

# IMPROVEMENT OF DISTRICT HOSPITAL SERVICE SYSTEM TO INCREASE TREATMENT ADHERENCE AMONG TUBERCULOSIS PATIENTS IN PAKISTAN

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**Abstract.** Adherence to medication regimen is essential for tuberculosis (TB) treatment success. We carried out quasi-experimental, single group intervention study at Rawalpindi District Hospital to improve TB patient treatment adherence using a Chronic Care Model (CCM). Ninety-nine newly diagnosed TB patients at the TB Clinic, Rawalpindi District Hospital, during February-March 2009, were included in the study. A set of four quality indicators were determined based on current scientific evidence: quality of service system, patient satisfaction, treatment adherence and cure rate. Care quality changes over time were analyzed by paired *t*-test. Significant improvements in service quality were seen post-intervention. Overall, the hospital service system quality improved to "good" (from 1.0% to 28.3%), and patient satisfaction increased to "good" (10.2% to 54.1%). Treatment adherence increased (from 23.2% to 56.1%). The quarterly cure rate increased notably (5.3% to 17.2%). The overall mean scores for hospital service system quality, patient satisfaction, and TB patient treatment adherence, improved significantly 6 month post-intervention ( $p < 0.001$ ).

**Keywords:** TB patients, chronic care model, hospital service system, patient satisfaction, treatment adherence, Pakistan

## INTRODUCTION

Tuberculosis (TB) is a leading cause of death among the communicable diseases of Pakistan (CDC, 2008). In 2005, Pakistan had an estimated 286,291 new TB cases, 468,460 people living with TB, and 128,724 new smear-positive cases. All of these cases were covered by Direct Observed

Treatment Strategy (DOTS) with a treatment success rate of 82% (Federal Bureau of Statistics, 2003).

Treatment adherence is an important factor in evaluating TB treatment-success rates (Mesfin *et al*, 2009). Experienced, motivated staff increase accessibility and improve hospital services, improving case-management capacity (Sabaté, 2003). At present, the TB control system in Pakistan does not consider follow-up visits in TB cases until they complete treatment and are cured; periodic surveillance is rare (Khan, 2003). A weak healthcare infrastructure, due to lack of trained staff,

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cannot provide TB case-management facilities under the DOTS strategy (Marsh *et al*, 1996). With the expansion of DOTS in Rawalpindi District, case detection rates have increased, but case-management capacity has not improved. The default rate increased from 1% to 10% between the second quarter of 2007 and the first quarter of 2008 (Provincial TB Control Program, 2008).

Appropriate management of TB patients requires a comprehensive approach, including diagnostic facilities, expert healthcare staff, an uninterrupted supply of drugs, and continuing treatment. It also requires improved adherence by TB patients to chemotherapy through health education, community involvement in the social support of TB patients and good case follow-up (Garner, 2007).

At present, the Chronic Care Model (CCM) is considered the standard of care for management of chronic diseases, especially type 2 diabetes (Wagner, 1998; Bonomi *et al*, 2002; Sunaert *et al*, 2009; Dancer and Courtney 2010; Khan *et al*, 2010). The model comprises 6 interrelated components that interact to promote high-quality care for patients with chronic disease. The 6 components include: healthcare organization, self-management support, delivery-system design, decision support, the community and an information system (Wagner *et al*, 2001).

Rawalpindi District Hospital is a tertiary-care hospital in Rawalpindi City. It is a 500-bed hospital, affiliated with Rawalpindi Medical College. It has a separate TB chest clinic (OPD) and indoor facilities for TB patients, with an average of 90 to 100 TB patients of all categories, *ie*, new, follow-up cases, default cases and pulmonary and extra-pulmonary cases. To improve treatment adherence and cure

rates of TB patients at Rawalpindi District Hospital, it was deemed important to improve hospital services through implementing a CCM-based intervention. Four quality indicators were used to evaluate the effectiveness of the intervention: quality of service system, patient satisfaction, treatment adherence, and TB cure-rates, based on current scientific evidence (Penney and Henry, 2008; Parasuraman *et al*, 1985, 1988; Berry *et al*, 1988; Rocha *et al*, 2003; WHO, 2003).

