Effectiveness of and Results from Directly Observed Treatment of Tuberculosis Patients by Health-care Workers vs. Family Members, Vachira Phuket Hospital, 2005-2006

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Abstract The World Health Organization (WHO) has been recommending the directly observed treatment short course (DOTS) for the management of tuberculosis since 1994. Vachira Phuket Hospital has strengthened its education of health-care workers (HCW) and family members to become directly observed treatment (DOT) observers in order to improve the success rates of the treatment. This study was conducted to evaluate the treatment outcomes that the HCW DOT or family member DOT provided to patients.

We prospectively collected epidemiologic data on TB patients treated at the TB clinic in Vachira Hospital from 2004 to 2006. We limited our analysis to pulmonary TB patients never previously treated for TB. We analyzed the proportion of the patients, stratified by type of drug administrator. We used chi-square to analyze the association of successful treatment with the type of DOT, and multivariate analysis for controlling other factors associated with treatment success. A total of 506 TB patients were included in this analysis, 364 (72%) had treatment success, compared with 142 (28%) of patients experiencing non-successful treatment, 90 percent received HCW DOT, and 10 percent family/other or self-administered therapy (SAT). Smear-positive TB was diagnosed in 72 percent of the cases, and 24 percent were infected with HIV. The type of drug administered had a significant impact on treatment success ($P<0.001$). Using multivariate analysis, controlling for confounding factors, HCW DOT was significantly associated with successful treatment (OR 2.1, 95% CI 1.1-4.3).

Based on the results of this study, TB patients who received HCW DOT achieved treatment success rates higher than patients receiving family member DOT.

Key words: *tuberculosis; directly observed treatment; treatment success*

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บทคัดย่อ **การดูแลรักษาผู้ป่วยวัณโรคแบบมีพี่เลี้ยงกำกับการกินยาของโรงพยาบาลวชิระภูเก็ต พ.ศ. ๒๕๔๘ - ๒๕๔๙**

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การศึกษานี้มีวัตถุประสงค์เพื่อประเมินผลการรักษาผู้ป่วยวัณโรคโดยมีเจ้าหน้าที่สาธารณสุขหรือสมาชิกในครอบครัวเป็นพี่เลี้ยงกำกับการกินยา ซึ่งทางโรงพยาบาลวชิระภูเก็ต ร่วมกับสำนักงานสาธารณสุขจังหวัดภูเก็ตและศูนย์ความร่วมมือไทย-สหรัฐ ได้เริ่มโครงการเพิ่มความสำเร็จของการรักษาโดยให้เจ้าหน้าที่สาธารณสุขเป็นพี่เลี้ยงกำกับการกินยาของผู้ป่วยวัณโรครายใหม่ ตั้งแต่ปีงบประมาณ ๒๕๔๘-๒๕๔๙, มีการเก็บรวบรวมข้อมูลของผู้ป่วยวัณโรคที่รักษา โดยวิเคราะห์ค่าร้อยละ เปรียบเทียบความสัมพันธ์ชนิดของพี่เลี้ยงกับความสำเร็จของการรักษาโดยใช้สถิติไฆ-สแควร์ และการวิเคราะห์พหุตัวแปร.

จากผู้ป่วย ๕๐๖ รายที่ศึกษา ร้อยละ ๗๒ เป็นวัณโรคปอดเสมหะพบเชื้อ และร้อยละ ๒๔ มีการติดเชื้อเอชไอวีร่วมด้วย ได้ผลสำเร็จของการรักษา (รักษาหายขาด และรักษาครบ) ร้อยละ ๗๒ และผลการรักษาล้มเหลว (เสียชีวิต ขาดยา และโอนออก) ร้อยละ ๒๘. ผู้ป่วยที่มีเจ้าหน้าที่เป็นพี่เลี้ยงร้อยละ ๕๐ และมีสมาชิกครอบครัวและญาติเป็นพี่เลี้ยงร้อยละ ๑๐ ซึ่งพบว่าเจ้าหน้าที่มีความสัมพันธ์กับผลสำเร็จของการรักษาอย่างมีนัยสำคัญทางสถิติ (ค่าพี < ๐.๐๐๑). เมื่อควบคุมตัวแปรกวนอื่นๆ ก็มีผลว่า การมีเจ้าหน้าที่เป็นพี่เลี้ยงมีความสัมพันธ์กับผลสำเร็จการรักษาอย่างมีนัยสำคัญทางสถิติ (อัตราส่วนออดส์ ๒.๑, ช่วงความเชื่อมั่น ๙๕% ๑.๑-๔.๓). สรุปได้ว่าการมีเจ้าหน้าที่สาธารณสุขเป็นพี่เลี้ยงทำให้ได้ผลสำเร็จการรักษาผู้ป่วยวัณโรคสูงกว่าให้สมาชิกในครอบครัวเป็นพี่เลี้ยงกำกับการกินยา.

