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Evaluation of the TB control programme in Umzinyathi District

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EDITORIAL

The World Health Organisation (WHO) declared tuberculosis (TB) a global emergency in the early 1990's. The WHO proposed a strategy of *Directly Observed Therapy, Short Course* (DOTS) as a solution to reduce the growing burden of TB. The key elements of DOTS are political commitment to support TB treatment, detection of TB by sputum microscopy, direct observation of short course therapy, regular supply of medicines and reporting of programme performance and treatment outcomes.

While the majority of countries worldwide have adopted the DOTS strategy (including South Africa) major constraints to it's success have been identified in developing countries. These constraints include insufficiently skilled staff to run programmes at district and central levels, staff shortages, absent or inadequate training programmes, drug shortages, weak laboratory services and inadequate infrastructure.

In South Africa we have adapted an integrated approach to primary health care service (PHC) delivery. As a result the nurses in PHC clinics are multi-skilled and are required to multi-task. Thus nurses who may have training in TB management do not work solely with TB patients and often have other responsibilities. Multiple responsibilities together with the growing burden of TB patients in the face of the HIV epidemic often result in overworked nurses at a PHC level.

This directly and indirectly impacts negatively on the efficiency of the TB control programme at a facility level. This inefficiency may manifest in, a failure to correctly diagnose and appropriately treat TB patients, insufficient time being spent on health education for TB patients, a failure to correctly record and report TB cases. In addition overworked PHC nurses are unlikely to have sufficient time to monitor contact tracing and DOT supervision in the community.
Similarly while the use of community health workers (CHWs) as DOTS supporters has shown success in several countries the multiple responsibilities of CHWs in South Africa (HIV home based care, Child Health, Maternal Health, TB etc.) results in a

division of labour reducing the focus on TB patients and contributes to a weakening of the TB control programme within the community. Furthermore in cases where DOTS supporters are volunteers their commitment to the task is likely to be challenged with increasing responsibilities and patient load.

This issue of the KZN Epidemiology Bulletin does well to highlight the concerns around the roles and responsibilities of human resources with respect to TB control and the impact these can have on the technical and administrative efficiency of a District's TB control programme. There is little doubt that appropriate solutions aimed at identifying dedicated human resources at the PHC level for TB control and improving their technical and administrative skills will benefit the TB control programme.

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ACRONYMS & DEFINITION OF TERMS

Case Finding	The number of new and retreated TB cases sub-classified into smear+, smear- and no smear
DOH	Department of Health
DOT	Direct Observed Treatment
KZN	KwaZulu-Natal
PHC	Primary Health Care
Suspect cases	Patients attending OPD Clinics who have been coughing in the previous two weeks and who undergo sputum collection for smear test
Success Rate	In the analysis presented in this Issue, the success rate was estimated among the patients identified between June 2004 and March 2005 as the proportion of all TB patients who completed the six-month treatment.

AKNOWLEDGMENT

This issue of the Epidemiology Bulletin is a joint product of the KwaZulu-Natal Department of Health and the Italian Cooperation, which provided the funds for the study and the technical support. Dr Venanzio Vella, Epidemiologist of the Italian Co-operation planned the survey, analysed the data and wrote the Issue. Dr Aida Tefera, Public Health Specialist, provided insights on the methodology, trained and supervised the survey team composed by Miss Hlengiwe Mhlophe and Miss Lindiwe Farlane, and contributed to the Annex. The survey team benefited from the inputs of Dr Claudio Marra, MD Italian Cooperation, and from the assistance of the district health team of Umzinyathi. Mr Alastair Van Heerden cleaned the data files. The collaboration of the nurses of the clinics was critical to the success of the validation.

Abstract

A survey was conducted between September and December 2005 to evaluate the TB control programme in Umzinyathi, KwaZulu-Natal. The Issue describes the characteristics of the clinics dealing with TB patients and how these influence treatment outcomes. The information provides a baseline on infrastructure, staffing, strategies to trace defaulters and other factors that before this survey were not quantified. In 2004, the TB control programme in Umzinyathi had a success (cured plus completed) rate above 70%. However, the was a high variation across clinics, with the district hospitals' clinics having a success rate of around 60% versus the more favorable conditions of the rural clinics, where the average success rate was around 79%.

The most important variable influencing success rate was the number of patients per nurse. Most variables characterizing the clinics such as infrastructure, staffing and access did not explain the variation in the success rate across clinics. This is due to the relatively high success rate and the relatively low variation across clinics with the exception of the lower performance of the clinics attached to the district hospitals. The main variable explaining more than 40% of the total variation in success rate was the number of patients per nurse. If the increase in the number of patients is not balanced by an increase in the staff, there is a linear decline in the success rate as shown in Figures 9-10.