## MATERIALS AND METHODS

### Setting and samples

This quasi-experimental study, of one-group pre-test/post-test design, was conducted at Rawalpindi District Hospital. The TB Clinic has separate TB and chest-disease wards for inpatients. The study consisted of two sample groups. The first group was 99 newly diagnosed TB patients, according to WHO guidelines (WHO, 2003), who attended the TB Clinic of Rawalpindi District Hospital during February-March 2009 meeting the following criteria: 1) a patients aged  $\geq 15$  years diagnosed with new pulmonary TB with either sputum positive or negative on AFB smear; 2) who attended the TB Clinic for their second visit. TB patients admitted to the TB ward and those who declined to participate in the study, were excluded. The second group was comprised of 17 healthcare staff: one medical supervisor and his assistant, two male and one female medical officers, two nurses, three DOTS facilitators, two community-health workers, one clerk, two laboratory technicians, and two assistant pharmacists. Patients were informed about the objectives and methods of the study and invited to participate. After giving informed consent, the patients were interviewed at their 2<sup>nd</sup>

visit using a structured questionnaire, before implementing the CCM intervention. The Ethics Review Committee of Mahidol University approved the study.

### **Intervention**

Chronic Care Model (CCM) concepts, with modifications to suit Rawalpindi District Hospital, the community health service system, and existing resources, were used to improve the hospital service system at the TB Clinic. The intervention duration was 6 months, preceded by 4 weeks preparation. Before implementing the intervention, the existing service system was analyzed and a collaboration workshop was conducted with members of the hospital administration. In this study, senior management at Rawalpindi District Hospital supported implementation of changes, including provision of an adequate supply of anti-TB drugs and logistics.

The service system at the TB Clinic was improved, in terms of accessibility, waiting time, and provider behavior. The physicians adopted the 5A technique (assess, advise, agree, assist, and arrange) to provide effective self-management support, which included goal-setting, action planning, problem solving, and follow-up. This phase also included counseling for TB patients. Communication between doctors and patients was also improved via the delivery-system design. The physicians were well-trained in DOTS, to ensure they could provide effective treatment for TB patients. This was done under the decision-support component of CCM. Care was coordinated by sharing clinical information with patients and providers. Staff-patient interactions were reviewed monthly. Patient appointments were arranged by treatment schedule. Fortnightly community visits by the healthcare

team encouraged patients to participate in the DOTS program, and raised community awareness through networking and health education. The community provided social support, and TB patients were able to overcome social barriers. Hospital staff underwent a retraining course and participated in a workshop on continuity of care and its sustainability. A guidebook on TB-patient care was produced and given to the healthcare team of the TB Clinic.

The main changes carried out to improve the hospital service system at the TB clinic were: 1) healthcare organization which includes-ownership and support for this study, implementation of changes recommended for improvement, the doctors and staff of TB Clinic were not be changed, rewards for good work by healthcare staff at the TB Clinic were given, and adequate supplies of anti-TB drugs were assured. 2) self-management support - healthcare staff worked on the concept of the central role of the patient in the management of disease, healthcare staff used the "5A" approach while working with patients, healthcare staff provided information about TB, such as the course of treatment, side-effects of the drugs, and preventive measures. 3) Delivery system design - staff duties were made to help them work as a single unit, unnecessary steps for service provision were eliminated, reducing waiting times, a separate waiting room was provided to help patient feel more secure, there was discipline at the TB clinic where every patient waited for his turn by appointment, reports from the laboratory were sent directly to the TB Clinic instead of being handed to patients, which had caused treatment delays, and scheduled follow-ups reduced default rate. 4) Deci-

sion support- the healthcare staff used up to date knowledge of the TB DOTS program for treatment, healthcare staff applied the concept of CCM effectively, healthcare staff provided written instructions to patients with a clear date for the next appointment, staff provided necessary education regarding health problems of the TB patients. 5) Community-fortnightly visits were made by healthcare staff to selected communities, Linkage of services with community resources were made. 6) Information system - systematic follow-up of TB patients was carried out, timely reminders were given to patients, monthly meetings of healthcare staff with hospital administration were carried out to solve problems and bring about further improvement.