คำสำคัญ: *วัณโรค, การรักษาแบบมีพี่เลี้ยง, ผลสำเร็จของการรักษา*

Background and rationale

The World Health Organization (WHO) adopted the DOT as a principal component of its global tuberculosis control strategy.[1] Current technical manuals define DOT as direct supervision of "medication ingestion by a treatment supporter who is acceptable and accountable to the patient and to the health system."[2]

Although WHO and other international agencies strongly advocate DOT, controversy still remains whether its benefits have been proven. Thailand is a low middle-income country with the 17th largest burden of TB in the world. Despite official adoption of the WHO TB control strategy in 1997, TB rates in Thailand have failed to decline; this could be due to the HIV epidemic and sub-optimal treatment success rates.[3]

As a tourist destination, Phuket has about 315,000 inhabitants. The incidence of TB cases in Phuket has increased to 43 per 100,000 in 2006, The aims of this study were to evaluate the treatment outcome of TB cases registered at Vachira Phuket Hospital, during the period 2004-2006 and to compare the success rate among patients receiving DOT from HCW, and family members or other groups.

Methodology

Data collection

For all Vachira Phuket Hospital, patients diagnosed with TB, public health staff recorded standardized epidemiologic data, collected sputum specimens for microbiologic testing, and offered HIV counseling

and testing. Patient data were collected prospectively from routine medical and laboratory records and entered into an electronic database. Patient outcomes were recorded through the end of TB treatment, which was usually about six to nine months after registration.

Patient population

All persons registered for TB treatment were considered TB patients, consistent with WHO guidelines.[4] In this study, patients were eligible for analysis if they were registered for TB treatment between 1 October 2004 and 30 September 2006, were diagnosed with pulmonary TB, and were not previously treated for TB or transferred on from a different TB program. We classified patients with extrapulmonary TB as ineligible because the duration of treatment, drug regimen, and classification of outcomes, such as failure, all vary depending on the location of the disease. We classified patients with previous TB treatment as ineligible because such patients are known to have substantially different treatment outcomes than newly diagnosed cases.[5] Eligible patients were excluded from the analysis of treatment outcomes if their TB diagnosis was changed after registration. For this study, patients with an outcome of "change diagnosis" or patients still on treatment at the time of this analysis were excluded from the analysis.

Definitions

We used standard WHO definitions to categorize patients according to previous TB treatment history, type of TB, and treatment outcome, and we classified any death which occurred during TB treatment as a TB death.[4]

Procedure of contribution to success treatment

TB clinic staff provided counseling on TB and gave advice about DOT to the patient and relatives who were living with the patient. The TB clinic staff assigned a DOT observer with the patient's agreement but the first priority was HCW DOT. The patients observed by HCW were to take their medication once daily on a work day; on Friday, enough medication was given to cover Saturday and Sunday.

Family member DOT patients were given medication once a week and they had to collect medication and bring in the remnant of tablet foils (RIF, PZA, EMB) to convince HCW that the tablets had been consumed. We also followed up the patients and family members by using mobile phones. We had 10 primary health centers geographically covering most residential areas of Phuket town, which patients could reach in a short time.

Data analysis

We used chi-square to compare proportions for statistical significance for the type of observer producing successful treatment. In bivariate analysis, we calculated the odds ratio (OR) and 95 percent confidence interval (CI) for factors associated with successful treatment. Univariate variables with a p-value <0.02 were entered into the multivariate logistic regression model, because some groups of patients were more likely to receive a specific type of DOT and because of some factors associated with treatment outcomes.

