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RESEARCH

Biopsychosocial factors affecting the treatment outcomes of pulmonary tuberculosis among patients enrolled in TB DOTS clinics

Rosanna Charmaine K T Vinson,[1] Cinderela Perez Baruiz,[1,2] Marjorie Pelegrino[1,3]

[1]Department of Family and Community Medicine, Davao Regional Hospital, Apokon, Tagum City, Philippines

[2]Department of Family and Community Medicine Southern Philippines Medical Center, Bajada, Davao City, Philippines

[3]Tagum City Health Office, Ernesto Punzalan St, Tagum City, Philippines

Correspondence
Rosanna Charmaine KT Vinson
star_vinson@yahoo.com

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ABSTRACT

Background. An exploration of the influence of biopsychosocial factors on the treatment outcomes of patients with pulmonary tuberculosis (PTB) can prove helpful in the holistic management of patients with the disease.
Objective. To determine the biopsychosocial factors that affect the treatment outcomes of PTB patients enrolled in tuberculosis directly observed therapy short course (TB DOTS) clinics.
Design. Cohort study.
Setting. Two TB DOTS clinics in Tagum City, Philippines, between August 2013 and July 2014.
Participants. 127 male and female patients who were newly enrolled in the TB DOTS clinics for PTB.
Main outcome measures. Odds ratios (95% CI) of treatment failure for selected biopsychosocial factors.
Main results. There were 93 (73.23%) males and 34 (26.77%) females in the study, with an overall mean age of 44 ± 17 years. PTB treatment failed in 38 (29.92%) of the patients. The multivariate odds ratios of treatment failure were 0.24 (95% CI 0.09 to 0.60, p=0.0023) for a family history of tuberculosis, 4.87 (95% CI 1.99 to 11.95, p=0.0005) for patients with more than one symptom of PTB, and 3.51 (95% CI 1.44 to 8.53, p=0.0056) for patients who come from a dysfunctional family. The treatment success group and treatment failure group were comparable in terms of age, sex distribution, educational attainment, employment status, and household size.
Conclusion. A family history of tuberculosis significantly decreased, while having more than one PTB symptom and coming from a dysfunctional family significantly increased the odds ratios of PTB treatment failure.

Keywords. dysfunctional family, multiple symptoms, treatment failure, Family APGAR

INTRODUCTION

Treatment outcomes of patients with pulmonary tuberculosis (PTB) partly reflect the performance of tuberculosis directly observed therapy short course (TB DOTS) clinics in controlling the disease and in improving health care.[1] However, several other factors that influence the treatment outcomes of PTB patients have been reported.[2-4] The association of sociodemographic and clinical characteristics, such as age, employment, education, comorbidities, smear positivity upon diagnosis, and history of previous tuberculosis treatment, to success of tuberculosis treatment have all been studied.[2-5] Comorbidities, such as HIV, as well as pulmonary and hepatic diseases alter the cure rates and prognosis of tuberculosis.[6 7] Despite our extensive knowledge on the diagnosis and therapy of tuberculosis, the disease remains to be a serious global problem.[1 8]

The biopsychosocial approach to diseases practiced by family physicians is a medical management approach that is less explored by contemporary practitioners for patients with tuberculosis.[9] Family physicians use several family assessment tools, including the genogram and Family APGAR.[10] A genogram allows assessment of a patient's family's structure and gives an overview of the medical problems within the family.[6] On the other hand, the Family APGAR is a tool used to assess family function by asking patients and their family members to rate their perception of the whole family's *A*daptation, *P*artnership, *G*rowth, *A*ffection, and *R*esolve.[11] The use of these family assess-

IN ESSENCE

Psychosocial factors influence the success of the biomedical treatment of pulmonary tuberculosis.

In this cohort study, patients with multiple symptoms of pulmonary tuberculosis upon starting a directly observed treatment short-course, and those coming from dysfunctional families had significantly increased odds ratios of having treatment failure.

