Original Article

PERFORMANCE OF A DOTS PROGRAMME: ADMINISTRATIVE AND TECHNICAL CHALLENGES - A FIELD REPORT FROM A DISTRICT IN SOUTH INDIA

P.G. Gopi, R. Subramani, T. Santha, S. Radhakrishnan, V. Chandrasekaran, R. Rajeswari, R. Balasubramanian, A. Thomas, M. Muniyandi and P.R. Narayanan

(Original received on 7.2.2006; Revised Version received on 4.4.2006; Accepted on 13.4.2006)

Summary

Background: Performance of tuberculosis (TB) control programme depends on the functioning of health facilities (HFs). TB control programmes have been evaluated based on the programme indicators of conversion and cure. We have attempted to correlate the programme performance based on the availability of staff and their performance at the HF level.

Objective: To correlate the performance of HFs to programme indicators, conversion and cure of patients treated under DOTS, in a district of south India.

Design: Analysis of the data on new sputum smear-positive cases registered in 17 HFs during 1999-2003 was undertaken using TB register. The HFs with a low conversion or cure rates were identified and the reasons for the same were analysed. A scoring system was designed for the functioning of the HFs based on staff availability, supervision and review meetings which was correlated with programme performance. Univariate and multivariate analyses were performed.

Results: Of 1893 new smear-positive patients registered during the study period, conversion was 1582 (83.6%) with cure rate of 76.4% (1447 of 1893), 254 (13.4%) default, 94 (5.0%) failure and 85 (4.5%) death. The conversion rates increased from 76% in 1999 to 87% in 2003; a statistically significant trend ($\chi^2 = 15.9$; $P<0.001$). Similarly, a significant increase in trend ($\chi^2 = 4.0$; $P < 0.05$) was observed in cure rates also (71 to 80%). The HFs were broadly classified into four groups namely; poor, fair, good and very good based on functioning scores .Correlation co-efficient was 0.77 between functioning of the HFs and conversion, and 0.76 between functioning and cure ($P<0.01$). Lack of regular review meetings was found to be independently associated with poor programme performance.

Conclusion: Availability of staff such as Medical Officer, Laboratory Technician, and regular supervisory visits and review meetings are essential for a well functioning of programme. There is significant impact on DOTS with good functioning of HFs. **[*Indian J Tuberc 2006; 53:123-134*]**

Key words: TB, conversion, cure, performance, DOTS.

INTRODUCTION

Directly Observed Treatment-Short-course (DOTS) is the globally recommended standard of care for management of TB. Government of India has implemented the DOTS strategy in the Revised National Tuberculosis Programme (RNTCP) introduced in 1993[1,2] and expanded in a phased manner. And has covered more than one billion population by 2005. The DOTS strategy, with the objectives of curing at least 85% new smear-positive cases and detecting a minimum of 70% of these cases, clearly emphasizes the importance of its various components like case detection, directly observed treatment, uninterrupted drug supply, monitoring of the progress, proper documentation and reporting. This strategy has been beneficial and successful in reducing the death rate and increasing the favourable treatment outcomes[3]. It reduces the chances of failure and relapse. And prevents emergence of multi-drug resistant TB (MDR-TB).

Under RNTCP, there is an additional supervisory unit for every 500,000 population (TB Unit: TU) headed by a Medical Officer TB control (MOTC). Adequate and uninterrupted monitoring activities such as follow-up by sputum examination at regular intervals and outcome evaluation is ensured

Tuberculosis Research Centre (ICMR), Chennai

Correspondence: Dr. P.R. Narayanan, Director, Tuberculosis Research centre (ICMR), Mayor V R Ramanathan road, Chetput, Chennai 600 031; Ph: 91-044-28369600; Fax: 91-044-28362528; E-mail: nrparanj@md2.vsnl.net.in

by Senior Treatment Laboratory Supervisor (STLS) and Senior Tuberculosis Supervisor (STS), two key personnel performing supervision on a daily basis, assisted by other health workers in the TU. MOTC conducts supervisory visits at least seven days in a month and supervises the functioning of the HFs in the TU. At each HF, a Medical Officer (MO) is in-charge of programme implementation and monitoring by regular supervisory visits and review meetings. The ultimate aim of this programme is to cure the patients and cut the chain of transmission for the control of TB.

Government of Tamil Nadu implemented the DOTS programme in a semi-urban population in Tiruvallur district in 1999 and TB Research Centre monitored the programme in one TU intensively for a period of 5 years since its implementation. We have undertaken several operational studies on various key aspects of DOTS strategy with a view to improving the performance and documented valuable information. However, the administrative and technical challenges have not been addressed so far.

This paper describes the performance of the DOTS programme in different governmental HFs as measured by programme indicators. Even though, the conversion and cure rates are the outcome of many factors, we have attempted to correlate them with the performance of the HFs.

MATERIAL AND METHODS

The study area is a semi-urban population of Tiruvallur district where the RNTCP was introduced in 1999. There are 17 governmental HFs catering to the health needs of an estimated population of 5,80,000 spread over 209 villages and nine urban clusters. Of these, seven offer microscopic facilities for diagnosis of TB. The study area has been divided into 5 blocks (these are five Panchayat Unions divided into five blocks for revenue and administrative purposes by the State Government), each block having 3-4 HFs. Subjects reporting voluntarily with cough of three weeks or more were investigated using sputum microscopy and those who were diagnosed were treated as per RNTCP guidelines[4]. The study subjects included all new smear positive TB patients who were registered under RNTCP at one of the above HFs from May 1999 to December 2003. The standard definitions were used for disease classification and programme indicators like conversion and treatment outcomes[5].