For the multivariate analysis, we controlled and adjusted confounder, sex, cough lasting >2 weeks, initial treatment prescribed and HIV status using a logistic regression model. For the end of treatment outcome analysis, patient outcomes included successful treatment (defined as cured or completed treatment), died, defaulted, failed or transferred out. We compared the proportion of patients successfully treated versus those that died, defaulted, failed or transferred out of treatment.

Results

Patients analyzed

Of the total of 919 patients recorded in the TB registration, 517 (56%) were eligible for the analysis (Figure 1). The most common reason for non-eligibility was extrapulmonary TB (24%) and previous treatment for TB (10%). Of the 517 eligible TB patients

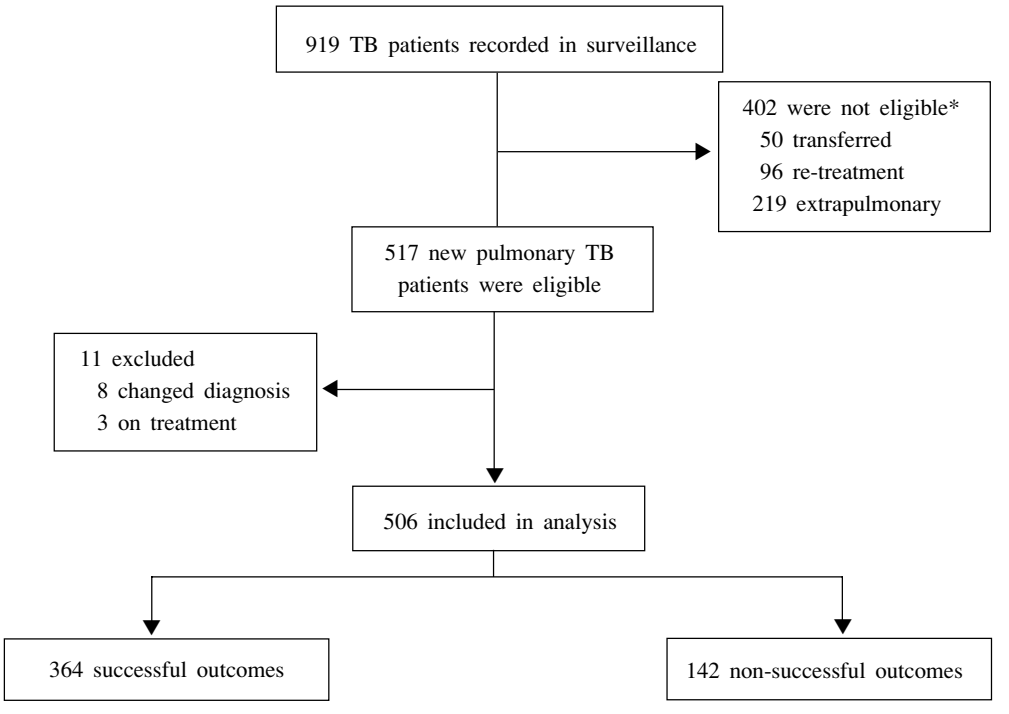

Figure 1 Patients included in the analysis.

analyzed we excluded 11 (2%) eligible patients that were recorded as still being on treatment, or who had a changed diagnosis.

Characteristics of eligible patients

Of the 506 patients eligible for the analysis, 90 percent received HCW DOT and 10 percent family or other DOT (Table 1). Pulmonary TB was classified as smear-positive in 362 cases (72%); overall, 65 cases had at least one sputum culture positive for *Mycobacterium tuberculosis*. Most patients were male, aged 15-44 years, and married. HIV infection was diagnosed in 122 (24%). The standard WHO category I regimen (two months of INH, rifampin, pyrazinamide, and ethambutol, followed by four months of INH and rifampin) was prescribed to 96 percent of them. At the end of the TB treatment, 364 (72%) had a successful outcome (cured or completed), 142 (28%) had an unsuccessful outcome (death, default, failure, or transfer out).

Outcomes by the end of treatment

At the end of TB treatment, of a treatment success rate of 76 percent was achieved by the DOT health-care workers compared with 53 percent by those receiving family or other DOT (Table 1). An association was observed between HCW DOT, family member DOT and treatment outcome (χ^2 = 33.05, degree of freedoms [df] = 5, P<0.001) (Table 2). Patients who received HCW DOT enjoyed significant treatment success compared with family member or other DOT (aOR 2.1; CI, 1.1-4.3) (Table 3).