The main recommendations are to:

- Use Figures 9-10 to predict the expected success rates per clinic according to ratio of TB patients per nurse. The ratio is obtained by dividing the number of all types of TB patient followed up during the most recent calendar year by the number of enrolled and professional nurses. This ratio can be put on the X-axis of Figure 9-10 where a vertical line is drawn till it reached the regression line. From the regression line, a horizontal line is drown till it reaches the Y-axis to indicate the predicted success rate;
- Estimate how many nurses are required to decrease the ratio of TB patients per nurse to reach the desired success rate;
- Plan how to appoint the extra nurses to the target clinics;
- Repeat the same survey in the upcoming years to monitor that the nurses have been appointed and to verify is this is associated with an improvement in the success rate;
- Conduct similar annual surveys in each district to provide an evaluation of the activities of the TB programme and to identify critical variables explaining the variation in the success rate and use the results to provide strategic direction; and
- Identify implementation problems and suggest solutions to be evaluated by the following annual surveys.

Introduction

The TB control programme has reported very low cure rate for KZN since 2001. These estimates were neither questioned nor acted upon showing that statistics is a low priority. Such low cure rates are unusual for a country having many more resources compared with neighboring countries reporting higher cure rates. No attempts have been made to validate the TB register and to find out the causes of low cure rate, confirming that statistics is more considered a bureaucratic requirement than a tool to improve management.

The emergency

The response to the above situation has been the launch of an emergency programme. The WHO African Regional Office has urged the countries in the region to put more efforts in the TB programme. The South Africa National DOH has launched a TB emergency programme in the worst affected districts of the country and the provincial Departments of Health have selected these districts for emergency action. However, the unreliability of the TB electronic register does not allow to ensure that the selected districts are indeed the worst ones. Unreliability will not allow to measure the impact because of poor comparability of the indicators before and after the emergency. Besides the poor reliability of the treatment outcomes, there is also a shortage of indicators on the programmed activities. Although it is easier to privilege action and underestimate the importance of information, without reliable indicators the situation is likely to deteriorate as soon as the emergency subsides.

To avoid the above shortfalls the first step was to validate the reliability of the TB electronic register. Issue 12 has described the difference found between the valid treatment outcomes, derived from the data entered during the survey, and the outcome reported by the electronic register. The validation has identified several technical problems leading to underestimation of all rates. The 2004 cure rates for Umzinyathi, which according to the electronic register was 48%, increased to 57% when the coding problems were tackled, to 66% after the methodological problems related to the transfers were dealt with and to 71% when the problem of the "not evaluated" was taken into account.

This Issue describes the situation of the TB programme in terms of staffing and other characteristics of the TB clinics. This information has never been quantified before and the objective was to provide a first baseline of programme indicators to identify what does not work, why and how this can be improved. The report start with a description of the routine quarterly report to show what was available in terms of programme indicators and proceed with the methodology used in the survey, followed up by results and discussion.

Quarterly reporting

The TB programme has been producing quarterly reports to update a few indicators on suspect cases, case finding, DOT coverage, treatment outcomes and sputum turn-around time. To provide an example of the problems faced by these reports, the indicators of the most recent quarterly report from Umzinyathi are summarized in Tables 1 through 5. The first problem of the quarterly reports is the lack of any introduction of the objectives, description of the methodology and interpretation of the information. The quarterly report consists of a list of tables without definition of the terms (e.g. suspect cases) related to the numerators and the denominators of the indicators, no indication of the audience to which the report is addressed and how to interpret and use the information. The tables are provided without reliability checks of the data and no interpretation of the statistics is provided.

Table 1 reports the case finding according to the suspect register. The suspect cases are identified by asking the patients attending the OPD clinics if anybody had been continuously coughing in the previous two weeks. These are then submitted to smear and other diagnostic tests. The first column of Table 1 shows that of the 179163 OPD patients who attended the clinics of Umzinyathi in the 3rd quarter of 2005, 2277 (1%) were identified as suspect cases. Of these suspect cases, 299 (13%) were found positive and of these positive cases, 273 (91%) begun treatment.