Data collection

Data on the initial results of sputum, classification of disease, follow-up smear results and treatment outcome were collected from the TB register maintained by the TU. After obtaining permission from the concerned state authorities, a field supervisor visited all the 17 HFs and collected the following data: leave and transfer particulars of MO, Village Health Nurse/Health Inspector (VHN/HI), Laboratory Technician (LT) and Pharmacist; the number of supervisory visits to field, number of review meetings held by verifying the relevant registers, holding health and other camps and occurrence of any social incidents like community clash or riots that might have affected the performance of HF activities during the period 1999-2003.

Data analysis

All data were computerized, edited and corrected for missing information. The overall conversion and cure rates were estimated and compared over the period 1999-2003. We compared the functioning of the HFs in each block with the programme indicators namely, conversion and cure. These indicators were further looked into for each block and the HFs with a poor performance of DOTS in terms of conversion and cure rates were identified and the possible explanation for the same was explored, identified and discussed.

Functional score

We designed a scoring system to evaluate the programme performance vis-à-vis the score for each HF year-wise. A score of '1' (otherwise '0') was given for each of the eleven parameters assessed as given below: Availability of (1) MO, (2) MOTC, (3) LT, (4) Pharmacist, (5) conducted review meeting, supervisory field visits by (6) MO, (7)

Table 1: Characteristics of TB patients registered under DOTS programme (between 1999 – 2003) in Tiruvallur district, south India

	Block					
	A	**B**	**C**	**D**	**E**	**Total**
	n 429	n 358	n 546	n 322	n 238	N 1893
Age in years						
< 45	52.9	53.9	52.4	51.9	52.5	52.7
≥ 45	47.1	46.1	47.6	48.1	47.5	47.3
Sex						
Male	74.1	76.0	78.4	72.7	76.5	75.8
Female	25.9	24.0	21.6	27.3	23.5	24.2
Literate						
Yes	43.9	53.6	60.6	70.0	50.9	55.7
No	56.1	46.4	39.4	30.0	49.1	44.3
Employed						
Yes	70.6	75.8	59.0	66.4	64.7	66.9
No	29.4	24.2	41.0	33.6	35.3	33.1
Smear at admission	64.1	52.2	57.0	61.5	55.5	58.3
2+, 3+	35.9	47.8	43.0	38.5	44.5	41.7
Scanty & 1+						
Conversion						
Yes	80.4	86.9	83.7	80.7	87.8	83.6
No	19.6	13.1	16.3	19.3	12.2	16.4
Cure						
Yes	74.6	81.8	73.8	72.7	82.8	76.4
No	25.4	18.2	26.2	27.3	17.2	23.6

Note: The figures indicate proportion (%) to the total cases.

Table 2: Correlation between functional score for the HF and programme performance under DOTS programme in Tiruvallur district, south India

Year	**Functional score**								Trend χ^2	
	Poor		**Fair**		**Good**		**Very good**			
	Conv. (%)	**Cure (%)**	**Conv. (%)**	**Cure (%)**	**Conv. (%)**	**Cure (%)**	**Conv. (%)**	**Cure (%)**	**Conv.**	**Cure**
1999	72	65	70	68	77	82	94	85	5.6	5.5
									P<0.05	P<0.05
2000	64	64	85	77	84	83	90	86	16.1	14.0
									P<0.001	P<0.001
2001	75	69	79	68	90	78	90	84	11.2	7.8
									P<0.001	P<0.05
2002	83	79	87	77	86	76	93	85	5.52	1.34
									P<0.05	NS
2003	77	67	86	77	91	88	94	83	13.9	9.0
									P<0.001	P<0.05

MOTC, (8) VHN/HI (9) other state officials, (10) No occurrence of community clash and (11) no other governmental health speciality camps held. These scores were added for each HF year wise. All HFs were broadly classified into four groups namely; poor, fair, good and very good based on percentiles (25, 50, 75, and above 75% respectively) of scores given. The overall conversion and cure rates of the HFs that included in each of these groups were calculated and compared. The functional score was then

Table 3: Risk factors for conversion and cure among new sputum smear positive TB patients

	Total	Conv* (%)	Cure** (%)
MO			
Available	69	41 (59.4)$^{+}$	39(56.5)$^{+}$
Not available	16	4	4
VHN			
Available	73	42(57.5)^{NS}	40(54.8)^{NS}
Not available	12	3	3
LT			
Available	55	39(70.9)$^{\#}$	33(60.0)$^{+}$
Not available	30	6	10
Pharmacist			
Available	72	41(18.1)^{NS}	39(54.2)^{NS}
Not available	13	4	4
Review meeting			
Conducted	47	37(78.7)$^{\#}$	33(70.2)$^{\#}$
Not conducted	38	8	10
MO			
Visited	34	29(85.3)$^{\#}$	25(73.5)$^{+}$
Not visited	51	16	18
MOTC			
Visited	36	27(75.0)$^{+}$	25(69.4)‡
Not visited	49	18	18
VHN			
Visited	56	37(66.1)‡	34(60.7)$^{+}$
Not visited	29	8	9
Others			
Visited	42	29(69.0)‡	28(66.7)‡
Not visited	43	16	15
Community clash			
No	83	44(53.0)ND	42(50.6)ND
Yes	2	1	1
Health camps			
Yes	53	33(62.3)$^{+}$	32(60.4)$^{+}$
No	32	12	11