#### **Main outcomes**

After 6 months of intervention, 4 quality indicators were used to evaluate the effectiveness of the intervention. It took 2 weeks to collect the data. The measures of quality indicators were:

**The quality of the hospital service system.** This indicator was evaluated with 24 questions (Penney and Henry, 2008). It assessed accessibility (7 items), continuity of care (6 items), counseling (5 items), drugs and side-effects (2 items), and logistics and supplies (4 items). Responses were rated on a 3-point scale, where 0=no/never, 1=yes, sometimes, and 2=yes, always. Scores ranged from 0-2, according to the services provided to patients. Scores of 0-30 were classified as poor or needing improvement, 31-35 was average, and 36-48 was good. Cronbach's alpha was 0.780.

**Patient satisfaction.** Patient satisfaction was evaluated with 20 questions (Parasuraman *et al*, 1985, 1988; Berry *et al*, 1988). It measured tangibles (6 items), reliability (5 items), responsiveness (4 items), assur-

ance (3 items), and empathy (2 items). Responses were rated using a 5-point Likert scale: 1=very dissatisfied, 2=dissatisfied, 3=uncertain, 4=satisfied, 5=very satisfied. Scores ranged 20-100, according to the level of satisfaction. Scores of 20-69 were classified as needing improvement, 70-79 average, and 80-100 good. Cronbach's alpha was 0.790.

**Treatment adherence.** Treatment adherence was evaluated with 10 questions assessing TB patient self-care (Rocha *et al*, 2003). The range of possible scores was 0-30, according to patient practices. Responses were rated on a 4-point scale; 0=never, 1=sometimes, 2=often, 3=regularly. Scores of 0-18 were classified as poor or needing improvement, 19-21 was moderate or fair, and 22-30 was good. The Cronbach's alpha was 0.730.

**The cure rate.** The cure rate referred to the proportion of TB patients whose sputum results were positive for acid-fast bacilli (AFB) at the start of treatment and smear-negative during the last month of treatment (WHO, 2003). It was calculated based on the actual number of TB patients in the study, compared with the cure rate from the quarterly report.

#### **Data analysis**

Descriptive statistics were used for the general characteristics of patients using frequencies, medians, means, standard deviations, and ranges. The differences in the 3 variables, before and 6 month after the intervention were analyzed by paired *t*-test, for quality of hospital service system, patient satisfaction, and treatment adherence. Treatment outcomes for the actual study population were compared with previous outcomes from quarterly reports using the chi-square and Fisher's exact tests. The significance level was set at  $p < 0.05$ .

Table 1  
General characteristics of 99 TB patients.

Variable	Number	%
Age (years)		
15-24	47	47.5
25-34	18	18.2
35-44	14	14.1
45-54	9	9.1
≥ 55	11	11.1
Mean=31.6, SD =15.4 Range 15-80		
Sex		
Male	42	42.4
Female	57	57.6
Religion		
Muslim	80	80.8
Christian	19	19.2
Marital status		
Married	49	49.5
Single	41	41.4
Widowed	9	9.1
Education		
No education	3	3.0
Primary school	40	40.4
Secondary school	55	55.6
University	1	1.0
Occupation		
Unemployed	38	38.4
Laborer	49	49.5
Govt employee	11	11.0
Farmer	1	1.0
Monthly income (Rupees) <sup>a</sup>		
No income	35	35.4
≤ 5,000	12	12.1
5,001-10,000	44	44.4
> 10,000	8	8.1
Median=6,000 Range 0-12,000		

<sup>a</sup>USD1= 85.6 Rupees

## RESULTS

### General characteristics

Of the 99 patients, 47.5% were aged 15 and 24 years (range 15-80 years). The mean patient age was 31.6 years; 57.6% of the patients were female and 80.8% were

Table 2  
Quality of hospital service system before and after the intervention.