Identifying and addressing the family psychosocial issues of patients treated for pulmonary tuberculosis can help achieve treatment success.

ment tools allows the family physician to plan and implement psychosocial interventions, which would complement the biomedical interventions that patients receive. We did this study in order to determine the biopsychosocial factors that affect the treatment outcomes of PTB among patients enrolled in TB DOTS clinics.

METHODS

Study design and setting

We did a cohort study in two TB DOTS clinics in Tagum City from August 2013 to July 2014. The first clinic is situated in Davao Regional Hospital (DRH), one of the two tertiary hospitals of the Department of Health in Southeastern Philippines. On average, the clinic sees 420 patients with tuberculosis per year. The DRH TB DOTS is the default referral clinic for patients seen within the hospital who are suspected of having tuberculosis. The second clinic, the Tagum City Health Office (TCHO), is also a government facilility. This clinic also caters to an average of 420 patients with tuberculosis per year. TCHO usually receives referrals from private and government clinics within the city and those from neighboring provinces. The two clinics are 6 kilometers apart.

Participants

Patients 15 years old and above, diagnosed with PTB, and who were newly enrolled in the two clinics, were eligible to participate in the study. We excluded patients who were mentally incapacitated, and deaf and mute since the study relied on personal interviews for data collection. To determine the adequate sample size for our study, we assumed that the overall treatment failure rate among PTB patients treated in DOTS clinics was 30%. We wanted for the study to detect an odds ratio of at least 3 as statistically significant. To reject the null hypothesis with a two-sided alpha error of <5% and with 80% power, we would need at least 110 patients to be in the study. We added 15% (~17) to the computed sample size in order to be able to fulfill the sample size requirement in the event that some patients would unexpectedly dropout from the study. We eventually recruited 127 patients into this study.

Data collection

We recruited eligible patients into the study at the start of their PTB treatment course and followed them for six months to monitor their treatment outcomes. Upon recruitment, we recorded the patients' sociodemographic profile, such as age, sex, and educational attainment. For clinical characteristics, we asked for the presence of PTB symptoms, aside from cough, upon enrolment into the TB DOTS program. We recorded each patient's genogram, from which we derived information on family history of PTB, the patient's household size, the type of family within the household (nuclear or extended), the patient's role in the family (breadwinner, caregiver, decision maker, more than one role, or none of the mentioned roles), the presence of somebody in the family who provides care for the patient, and the family's stage in the family life cycle (unattached young adult, newly married couple, family with young children, family with adolescents, launching family, or family in later life). We also measured individual Family APGAR scores by asking each patient and at least one other family member to answer the tool. We used the Filipino version of the tool, which has been used in the Philippines since 1992.[11] Family APGAR scores are interpreted as: highly functional family for scores of 8 to 10, moderately dysfunctional family for scores of 4 to 7, and severely dysfunctional family for scores of 0 to 3.[7 11]

The primary outcome measures in this study were the odds ratios (95% CI) of treatment failure for selected biopsychosocial factors. For this study, we classified patients' treatment outcomes into either 'treatment failure' or 'treatment success.' We based our classification on patients' dispositions six months from enrolment into the PTB treatment program, as written in their medical records at the TB DOTS clinics. The TB DOTS clinics use the following standard definitions of dispositions, adopted by the National Tuberculosis Program (Philippines) from the definitions of the World Health Organization: a patient whose sputum smear or culture remains positive after 5 months or more of treatment is considered 'failed'; a patient whose treatment was interrupted for two or more consecutive months is considered 'defaulted'; a patient who dies, regardless of cause, during the treatment course is classified as 'died'; a patient with demonstrated sputum conversion from positive upon enrollment to negative in the last month of treatment and during the continuation phase is considered 'cured'; and

Table 1 Demographic, family and clinical characteristics of 127 patients with PTB