* $\geq$85% (median) ** $\geq$ 78% (median); $^{+}$ P <0.05; $^{\#}$ P<0.01; ‡ P <0.001;
NS-Not significant; ND- Test of significance not done;
Note: In multivariate analysis, conducting review meetings was an independent risk factor associated with the higher conversion and cure rates. Availability of LT was an additional factor for a higher cure rate.

correlated with these indicators.

A univariate analysis was performed to identify potential factors among those patients with a high conversion and those with a low conversion taking the median value as the cut-off (similarly for cured cases also). The Chi- square test of significance was used to test the difference in proportion of converted cases among patients with and without factors (similarly for cured cases also). Logistic regression analysis was performed for those risk factors found significant in the univariate analysis. Trend chi-square was used to test the significance of trend of the performance over years. A P value of <0.05 was considered as statistically significant.

RESULTS

The demographic and other basic characteristics of all patents in the five blocks are given in Table 1. The age and sex compositions of the patients were found to be similar in all blocks. Fig 1a shows the conversion and cure rates of new smear positive cases in the TU from 1999 to 2003. The conversion rates increased from 76% in 1999

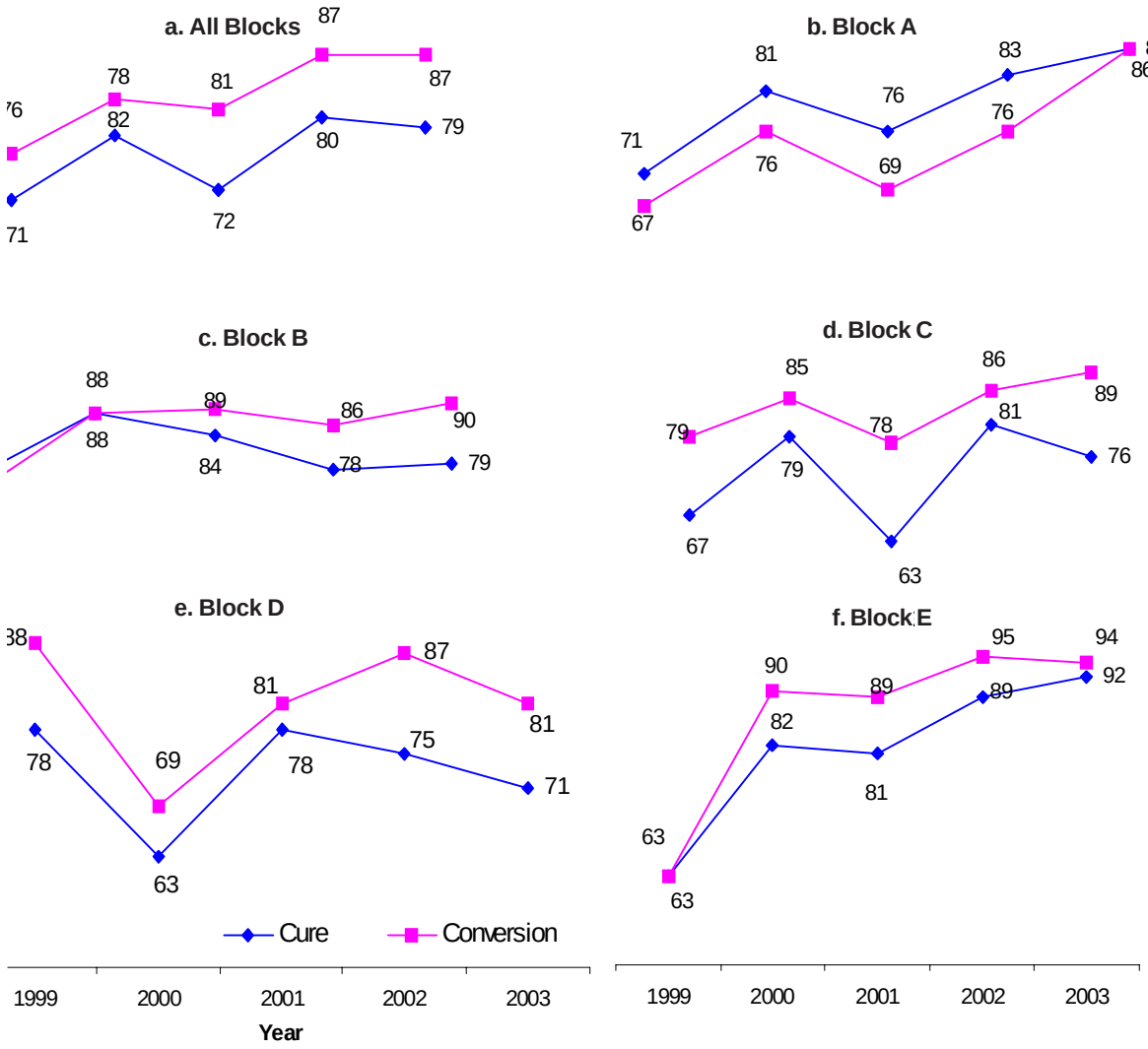

Fig 1: Cure and conversion rates from 1999-2003 for new smear positive patients

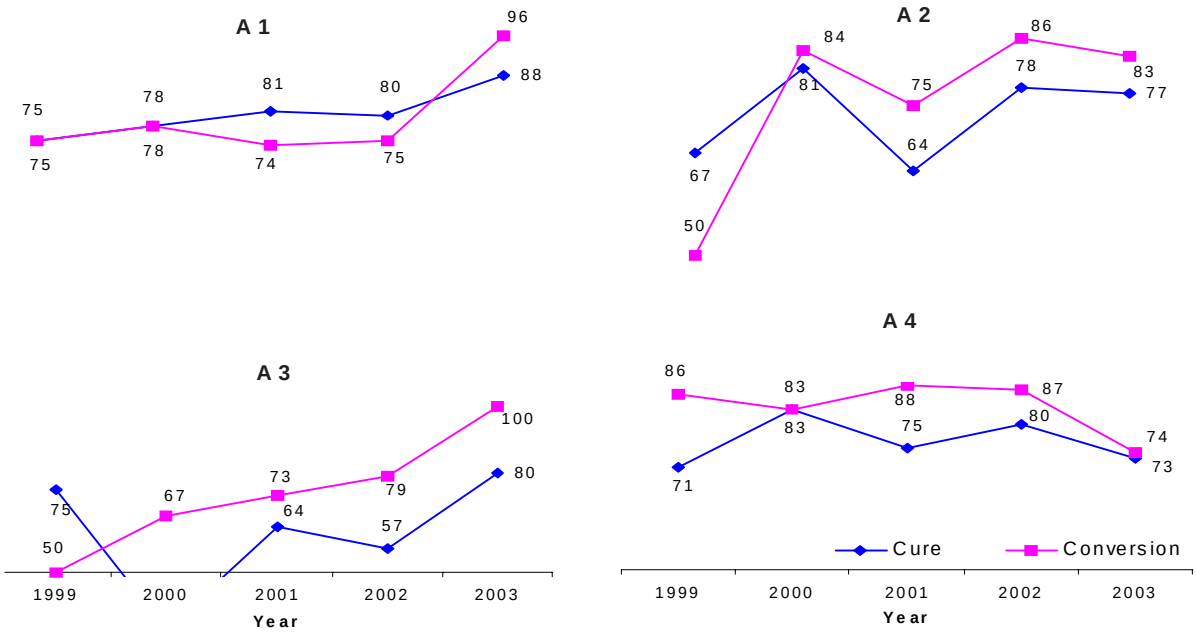

Fig 2a: Cure and conversion rates in each HF under Block A (1999 – 2003)

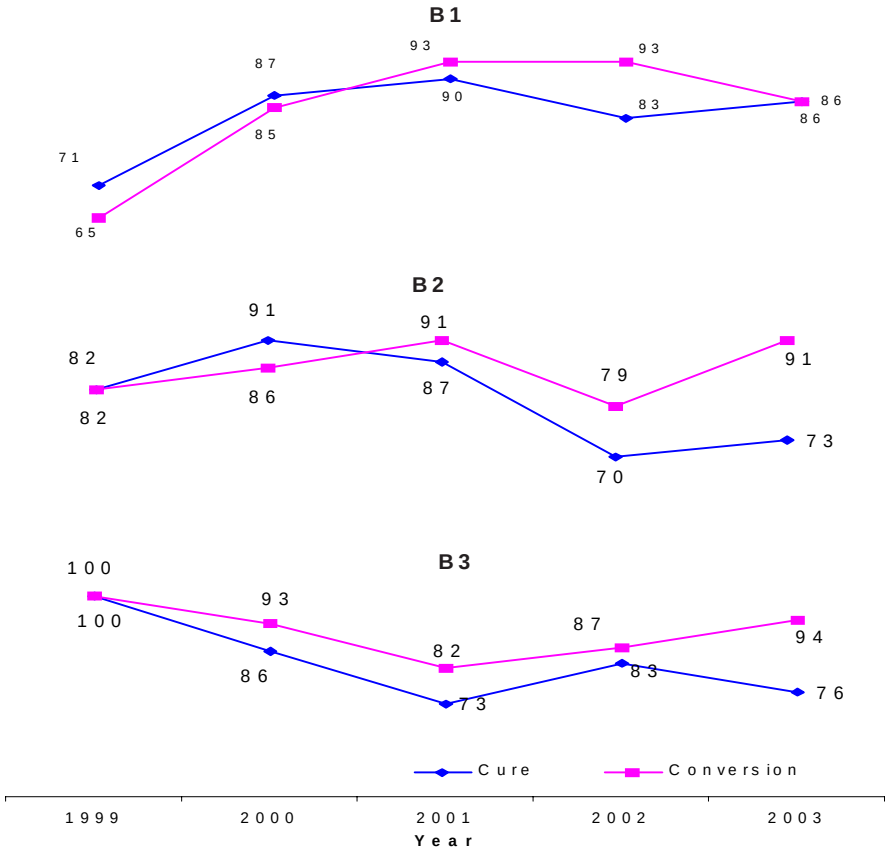

Fig 2b: Cure and conversion rates (%) in each HF under Block B (1999 – 2003)