Table 1 Suspect register, Umzinyathi TB Progress Report

Quarter	**3rd-05**		**2nd-05**		**1st-05**		**4th 04**		**3rd 04**	
	Number	%	Number	%	Number	%	Number	%		
OPD>5	179163		166995		168534		168534		179925	
Suspect	2277	1%	1405	1%	1162	1%	1189	1%	2013	1%
Smear+	299	13%	198	14%	189	16%	182	15%	249	12%
On treatment	273	91%	192	97%	183	97%	170	93%	242	97%

Tables 2 and 3 present the case finding categorized according to the number of new and retreated cases and the DOT coverage. The 72% of DOT coverage in the third quarter (Q3) of 2005 is based on the total of 1274 TB patients under treatment. The different types of DOT described in the quarterly report include hospital, family, traditional healer, CHW, volunteer, workplace, and elsewhere like school. These terms should have been defined better, for example disaggregating pediatric cases into self-supervised and under family DOT is not very meaningful. It is unclear how a child could be self-supervised or how is it possible that parents will not take care of their child's treatment. Unless a clear definition is provided, the explanation of the treatment schedule to a parent cannot be certainly be considered child DOT because it is routine clinical practice to instruct parents on how to provide treatment to a child affected by TB. The same case is true for any family DOT because it is likely that, unless the patient lives alone, families are usually concerned that the patients take their drugs. Another term to be described is the hospital DOT, which could include inpatients and or OPD patients coming every day to the hospital clinic.

Table 2 Case Finding Umzinyathi TB Progress Report

Quarter	New cases	Retreated cases			TOTAL
		relapses	default	Failure	
2004/3	1003	101	31	43	1178
2004/4	950	108	25	17	1100
2005/1	928	134	29	12	1103
2005/2	949	119	23	15	1106
2005/3	1014	168	20	9	1211

Table 3 DOT coverage according to the quarterly reports

Quarterly Report	Self Supervised	On DOT	Total under TB treatment
2nd Q 2005	545	953 (72%)	1498
3rd Q 2005	361	913 (64%)	1274

Table 4 provides an example of problematic presentation of the treatment outcomes. The 22% cure rate is wrong because it is based on all TB patients (including smear negative cases). Only the 55% among new cases and the 19% among the retreated cases are to be presented as cure rates because they are based on the smear positive cases. Because the cure rate is based on the initial smear positive cases turning smear negative at the end of treatment, the cure rate can only be based on the smear positive cases.

Table 4 Treatment outcome for the 1st Q 2004

	Cured	Completed	Failure	Died	Transferred	Defaulted	Not evaluated	Total
No	268	494	6	179	182	37	48	1214*
%	22%	41%	<1%	15%	15%	3%	4%	100%
No	243	32	2	75	71	14	9	446**
%	55%	7%	<1%	17%	16%	3%	2%	100%
No	14	11	-	18	17	4	9	73***
%	19%	15%	-	24%	23%	6%	12%	100%

* all TB cases (including smear negative) ** New smear+ *** Retreated smear+

Another indicator in the quarterly report is the laboratory turnover rate of the smear results (see Table 5). The turnover is the time required to receive back the laboratory results on the sputa and in this case it is unclear if the results are extrapolated on the basis of only 50 specimens. Without a description on the method used to select this sample it is not possible to draw any conclusion of the turn-around rates.

Table 5 Turn-around time for sputum specimens Second 2005

	<12 hours	<24 h	<48	3-7 days	7-14 days	>14 days	Total
Number	4	12	8	19	3	4	50
%	8%	24%	16%	38%	6%	8%	100%

Consequences

The above statistics is per se a justification for a survey, which might more clearly reflect what is going on. The above information is hardly usable for management action and has problems related to the present use of statistics related to programme's activities. The fact that the TB management does not question the apparent contradiction between the reported high DOT coverage and the persistent low cure rate means that statistics in its present format cannot provide a solid basis for management decisions.

Reason for the survey

Substituting quarterly reports with annual surveys would provide better and timelier information for management. Shortage of skills and lack of awareness about the importance of indicators cannot be solved by a series of training especially if the center itself is not very conversant in statistics. In the present situation, the only solution is to resort to a standardized method of data collection through annual surveys. The first survey of this kind was carried out in Umzinyathi district at the end of 2005 to provide an example of a more effective information gathering. The results provide for the first time reliable information on the activities of the TB programme in this district.

Methodology

The survey carried out in Umzinyathi had two objectives. The first objective of validating the TB register was already covered in Issue 12 of the Bulletin. The second objective was to provide enough information on programme activities to help the district managers to improve the efficiency of the programme. The Epidemiology Unit and the Italian Cooperation identified Umzinyathi as the most suitable district to run the first survey.