Characteristics	Values (n=127)
Mean age ± SD, *years*	
Sex, *frequency (%)*	
Female	34 (26.77)
Male	93 (73.23)
Educational attainment, *frequency (%)*	
Elementary level	46 (36.22)
High school level	53 (41.73)
College level	24 (18.90)
Vocational course	4 (3.15)
Employment status, *frequency (%)*	
Employed	61 (48.03)
Unemployed	66 (51.97)
Household size, *frequency (%)*	
≤6 members	106 (83.46)
>6 members	21 (16.54)
Family within the household, *frequency (%)*	
Nuclear	88 (69.29)
Extended	39 (30.71)
Signs and symptoms aside from cough, *frequency (%)**	
Hemoptysis	41 (32.28)
Dyspnea	42 (33.07)
Chest pain	22 (17.32)
Back pain	65 (51.18)
Others symptoms	48 (37.80)
Multiple	61 (48.03)
No symptoms	2 (1.57)
Patient's role in the family, *frequency (%)***	
Breadwinner	55 (43.31)
Caregiver	38 (29.92)
Decision maker	71 (55.91)
More than one role	56 (44.09)
Not a breadwinner, caregiver or decision maker	34 (26.77)
With caregiver, *frequency (%)*	89 (70.08)
Family life cycle stage, *frequency (%)*	
Unattached young adult	11 (8.66)
Newly married couple	2 (1.57)
Family with young children	22 (17.32)
Family with adolescents	23 (18.11)
Launching family	50 (39.37)
Family in later life	19 (14.96)
Family APGAR, *frequency (%)*	
Highly functional (score 8-10)	60 (47.24)
Moderately dysfunctional (score 4-7)	62 (48.82)
Severely dysfunctional (score 0-3)	5 (3.94)

*Measured upon enrolment into the TB DOTS program, one patient may have more than one symptom; **one patient may have more than one role.

a patient who does not meet the criteria for failure or cure but completed treatment was classified as 'completed.'[21] We considered a patient to have 'treatment failure' if the disposition after 6 months was either 'failed,' 'defaulted,' or 'died.' On the other hand, 'treatment success' was considered when a patient's disposition after 6 months was either 'cured' or 'completed.'

Statistical analysis

Using descriptive statistics, we summarized continuous data using means ± standard deviations, and categorical data using frequencies and percentages. Logistic regression was used to calculate the univariate odds ratios and 95% confidence intervals (OR, 95% CI) of treatment failure for selected biopsychosocial characteristics. We predetermined the cut-off points of some variables that we included in the logistic regression as follows: ≥ 60 years old for age, at least college level or vocational level for education, up to six members for household size, the presence of at least two symptoms for 'multiple symptoms', at least two roles for 'more than one role in the family'. We also considered 'launching family' and 'family in later life' as 'later stages in the family life cycle', and APGAR scores of 0 to 7 as 'dysfunctional family.' For characteristics with significant associations with treatment failure ($p<0.05$), a multivariate logistic regression model was used to calculate the adjusted odds ratios of having the outcome. All statistical tests were done using Epi Info 7.1.4.0.

RESULTS

A total of 127 patients were recruited into the study and interviewed within 1 week of enrolment in the TB DOTS program. All the patients' charts were available 6 months after enrolment for data collection on treatment outcomes. The demographic, family and clinical characteristics of the patients are shown in Table 1. The patients had a mean age of 44 years and were mostly males (93/127, 73.23% males versus 34/127, 26.77% females). Most of the patients come from households with less than six members (106/127, 83.46%) and from nuclear families (88/127, 69.29%).