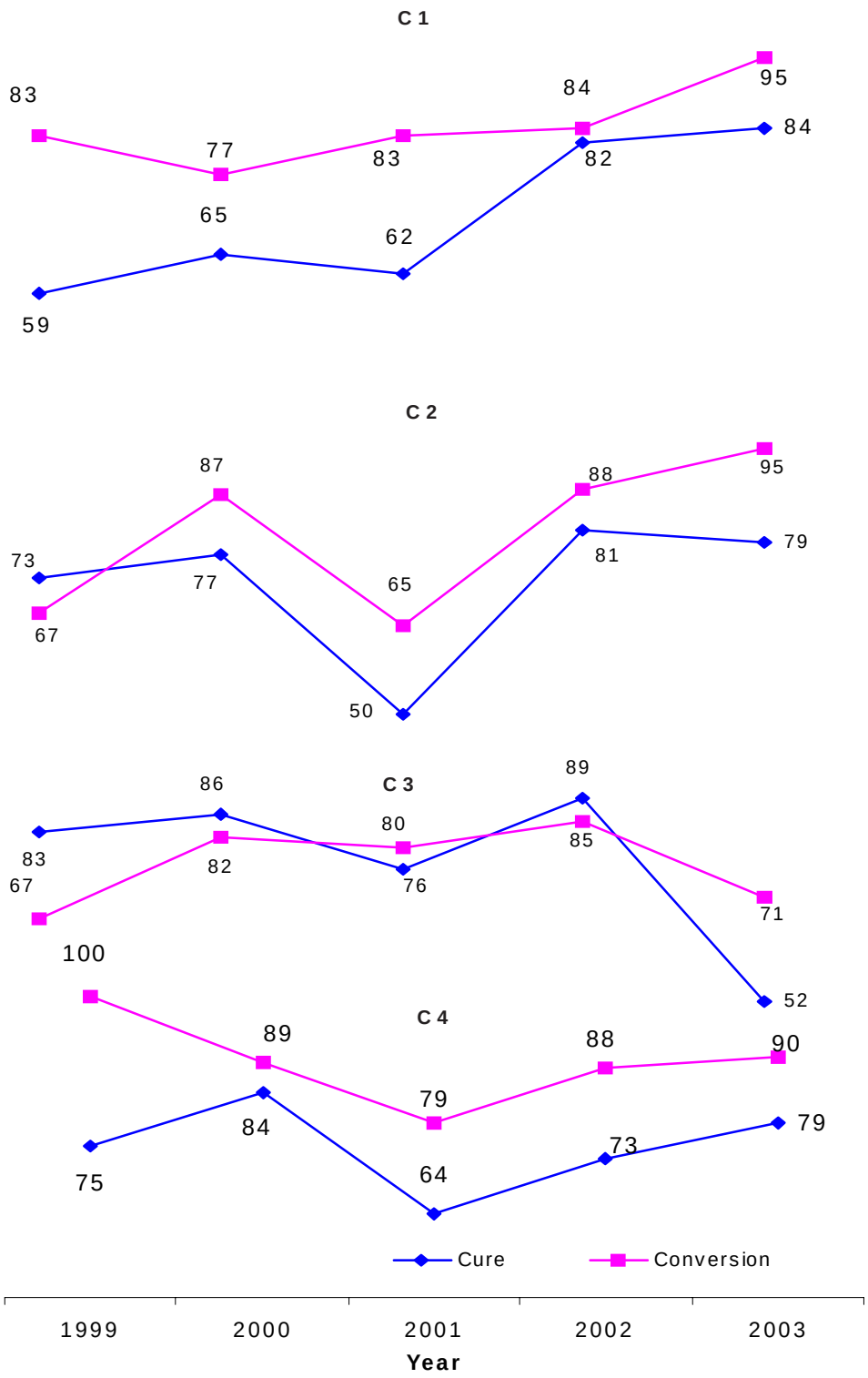

Fig 2c: Cure and conversion rates (%) in each HF under Block C (1999 – 2003)

to 87% in 2003 and the trend was statistically significant (Trend $\chi^2 = 15.9$; $P < 0.001$). Similarly, a significant increase in trend (Trend $\chi^2 = 4.0$; $P < 0.05$) was observed in the cure rates 71, 78, 72, 80 and 79% for the years 1999, 2000, 2001, 2002 and 2003 were respectively. Fig 1b, 1c, 1d, 1e and 1f give the performance of the five blocks (A, B, C, D and E), respectively. Block D showed a decrease in the cure and conversion in the year 2000 and blocks A and C in 2001.

In block A, both conversion and cure showed a gradual increase till 2003. In block C there was an increase in cure in 2002, but declined again in 2003. In block D, though cure increased in 2001, it declined again in 2002 and 2003. The low rate for conversion and cure observed in these two blocks was compensated by high rates in the other blocks giving an overall conversion and cure rates of 82% and 78% respectively.

