical alterations. Subsequent samples tested negative in post-treatment follow-up evaluations, and there were no complications.

In our sample, there was only one patient who did not comply with the DOT. The difficulty in achieving treatment compliance was related to the profession of the patient (truck driver). The staff became aware of this situation through analysis of the DOT card, on which there was no supervisor signature. In the city of Bauru, located in the state of São Paulo, the rate of treatment abandonment was found to be four times higher in males than in females, and working outside of the city was shown to be a determinant of treatment abandonment.⁽¹⁰⁾

The forms found at the centers for the control of tuberculostatic drug intake and the DOT card proposed by this study are not designed for use with illiterate patients, which calls for alternative ways of registering patients. In our study, there was one case of illiteracy, and the patient was taught how to mark an 'X' instead of signing.

There is no consensus among health professionals on the issue of DOT, since various DOT studies have obtained discrepant results. If, on one side, DOT using When community volunteers function as supervisors, success rates are the same as those obtained when DOT is supervised by health professionals.⁽¹⁹⁻²⁹⁾ However, some authors have suggested that DOT does not answer all of the questions and cannot be considered the only solution in tuberculosis control.⁽²¹⁾ One study conducted in the United States found a significant difference between patients under DOT and those under self-administered treatment in terms of completion of the treatment regimen.⁽²²⁾ However, a recent study

carried out in Mexico found no difference between the cure rate of patients under DOT and that of patients under self-administered treatment.⁽²³⁾

In Brazil, a study conducted in the city of Cuiabá revealed that the incidence of treatment abandonment was lower in supervised groups. The chance of treatment abandonment was 2.41 times higher among individuals under unsupervised treatment, which remained a major predictor of treatment abandonment in that study. It is also of note that semi-supervised treatment and strictly supervised treatment presented similar rates of treatment abandonment (2.57% and 2.38%, respectively), which leads to the hypothesis that semi-supervised treatment, albeit less rigorous regarding the supervision of medications ingested, is as effective as strictly supervised treatment.⁽³⁰⁾ These findings corroborate the results found in the supervised treatment model proposed in the present study.

As demonstrated, compliance with the treatment proposed in the present study was not due to a single factor but rather to the set of measures adopted: providing transportation passes; supplying baskets of groceries; allowing the use of concomitant medication to control adverse effects resulting from the treatment; programming educational activities; conducting careful evaluations; and, principally, taking an individualized approach to the treatment of each patient.

Our results allow us to state that the model proposed in this study, in addition to being operationally feasible, achieved cure rates and treatment abandonment rates for tuberculosis control that were much better than those recommended by the Brazilian National Ministry of Health. Another point that must be highlighted is the possibility of implementing this activity in the family health strategy in mid-sized and large cities, where coverage is extended to less than 40% of the population.

Based on these findings, promoting treatment compliance transcends monitoring the simple ingestion of medications and should be more thoroughly understood, including, but not limited to, the following aspects: establishing a link with the health team; providing access to information; conducting clinical and laboratory test follow-up evaluations; and adapting the treatment to individual habits and needs. In addition, it must be borne in mind that sharing decisions related to the health of the patient involves not only the patients but their families and

communities. It is fundamental, therefore, that the specific responsibilities of each individual be recognized in order to strengthen autonomy, thereby making self-care effective.

Note: The forms used in this study are available to the authors of other studies upon requests.

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