Table 2 shows the outcomes of the patients with PTB after six months into the TB DOTS program. A total of 89/127 (70.08%) patients had treatment success, and 38/127

Table 2 Treatment outcomes of patients with PTB

Outcomes	Frequency (%) (n=127)
Treatment success	
Cured	46 (36.22)
Completed	43 (33.86)
Treatment failure	
Failed	2 (1.57)
Defaulted	32 (25.20)
Died	4 (3.15)

Table 3 Univariate odds ratios (95% CI) of treatment failure

Characteristics	Odds ratio (95% CI)	p-value
Age ≥60 years	1.23 (0.51 to 2.96)	0.6408
Male sex	1.26 (0.52 to 3.03)	0.6080
At least college/vocational level education	1.14 (0.46 to 2.82)	0.7713
Unemployed	1.92 (0.88 to 4.18)	0.1014
Up to 6 household members	1.45 (0.49 to 4.28)	0.5048
Nuclear family in household	1.13 (0.49 to 2.59)	0.7786
Family history of PTB	0.40 (0.18 to 0.90)	0.0268*
Hemoptysis on consultation	1.86 (0.84 to 4.11)	0.1243
Dyspnea on consultation	1.08 (0.48 to 2.40)	0.8584
Chest pain on consultation	1.43 (0.54 to 3.75)	0.4694
Back pain on consultation	1.72 (0.79 to 3.71)	0.1706
Multiple symptoms	3.34 (1.49 to 7.48)	0.0033*
Breadwinner	0.58 (0.26 to 1.28)	0.1786
Caregiver	0.52 (0.21 to 1.28)	0.1576
Decision maker	0.96 (0.45 to 2.07)	0.9241
More than one role in the family	0.56 (0.25 to 1.22)	0.1450
Not a breadwinner, caregiver or decision maker	1.68 (0.73 to 3.86)	0.2184
Later stages in the family life cycle	1.97 (0.89 to 4.33)	0.0927
Dysfunctional family (APGAR scores 0-7)	2.54 (1.14 to 5.65)	0.0227*

*Statistically significant.

Table 4 Multivariate odds ratios (95% CI) of treatment failure

Characteristics	Odds ratio (95% CI)	p-value
Multiple symptoms	0.24 (0.09 to 0.60)	0.0023*
Family history of PTB	4.87 (1.99 to 11.95)	0.0005*
Dysfunctional family	3.51 (1.44 to 8.53)	0.0056*

*Statistically significant.

(29.92%) had treatment failure. Most of the patients classified under 'treatment failure' (32/38, 84.21%) defaulted from treatment. Among those who had treatment failure 4/38 (10.53%) died.

The univariate odds ratios (95% CI) of treatment failure for the biopsychosocial characteristics are presented in Table 3. Having a family history of PTB significantly decreased the odds ratio of treatment failure (OR=0.40; 95 CI % 0.18 to 0.90; p=0.0268). On the other hand, having multiple symptoms upon enrolment into the TB DOTS program (OR=3.34; 95% CI 1.49 to 7.48; p=0.0033) and coming from a dysfunctional family (OR=2.54; 95% CI 1.14 to 5.65; p=0.0227) both significantly increased the odds ratios of treatment failure.

In the multivariate logistic regression model, the changes in the odds ratios were minimal, and all three characteristics remained to be significantly associated with treatment failure (Table 4). A family history of PTB decreased the odds ratio of treatment failure (OR=0.24; CI 95% 0.09 to 0.60; p=0.0023), while multiple symptoms (OR=4.87; 95% CI 1.99 to 11.95; p=0.0005) and having a dysfunctional family (OR=3.51 95% CI 1.44 to 8.53; p=0.0056) increased the odds ratios of having the outcome.

DISCUSSION

Key results

We found out that a family history of tuberculosis significantly decreased the odds of PTB treatment failure. On the other hand, having more than one PTB symptom upon enrolment into the TB DOTS program, and coming from a dysfunctional family significantly increased the odds ratios of PTB treatment failure.