Fig 2a, 2b, 2c, 2d and 2e give respectively

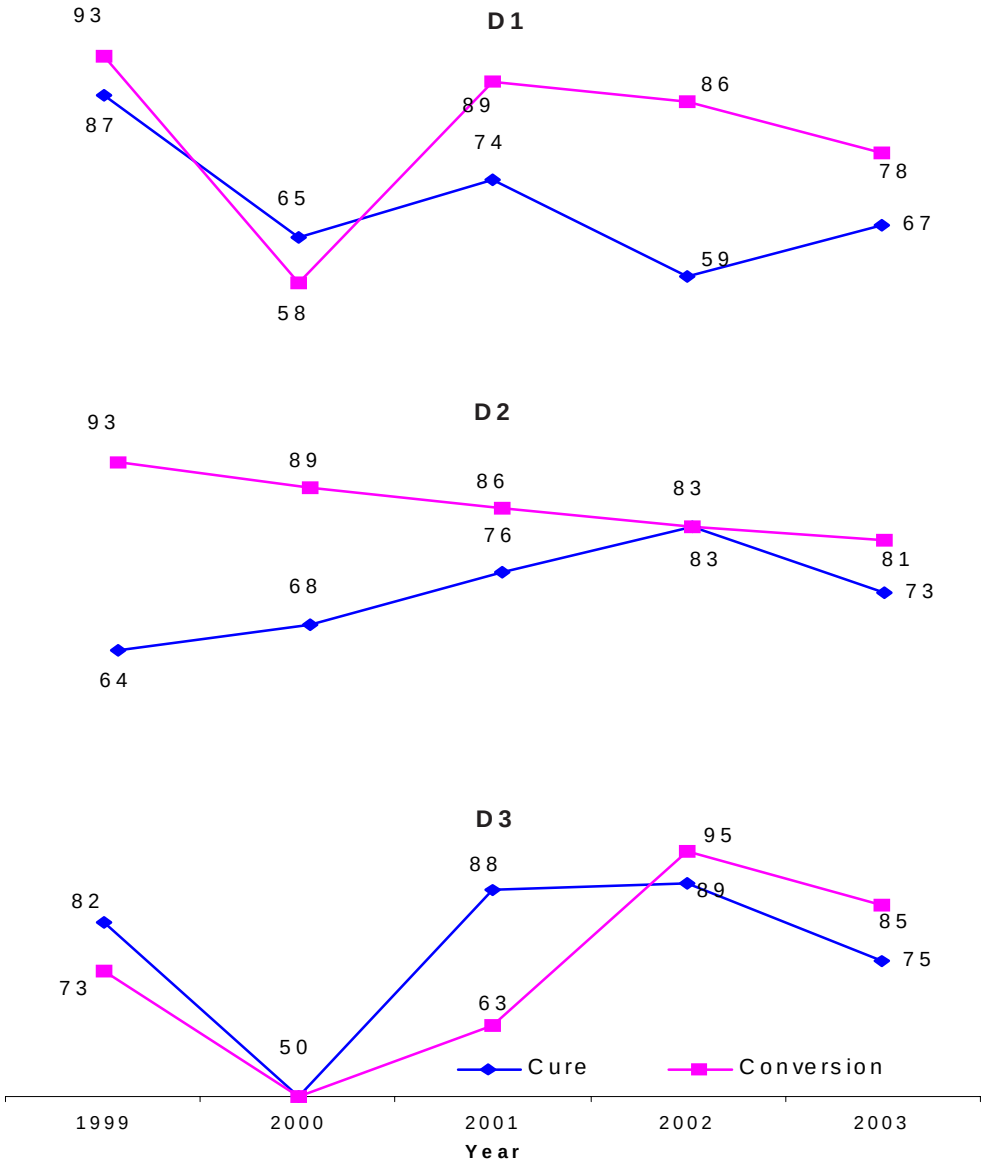

Fig 2d: Cure and conversion rates (%) in each HF under Block D (1999 – 2003)

the performance of the HFs under each of the five blocks. In block A, the decline observed in conversion and cure for the year 2001 was contributed by the HF A2. In block B, the decline observed from 2001 in the cure rate was contributed by HF B3 in 2001 and B2 in 2002. The cure and conversion rates were low in HFs C1 (for cure only), C2 and C4 of block C for the year 2001. Similarly in block D, the decline observed for cure and conversion in 2000 was contributed by D1 and D2.

The functional score was correlated to both conversion and cure (Table 2). The correlation co-efficient was 0.78 for conversion and 0.83 for cure ($P<0.01$). A significant increase in trend for both conversion and cure in relation to the functional score was observed except for cure in 2002. In univariate analysis of the eleven parameters (score 1 or 0) for 17 HFs for five years (n=17*5=85), all factors except for availability of VHN and Pharmacist were found to be significantly associated with a high conversion