Discussion

In our study, the treatment success rate of newly diagnosed tuberculosis by HCW DOT was higher than family DOT (76% vs. 53%) but this figure did not meet the WHO-targeted success rate of 85 percent. Pa-

Table 1 Demographic and clinical characteristics of new pulmonary TB patients in Vachira Phuket Hospital, stratified by HCW DOT and family member DOT, 2004-2006.

Characteristics	HCW DOT No. (%) (n= 457)	FAM DOT No. (%) (n= 49)	Total No. (%) (n=506)
Age group (years)			
0-14	4 (1)	6 (13)	10 (2)
15-44	326 (71)	29 (60)	355 (50)
45-64	91 (20)	7 (32)	98 (19)
>65	36 (8)	7 (15)	43 (9)
Mean age, SD, (Min.-Max.)	38.1, 15.0 (7-88 yrs)	37.8, 20.6 (2 -91 yrs)	
Sex			
Male	311 (68)	38 (78)	349 (69)
Female	146 (32)	11 (22)	157 (31)
Marital status			
Married	266 (58)	24 (49)	290 (57)
Non-married	191 (42)	25 (51)	216 (43)
Nationality			
Thai	393 (86)	36 (73)	429 (85)
Non-Thai	64 (14)	13 (27)	77 (15)
Cough lasting > 2 weeks at time of diagnosis			
Cough > 2 weeks	348 (76)	31 (63)	379 (75)
No cough > 2 weeks	109 (24)	18 (37)	127 (25)
Chest radiograph			
Abnormal	440 (96)	48 (98)	488 (96)
Normal	17 (4)	1 (2)	18 (4)
Cavity			
Presence of a cavity	100 (22)	17 (35)	117 (23)
No cavity	339 (74)	31 (63)	370 (73)
Unknown/missing	18 (4)	1 (2)	19 (4)
Type of pulmonary TB			
Smear-positive	337 (74)	25 (51)	362 (72)
Smear-negative	117 (25)	23 (47)	140 (28)
Smear-unknown	3 (1)	1 (2)	4 (1)
Sputum culture result			
Growth (TB)	308 (67)	21 (43)	329 (65)
No growth	55 (12)	9 (18)	64 (13)
Not performed, contaminated, NTM	94 (21)	19 (39)	113 (22)
Initial treatment prescribed			
CAT I (2HRZE/4HR)	443 (97)	45 (92)	488 (96)
Other regimens/missing	14 (3)	4 (8)	18 (4)
HIV status			
Positive	114 (25)	8 (16)	122 (24)
Negative	319 (70)	35 (71)	354 (70)
Unknown	24 (5)	6 (12)	30 (6)

HCW= Health-care worker; FAM= family member; DOT= directly observed treatment

Table 2 Treatment outcomes of new pulmonary TB patients in Vachira Phuket Hospital, by HCW DOT and family member DOT, 2004-2006*

Treatment outcome	HCW DOT No. (%) (n= 457)	FAM DOT No. (%) (n= 49)	Total No. (%) (n=506)
Successful	336 (76)	26 (53)	364 (72)
Cured	238 (52)	7 (15)	246 (49)
Completed	98 (21)	19 (40)	118 (23)
Not successful	121 (26)	21 (43)	142 (28)
Failure	3 (1)	0 (0)	3 (1)
Died	59 (13)	6 (13)	65 (13)
Default	20 (4)	2 (4)	22 (4)
Transferred out	39 (9)	13 (28)	52 (10)

X^2 = 33.05 (df = 5, P< 0.001)

HCW= Health-care worker; FAM= family member; DOT= directly observed treatment; df= degree of freedom

tients without a cavity had a higher success rate. The association of HIV and pulmonary cavities should be separated into a special category which needs more attention and should be HCW DOT only. In the future, we should subdivide patients: those who are HIV-positive and/or have cavities into another category to be followed up more carefully and put more effort into gaining a better outcome.