Between September and December 2005, a survey team visited all the OPD clinics in Umzinyathi to interview all the nurses on duty. The information included geographic location, number of rooms, water supply, electricity, garbage disposal, laboratory turn around time, number and type of staff, length of service, training and supervision received, knowledge about treatment of TB, correct definitions used to fill the TB register, presence and use of the CHWs and volunteers, strategies to identify and trace defaulters, problems faced by staff and other factors influencing the efficiency of the

TB programme. The GIS of the DOH provided the information related to the population in the catchment area, the distance of the clinic from the provincial nearest road and the difficulty in accessing the clinic.

The analysis describes the characteristics of the TB programme and how the clinic environment influences the success rate among its patients. The data were analyzed through SPSS 14 to describe the situation in the clinics and to identify predictors of success rate. The result is a baseline that could be updated through annual surveys at lower costs and with better results than the present reporting system. Besides producing a baseline on several indicators, the survey identified favorable factors for treatment outcomes. This was done by analyzing the variables influencing success rate among the patients who begun treatment between June 2004 and March 2005. This period was selected to have a sufficient number of patients completing treatment by September 2005, when the survey began, without going too far in the past. The success rate of each clinic was based on:

$$\frac{\text{Number of TB patients who are a success}^{1}}{\text{All TB patients who started treatment between 1/6/04-31/3/05}}$$

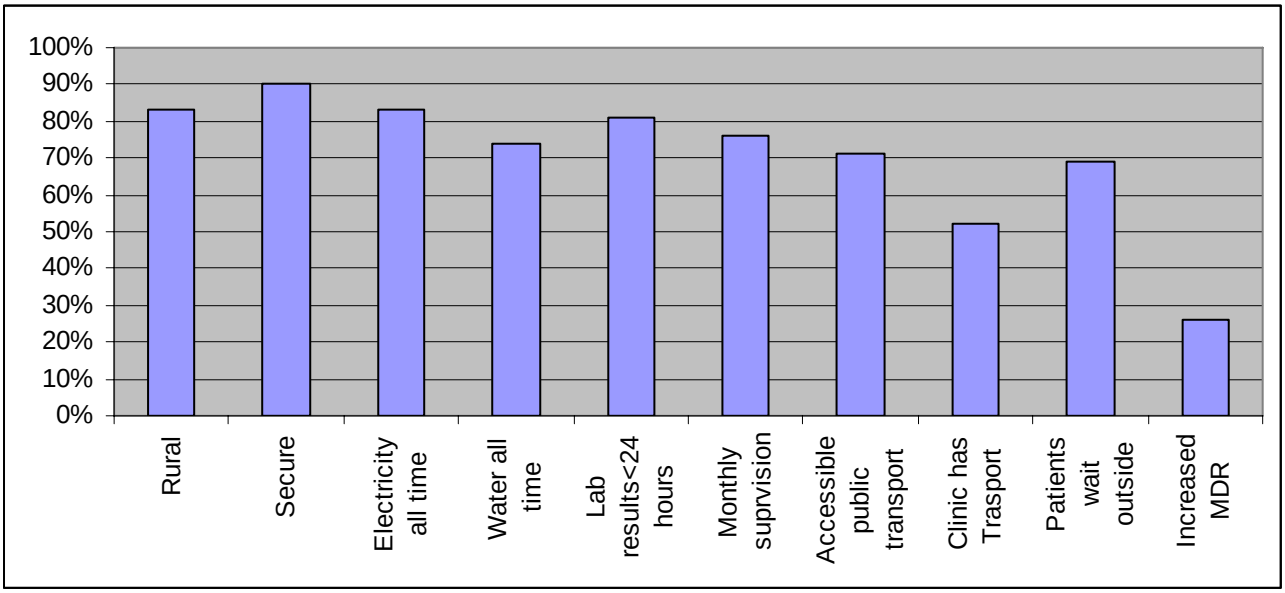
The results of the analysis provide as an example of what can be done in terms of management actions. The analysis begins with the description of the human and other resources available to the TB programme and continues with the identification of the variables, which are associated with success rates. Linear regression was used to predict the success rate associated with certain characteristics of the clinics.