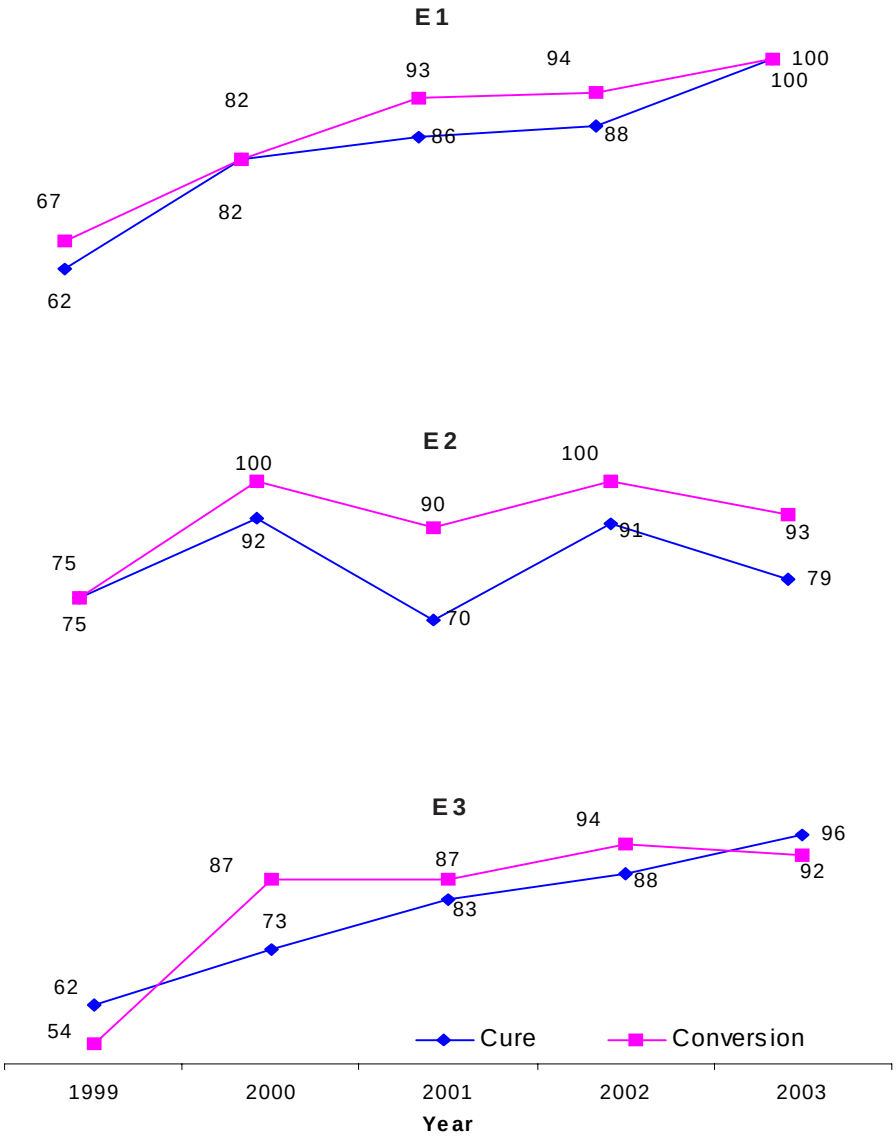

Fig 2e. Cure and conversion rates in each HF under Block E (1999 – 2003)

and cure (Table 3). In multivariate analysis, holding review meeting was independently associated with conversion and cure. Availability of LT was an additional factor found to be independently associated with cure.

DISCUSSION

The main finding of our study was that the programme performance varied between the HFs in the area over the years and for the first time we are able to correlate the functioning of HF with programme performance. Factors that influence the indicators are regular availability of essential staff such as MO, LT, regular supervisory visits of field staff, and review of DOTS activities. Availability of VHN and Pharmacist appeared to have not contributed significantly towards improving the conversion and cure. This could be due to the decentralization of the DOTS activities and hence their availability would not have contributed much.

In block A, redeployment of staff for the speciality health camps conducted might have affected the DOTS performance. The absence of a MO and lack of review meeting might have contributed to poor performance in some of the HFs for 2001. Speciality health camps and lack of regular review meetings might have contributed for the sub-optimal performance of B3 in 2001. In HF B2, lack of MO, review meetings and supervision in the year 2002 were found to be the factors that might have contributed for a poor performance in 2002. In HF C1, patients not belonging to the area were started on treatment, resulting in high default. In HF C2, there was no permanent MO for 8 months and adequate training was not given for those posted temporarily. In HF C4, the MO was deputed for health camp. The performance improved from 2002 due to the posting of regular MO and regular review meetings. In HF C3, there was no permanent MO in 2003 and hence no supervisory field visit was made during this year. The low conversion and cure rates in block D for the year 2000 might be due to the poor performance of D1 and D3. In HF D1, the MO in-charge was transferred and there was no review on DOTS activities. In 2001, the performance improved but decreased further due to frequent transfers of MOs and posting of MO who was not trained in DOTS. In HF D3, MOTC did no field visit throughout the year 2000. There was no pharmacist for four months. The performance improved in the subsequent two years. In 2003, the non-availability of MO and diversion from the DOTS activities, might have contributed to the slight reduction in cure and conversion. All HFs of the block E performed well except HF E2 where there was slight decline in the cure rate for 2001. This was due to migration of patients to the neighboring state. HFs A1, A4, B1, B2, C3, and D2 had performed better since the supervision and review meetings were regular in these areas.

There is an existing comprehensive system of monitoring of RNTCP based on indicators that have international acceptance. There is a need to emphasize the need for periodic evaluation of the functioning of each HFs and outreach of services to the patients to ensure that the programme is well functioning with adequate staff and other functionaries to achieve the expected level of cure and conversion[6]. Keeping these in mind, we have attempted to identify HFs not functioned optimally that might have resulted in low conversion and cure rates.