Variable	Before (n=99) %	After (n=98) <sup>a</sup> %
Overall quality of hospital service system		
Good	1.0	28.3
Average	4.1	64.6
Needs improvement	94.9	6.1
Accessibility		
Good	1.0	26.5
Average	23.2	54.1
Needs improvement	75.8	19.4
Continuity of care		
Good	39.4	53.1
Average	29.3	33.6
Needs improvement	31.3	13.3
Counseling		
Good	0.0	9.2
Average	2.0	41.8
Needs improvement	98	49.0
Drugs and side-effects		
Good	32.3	78.6
Average	0.0	21.4
Needs improvement	67.7	0.0
Logistics and supplies		
Good	49.5	81.6
Average	0.0	0.0
Needs improvement	50.5	18.4

<sup>a</sup> 1 case died during the study

Muslims; 49.5% were married, 55.6% had a secondary school education level; 49.5% were laborers and 44.4% had incomes of 5,001 to 10,000 rupees per month (median 6,000 rupees/month) (Table 1).

### Quality of hospital service system

Six months after the intervention, the overall quality of the hospital service system changed to "good" (from 1.0 to 28.3%). This rating covered: accessibility (1.0 to 26.5%), continuity of care (39.4 to 53.1%), counseling (0.0 to 9.2%), drugs

Table 3  
Quality of hospital service system before and after intervention, according to 98 TB patients<sup>a</sup>.

Variable	Before	After	<i>p</i> -value <sup>b</sup>
	Mean (SD)	Mean (SD)	
Overall quality of hospital service system	25.1 (3.7)	32.8 (2.4)	< 0.001
Accessibility	7.1 (1.7)	9.3 (1.3)	< 0.001
Continuity of care	8.0 (1.5)	8.6 (1.0)	< 0.001
Counseling	3.0 (1.2)	6.5 (0.9)	< 0.001
Drugs and side-effects	2.1 (0.7)	3.0 (0.8)	< 0.001
Logistics and supplies	5.4 (1.2)	6.3 (1.1)	< 0.001

<sup>a</sup> 1 case died during the study; <sup>b</sup> *p*-value by paired *t*-test

Table 4  
Patient satisfaction before and after intervention.

Variable	Before	After
	( <i>n</i> =99) %	( <i>n</i> =98) <sup>a</sup> %
Overall patient satisfaction		
Good	10.2	54.1
Average	81.7	45.9
Needs improvement	8.1	0.0
Tangibles		
Good	6.1	29.6
Average	61.6	70.4
Needs improvement	32.3	0.0
Reliability		
Good	15.2	54.1
Average	58.5	42.8
Needs improvement	26.3	3.1
Responsiveness		
Good	35.4	52.0
Average	51.5	48.0
Needs improvement	13.1	0.0
Assurance		
Good	42.4	65.3
Average	40.4	27.6
Needs improvement	17.2	7.1
Empathy		
Good	39.4	70.4
Average	36.4	28.6
Needs improvement	24.2	1.0

<sup>a</sup> 1 case died during the study

and side effects (32.3 to 78.6%) and logistics and supplies (49.5 to 81.6%) (Table 2). Significant positive differences in the quality of the hospital service system were apparent during the 6 month interval after the intervention  $p < 0.001$  (Table 3).

#### Patient satisfaction

The patient satisfaction level of "good" increased from 10.2 to 54.1%. All dimensions improved in terms of tangibles (6.1 to 29.6%), reliability (15.2 to 54.1%), responsiveness (35.4 to 52.0%), assurances (42.4 to 65.3%), and empathy (39.4 to 70.4%). Six months after the intervention, patient satisfaction was higher in all dimensions measured  $p < 0.001$  (Tables 4-5).