Strengths and limitations

Our study focused on looking for psychosocial characteristics, especially family characteristics that are possibly associated with treatment outcomes of PTB. This study was able to demonstrate that family dysfunction contributes to PTB treatment failure. However, we have not included other clinical factors that may influence treatment outcomes, or that may or may not exhibit collinearity with the ones that we have included in our list of pre-determined explanatory variables, such as smoking history, alcohol consumption, comorbidities, and side effects of anti-TB drugs. There are also other available family assessment tools that we did not utilize in this study, such as the Family Circle, Family Mapping, Social Cultural Religion Economic Education Medical (SCREEM) tool, Family Enivonmental Scale (FES), and Draw a Family Test (DRAFT).[11] These tools – designed to recognize family structure, function, and patterns of behavior – could have helped us identify other family-related

factors that can potentially affect treatment outcomes in PTB and aid in providing better treatment strategies.

Interpretation

Prior experience of other members of the family on PTB as a disease and, presumably, on PTB treatment regimens appear to have a positive effect on the patient's own PTB treatment outcomes. This underscores the role that patient education (in this case, by experience) plays in influencing favorable treatment outcomes. Social support, whether coming from the patients' family or community, can help patients overcome structural and personal barriers, and may influence their knowledge, attitudes, beliefs, and behavior around their illness.[12] A study in Finland also reported lower risk of death among patients with a previous history of tuberculosis.[13] Having more than one symptom at the start of treatment may represent a more severe manifestation of the disease. A more advanced disease at the outset understandably translates into poorer prognosis.[14]

Our finding on the association of family dysfunction and treatment failure is consistent with other studies among Asians, which showed that coming from a functional family increased the chances of compliance or adherence to TB treatment.[15 16] Adherence to treatment is an important determinant that affects successful outcomes of TB. This association was not found in another study, which reported that alcohol consumption and being single, but not family function, are associated with lower chances of treatment completion.[10]

We did not find any association between treatment outcomes and characteristics related to family structure like household size, the presence of a caregiver for the patient, whether the family in the household where the patient came from was nuclear or extended, the family life cycle stage that the patient was in, or the patients' role in the family. Family function seems to have a stronger influence on treatment outcomes compared to family structure. Structural, instrumental, or informational support may not be able to replace the emotional support of a well-functioning family in positively influencing a patient's treatment outcomes.[17]

Generalizability

Our findings in this study highlight the interrelatedness of biomedical symptoms and psychosocial contexts in the experience of illness. Patients who are on long-term treatment regimens, such as PTB chemotherapy, will benefit from a psychosocial program that focuses on the participation of immediate family members in the treatment process. It is vital to learn how each family member understands family functionality. For the physician to gain insight on how family members can contribute to the therapy of the patient, initial assessment of family function can be done with the use of the Family APGAR. The Family APGAR allows assessment of the family members' satisfaction with the family function, based on the elements considered essential in the family unit.[11]

In order to complement ongoing PTB treatment, psychosocial interventions should be geared towards building up adaptation (using and sharing of inherent resources), partnership (sharing of decision making), growth (freedom to change), affection (emotional interaction) and resolve (commitment) within the family members.[11] The Family APGAR can also be used to monitor and evaluate psychosocial interventions geared towards making family functions healthy and capable of providing adequate patient support.[18]

Interventions can include conducting several family meetings prior to, during and after giving the PTB treatment regimen. Family meetings serve various purposes, such as educating the family, discussing the logistical aspects of the treatment, resolving interpersonal relationship issues between or among members, and assessing and adjusting ongoing interventions.[19]

Combining psychosocial interventions with biomedical interventions creates a holistic approach to patient care, and makes good use of the positive emotional and social support that family members can provide in order to achieve better treatment outcomes among patients with PTB.

CONCLUSION

In this cohort study, the odds ratio of treatment failure significantly decreased among PTB patients with family history of PTB. In contrast, the odds ratios of treatment failure significantly increased among patients who had more than one PTB symptom upon enrolment into the TB DOTS program, and among those who come from dysfunctional families.

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Ethics approval
This study was reviewed and approved by the Department of Health XI Cluster Ethics Review Committee (DOHXI CERC reference P13053101).

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