We compared our study with the study in Gurgeon district in India[6] where government health workers (GHW) and community volunteers (CV) were employed as DOT providers. The success rate among patients in the care of community volunteers was comparable with that of GHWs (78% vs. 77%). Our study had a similar success rate (76%) in the care of health-care workers. Could this model of approach be followed elsewhere? It could be possible if the area is not too large (Gurgeon has a population of 600,000, whereas Phuket has a population of 400,000). Our hospital has seven primary health centers plus three municipal health centers scattered throughout the region. Each primary health center covers a population of approximately 7,500-34,000. Vachira Phuket Hospital acts as headquarter for all of them. Hence, medication provided to all zonal areas facilitates the distribution. Usually, each primary health center has to deal with about 10-25 patients. The accessibility to medication in PHC helps the patients to adhere to DOT until discharge and almost none turned to self administration. However, in a Hong Kong study[7] about 30 percent of DOT patients switched to non-DOT within 2-6 months because of geographical inconvenience (31.7%).

Culture and social beliefs may be another factor. Thai patients consider DOT as good medical care, but this approach may be considered as intrusive in Western countries. The availability of telephones played a very important role. One of the reasons for the failure of patients to adhere to six months of therapy in the US is that they do not have listed telephone numbers or mobile phones to contact[8].

We attribute our successful cure rate to our staff members who have long been working in this field. To achieve a success rate of 85 percent in the future may be possible if we employ HCW DOT to most of the patients and DOT by family selectively to some. We believe that our study could best contribute to the improvement of tuberculosis treatment in our region.

Table 3 Factors associated with treatment, successful vs. non-successful (failure, died, default, and transferred out), outcome among new pulmonary TB patients, October 2004-September 2006

Characteristic	Success/Total (%)	Crude OR (95% CI)	Adjusted (OR) (95% CI)
Observation			
Health-care worker DOT	336/457 (74)	2.1 (1.1-3.8)	2.1 (1.1-4.3)*
Family/other DOT	28/49 (57)	Referent	Referent
Age group (years)			
0-14	8/10 (80)	1.5 (0.3-7.1)	
15-44	259/355 (73)	Referent	-
45-64	68/98 (69)	0.8 (0.5-1.4)	
>65	29/43 (67)	0.8 (0.4-1.5)	
Sex			
Male	243/349 (70)	Referent	Referent
Female	121/157 (77)	1.5 (0.9-2.3)	1.3 (0.8-2.1)
Marital status			
Married	214/290 (74)	1.2 (0.8-1.8)	-
Non-married	150/216 (69)	Referent	
Nationality			
Thai	306/429 (71)	Referent	-
Non-Thai	58/77 (75)	1.2 (0.7-2.1)	
Cough lasting > 2 weeks at time of diagnosis			
Cough > 2 weeks	283/379 (75)	1.7 (1.1-2.6)	1.4 (0.9-2.2)
Not cough > 2 weeks	81/127 (64)	Referent	Referent
Chest radiograph			
Abnormal	352/488 (72)	1.3 (0.5-3.5)	-
Normal	12/18 (67)	Referent	
Cavity			
Presence of a cavity	83/117 (71)	Referent	
No cavity	268/370 (72)	1.1 (0.7-1.7)	-
Unknown/missing	13/19 (68)	0.9 (0.3-2.5)	
Smear status			
Positive	263/362 (73)	1.4 (0.9-2.3)	
Negative	97/140 (69)	1.2 (0.8-1.8)	-
Not done/unknown	4/4 (100)	-	
Sputum culture result			
Growth (TB)	238/329 (72)	Referent	Referent
No growth	47/64 (73)	1.1 (0.6-1.9)	-
Not performed, contaminated, NTM	79/113 (70)	0.9 (0.6-1.4)	
Initial treatment prescribed			
CAT I (2HRZE/4HR)	356/488 (73)	3.4 (1.3-8.7)	1.7 (0.6-4.7)
Other regimens	8/18 (44)	Referent	Referent
HIV status			
Positive	59/122 (48)	Referent	Referent
Negative	294/354 (83)	5.2 (3.3-8.2)	5.3 (3.3-8.4)**
Unknown	11/30 (37)	0.6 (0.3-1.4)	0.7 (0.3-1.7)

***P value<0.05; **P value<.001**

OR= Odds ratio; CI= confidence interval; DOT= Directly Observed Treatment

Conclusions

Our study shows that DOT by health-care workers has a higher success rate compared with DOT by family or other means. The choice between HCW DOT or family DOT will depend on the preference of individual patients and families, but we should encourage our patients to use HCW DOT to attain a higher success rate.

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