In our series, there was a correlation between good performance of HFs and the availability of supervisory staff at the HF, supervision and conduct of review meeting. There was a mutual relationship between activities of the HFs in terms of functional scores and programme indicators. The correlation co-efficient of 0.8 each obtained between functional score and conversion; and functional score and cure was a quantitative expression of the similarity between HF activities and success of the TB programme. In general, there was a significant increase in trend for both conversion and cure based on the functional score.

TB can be controlled only with effective supervision and efficient management. One of the major weaknesses of the earlier national TB control programme of India identified in 1992[7], was lack of supervision. Though, in RNTCP adequate emphasis

has been given for supervision, there is a need to re-emphasize this important component as shown in this analysis. It needs to be stressed that "What gets supervised gets done"[8]. To overcome this there should be a political commitment to have required number of supervisory staff at all levels. The programme should attract the right kind of people to learn and be committed to the programme[9]. The programme has already shown that with careful management, it is possible to treat a large number of patients even in the context of a sub-optimally functioning health care system[10]. A poorly managed TB control programme can worsen the epidemiological situation of TB in our country[3].

Lack of regular review meetings and supervisory visits by the MO, MOTC and VHN/ HI were the main factors that might have contributed to the poor performance of some HFs. It was observed that in these centers either the MO was not available due to transfer, deputation or long leave. During one year, many speciality health camps were organized by the state government, requiring the staff of the HFs to be present in the camps which might have affected the TB programme functioning. Lack of review meetings were independently associated with low conversion and cure.

TB can be controlled if appropriate policies are followed, effective clinical and public health management is ensured, and there are committed and co-ordinated efforts from within and outside the health sector. We have correlated the health functions with the programme indicators by a scoring system. Both were found to be well correlated indicating that success of the DOTS depends on the health functions.

Limitation of the study

The performance was generally low in the year 1999 when the DOTS was introduced. Since this was in the initial stage of implementation (May-Dec), the conversion and cure were found to be low. The conversion was less than the cure in 1999 as observed in some of the HFs due to small number of patients. In some of the HFs, during the later years also, the conversion was found to be less than the cure because of small numbers.

The comparison of the programme indicators among different HFs was based on small numbers (as low as 10 in some HF) and it may not be strictly comparable. However, identifying areas with poor performance and exploring the reasons for the same would be useful for monitoring and improving the programme.

There could be some other factors that would have contributed to a low performance of DOTS programme. We have not looked into these factors and hence our observations attributed for a low DOTS performance need not be necessarily true.

In conclusion, a well functioning programme requires regular availability of essential staff such as MO, LT, and regular supervisory visits in addition to review of DOTS activities will help to motivate the staff involved on a continuous basis to work with dedication. This will be a challenge to improve and sustain the programme with the existing health care system.

ACKNOWLEDGEMENTS

The authors are grateful for the assistance and cooperation of the Joint Director Health, Deputy Director of Medical Services (TB), Deputy Director of Health Services, and all the Medical Officers and paramedical staff including treatment observers who participated in this work. The authors thank Mr. E. Prabhakaran (Senior TB Laboratory Supervisor) for his assistance in maintaining the TB register. The authors are thankful to Dr. Renu Garg for her suggestions in further strengthening the report. The staff of EDP division is gratefully acknowledged for data entry and data management. Lastly, the authors are grateful to all the patients for their cooperation.

This work was funded in part by a grant from the United States Agency for International

Development provided through the World Health Organization, SEARO, New Delhi.

REFERENCES

1. Revised National Tuberculosis Control Programme: Government of India. Technical Guidelines. New Delhi: Government of India, 1997.
2. Khatri G R, Frieden T R. The status and prospectus of tuberculosis control in India. *Int J Tuberc Lung Dis* 2000; **4**: 193-200.
3. Thomas R. Frieden. Can tuberculosis be controlled? International Journal of Epidemiology 2002; **31**: 894-899.
4. World Health Organization. Revised international definitions in tuberculosis control. *Int J Tuberc Lung Dis* 2001; **5**: 213-215.
5. L S Chauhan, Vineet Bhatia. Monitoring of RNTCP. Health Administrator Vol: XV, Numbers; **1-2**, pg. 80-82.
6. Narayanan P R, Santha T, Paul Kumaran P. Tuberculosis control strategies: Challenges to health management research. Health Administrator Vol: XV, Numbers; **1-2**, pg. 113-117.
7. World Health organization, Tuberculosis Programme review, India, 1992, WHO/TB/95/186, Geneva: WHO, 1995
8. GR Khatri and Thomas R Frieden. Rapid DOTS expansion in India. *Bulletin of the World Health Organization* 2002; **80**: 457-463
9. G.R. Khatri and Thomas R. Frieden. Controlling tuberculosis in India. *N Engl J Med 2002*; 347 **(18)**: 1420-1425.
10. Tuberculosis: a look at the world situation. *Chest*, 1983; **84**: 756-761.

The Editorial Board of IJT has decided to bring out a series of review articles covering various aspects of extra-pulmonary tuberculosis starting from January 2007 issue onwards. The contributors are requested to kindly send review articles on various aspects of extra-pulmonary tuberculosis well in time.