Results

The clinics were in good conditions. Figure 1 shows that most of the 42 fixed clinics were located in rural and safe areas, had running water and electricity, received lab results within 48 hours and were supervised once a month. About 70% of the clinics were accessible through public transport, half had transport to trace defaulters and more than one fourth declared that they had noticed an increase in the MDR. In this context, the increase in MDR is to be interpreted and number of patients not responding to treatment because no data was available on culture results. Table 6 shows that the average clinic was about 2.5 km away from the nearest provincial road, 10 km away from the nearest town, had a catchment population of about 10000 people and had about 3 consulting rooms. The average nurse was 40 years old, with 12 years of services, 4.5 of which had been spent at the present clinic. The average staffing per clinic was less than one for Enrolled Nursing Assistant (ENA), Chief Professional Nurse (CPN) and Senior Professional Nurse (SPN), one for Enrolled Nurse (EN), one - two Counselors (VCT) and about two Professional Nurses (PN).

[1] Smear positive cases who were declared cured plus any TB patient (including smear negative cases) who completed the six month treatment without smear confirmation.

Figure 1 Profile of the 42 fixed clinic



TB patients per year, which is equivalent to about one or two visits per day. Therefore the workload can be manageable in most clinics especially if one nurse can be assigned to TB patients. About half of the clinics were not receiving visits from doctors, about one third received a visit from a doctor once or twice a month and the rest were visited weekly or daily. There were an average of three CHWs and six volunteers in the catchment area of each clinic.

The strategies used to trace the defaulters are presented in Figure 2. When the nurses were asked if they knew how many TB patients were scheduled for that day only a minority could reply. However, more than half of the nurses knew how many defaulters there were in the previous month and about half of the Clinics had access to transport to trace the defaulters. About three every four clinics had CHWs (Figure 3) with whom the staff had daily, weekly or monthly meetings (Figure 4). About two every three clinics had volunteers with whom they met mainly once a month. Although 60% of the clinics made use of CHWs and volunteers to trace defaulters, it was not possible to know how many hours per week these multipurpose workers dedicated to trace defaulters. About one third of the clinics used Direct Observed Treatment (DOT) supporters to trace defaulters. These DOT supporters consisted of family members observing the daily treatment of their relatives.

Table 6 Profile of the 42 fixed clinics

	Variables	Min	max	average
GIS	Distance in km from provincial road	0	17	2.5
	Distance in km from town	0	37	10
	Population 5 km radius	2280	28669	10255
Structure	Consulting rooms	1	5	3
Staff in the TB Clinics	10 ENA	0	5	0.2
	50 EN	0	6	1.2
	71 PN	0	4	1.7
	23 CPN	0	3	0.6
	21 SPN	0	2	0.5
	64 VCT	0	8	1.5
	135 CHWs in the catchment area	0	20	3
	235 Volunteers in the catchment area	0	30	6
	Age of the nurse	24	66	40
	Years of service as a nurse	0	41	12
	Years of service at facility	0	38	4.5
Workload	Number of annual TB patients per clinic	5	688	86
	Number of annual TB patient per nurse	2	112	26