#### Treatment adherence

TB patient treatment adherence was measured by self-care practices. Six months after the intervention, treatment adherence increased from 23.2 to 56.1% (data not shown). Significant differences in treatment adherence overall, and by item, were found ( $p < 0.05$ ) except for two items: living in a cross-ventilated room and visiting a hospital for follow-up (not significant) (Table 6).

Table 5  
Means (SD) of patient satisfaction among 98 patients <sup>a</sup>.

Variable	Before	After	<i>p</i> -value <sup>b</sup>
	Mean (SD)	Mean (SD)	
Overall patient satisfaction	69.9 (4.4)	75.0 (2.9)	<0.001
Tangibles	21.0 (1.7)	23.0 (1.3)	<0.001
Reliability	18.1 (1.8)	19.7 (1.4)	<0.001
Responsiveness	14.9 (1.2)	15.7 (1.1)	<0.001
Assurance	11.4 (1.2)	12.0 (1.1)	<0.001
Empathy	7.2 (1.0)	8.1 (0.9)	<0.001

<sup>a</sup> 1 case died during the study; <sup>b</sup> *p*-value by paired *t*-test

Table 6  
Treatment adherence (individual items) among 98 TB patients <sup>a</sup>.

Variable	Before	After	<i>p</i> -value <sup>b</sup>
	Mean (SD)	Mean (SD)	
Overall treatment adherence	16.6 (2.6)	19.2 (1.9)	< 0.001
Taking anti-TB drugs	2.4 (0.8)	2.6 (0.5)	0.001
Live in cross-ventilated room	2.1 (0.6)	2.2 (0.5)	0.058
Visit hospital for follow-up of treatment	2.3 (0.7)	2.4 (0.6)	0.158
Meals composed of meat, vegetables, rice and fruits	1.3 (0.6)	1.6 (0.5)	< 0.001
Perform breathing exercises to maintain good lung function	0.8 (0.7)	1.6 (0.5)	< 0.001
Leave the room if a person starts smoking	1.8 (0.6)	1.9 (0.5)	0.012
Avoid working in a smoky place	1.8 (0.5)	1.9 (0.6)	0.032
Collect sputum in a small box with a cover	1.7 (0.8)	2.0 (0.7)	< 0.001
Avoid staying in a crowded place	2.0 (0.7)	2.7 (0.5)	< 0.001
Consult a doctor if there are any health problems, eg, side-effects	2.4 (0.6)	2.8 (0.4)	< 0.001

<sup>a</sup> 1 case died during the study; <sup>b</sup> *p*-value by paired *t*-test

Comparison of treatment outcomes before and after the intervention (Table 7) showed cure rates rose significantly, from 5.3 to 17.2% ( $p=0.001$ ), treatment completion increased non-significantly from 76.7 to 79.8% ( $p=0.560$ ) and the default rate fell significantly, from 11.6 to 2.0% ( $p=0.005$ ).

## DISCUSSION

This is the first study to introduce

the CCM to improve the hospital service system to increase TB treatment adherence and cure rates at a TB Clinic of a tertiary public hospital in Pakistan. The CCM-based intervention was modified to suit the hospital, the community-health service system and existing resources. In this study, TB patients evaluated quality improvements in the hospital service system, patient satisfaction, and treatment adherence, via a structured question-

Table 7  
Number and percentage of treatment outcomes.

Outcome measure	Before <sup>a</sup> (n=172)	After <sup>b</sup> (n=99)	p-value
	Number (%)	Number (%)	
Cured	9 (5.3)	17 (17.2)	0.001 <sup>c</sup>
Treatment completed	132 (76.7)	79 (79.8)	0.560 <sup>c</sup>
Died	2 (1.2)	1 (1.0)	1.000 <sup>d</sup>
Treatment failed	0 (0.0)	0 (0.0)	NA <sup>e</sup>
Defaulted on treatment	20 (11.6)	2 (2.0)	0.005 <sup>c</sup>
Transferred out	9 (5.2)	0 (0.0)	NA <sup>e</sup>

<sup>a</sup> Data from Rawalpindi District Hospital quarterly report, for 172 TB patients, 1<sup>st</sup> quarter 2008 (Provincial TB Control Program, 2008).

<sup>b</sup> Calculated from the 99 TB patients who participated in the intervention.

<sup>c</sup> p-value by chi-square test; <sup>d</sup> p-value by Fisher's exact test

<sup>e</sup> Not applicable

naire based on current scientific evidence (Parasuraman *et al*, 1985, 1988; Berry *et al*, 1988; Rocha *et al*, 2003; WHO, 2003; Penney and Henry, 2008). Assessment of the chronic illness care (ACIC) instrument, a well-developed practical tool to measure quality improvement (Bonomi *et al*, 2002) was not used in this study because the intervention was implemented in only one health facility. The number of health facilities and healthcare providers was too small to use the ACIC.

The results reveal the intervention was effective for improving the self-reported overall quality of the hospital service system, patient satisfaction, and TB-treatment adherence. The quarterly cure rate increased significantly (5.3 to 17.2%;  $p < 0.001$ ). The CCM-based intervention provided a multi-dimensional approach to improving the quality of the hospital service system, since it focused on increasing the capacity of hospital staff, active involvement of hospital administration and using community resources for effective case management. However,

pre-intervention preparation, and the details of implementing each component, were also important. For example, analysis of the existing service system and informal interviews of patients and staff before the intervention indicated the patients' expectations of TB services were not fulfilled due to the unfriendly behavior of the doctor, accessibility difficulties, long waiting times, and the lack of disease-related information. This resulted in patients losing confidence in the treatment and distrusting the doctor and other staff. The healthcare staff were overwhelmed with duties and were unclear about their work, resulting in reduced concern for patients. The staff were inadequately trained in updated for TB-patient management techniques. The preparatory period enabled a better understanding of the process, to improve the hospital service system using CCM.

Six CCM components were incorporated into the TB Clinic operations: 1) Hospital administration/healthcare organization: the hospital provided full



support to implement changes recommended during the improvement process, since they understood the process and usefulness of the study. This support provided a positive message to members of the healthcare team working at the TB Clinic. 2) Self-management support: it is clear from this study the central role of the patient in the management of TB; health education is necessary to improve treatment adherence. 3) Decision support: healthcare staff with an updated knowledge of TB management provided a basis for improving the hospital service system, thereby increasing treatment adherence. 4) Delivery system design: laboratory reports were sent directly to the TB Clinic within a predetermined time frame, which shortened waiting times. Assigning duties to healthcare staff also helped decrease waiting times. 5) Community: hospital staff visits to the community were a source of social support for TB patients, since they involved the whole community and reduced the cultural and social stigma associated with TB. 6) Information system: the information system was a good tool for educating patients about treatment and timely appointments.

This study had 3 major limitations: 1) a National Immunization Campaign started during the study, in which the Health Department, Government of Punjab, assigned duties to all hospital staff. This affected TB-patient treatment routines; 2) there were some language barriers with TB patients from the North Western Frontier Province (NWFP), who spoke "Pashto", different language. Hospital staff and patients had to communicate through interpreters, so messages may have been incompletely translated, or may not have conveyed the intended message of the patient; and 3) the study was not a randomized control trial, so that

the results could be explained by factors other than the intervention.

In conclusion, the quality of the hospital service system, patient satisfaction, and treatment adherence by TB patients after the 6-month CCM intervention improved significantly compared with before the intervention. Treatment outcomes were also better, especially cure rates. Senior hospital management should introduce and maintain a policy of continuous quality improvement. Simple measures, such as providing a separate waiting room, privacy in examination rooms, and effective interpersonal communication with TB patients, should be introduced immediately as a priority. Hospital staff at the TB Clinic should undergo retraining in DOTS for TB case-management, to ensure quality of care. Logistics and supplies should be maintained regularly. More relevant information should be provided at clinics, and in the community to encourage TB patients to adhere to treatment and assure more positive treatment outcomes. A future study should involve more study sites, to provide a better representation of the average healthcare facility. ACIC, which involves assessment by organizational teams, should be used to measure quality improvement.

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