Figure 2 Proportion of clinics applying a tracing strategy

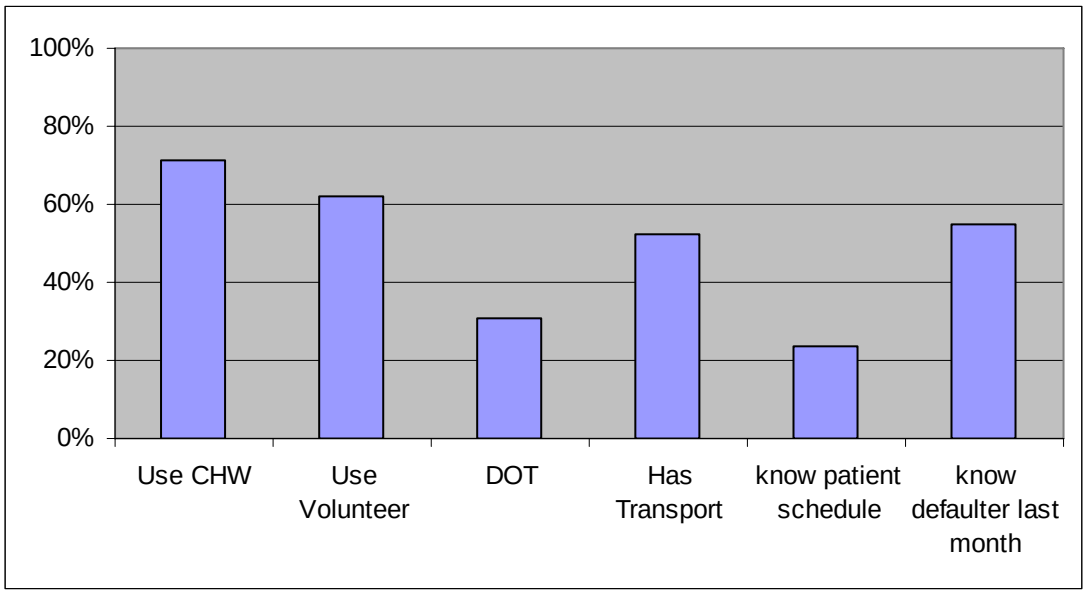


Figure 3 Proportion of clinics having 10 or more CHWs and Volunteers

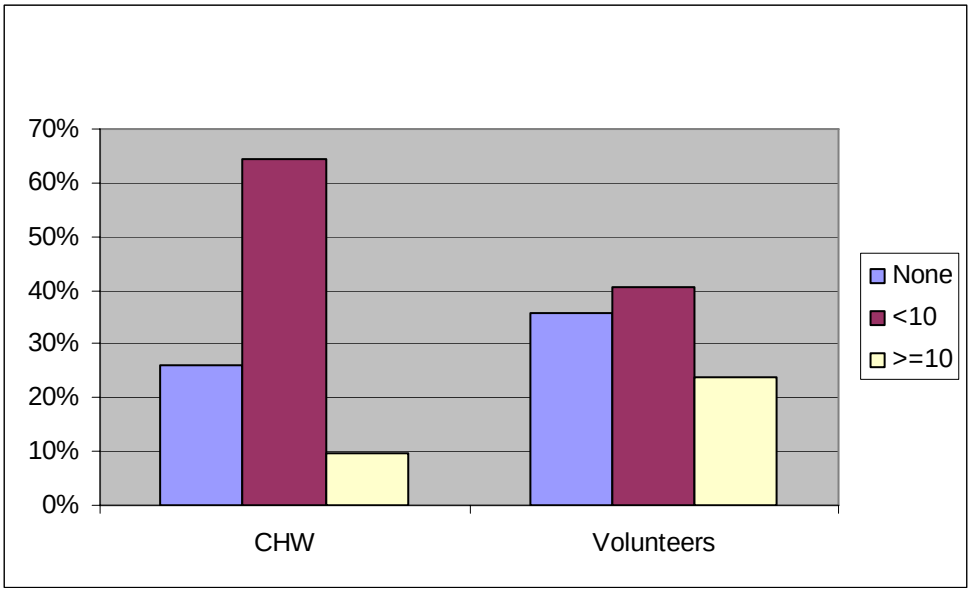
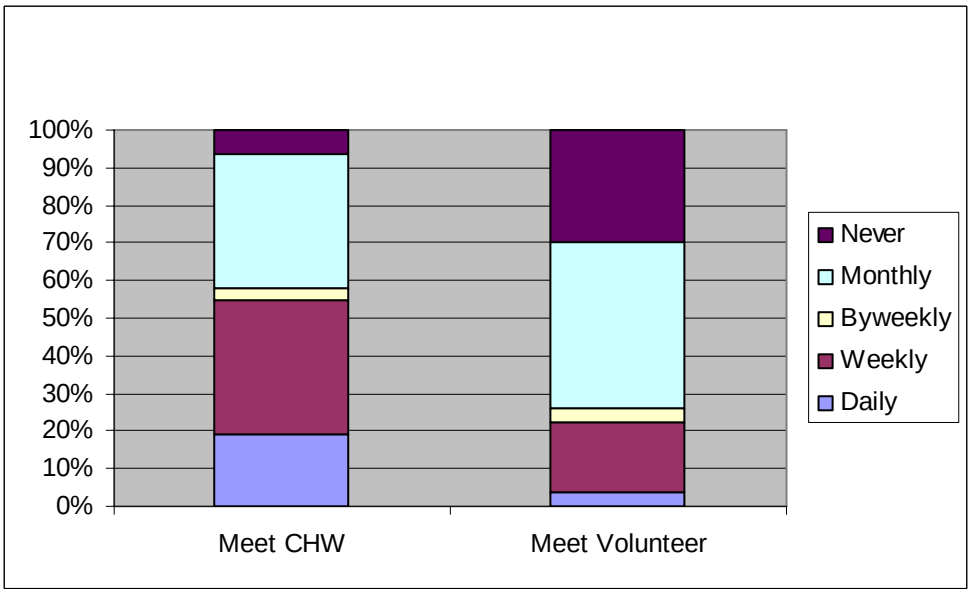


Figure 4 Frequency of staff meetings with CHWs and volunteers

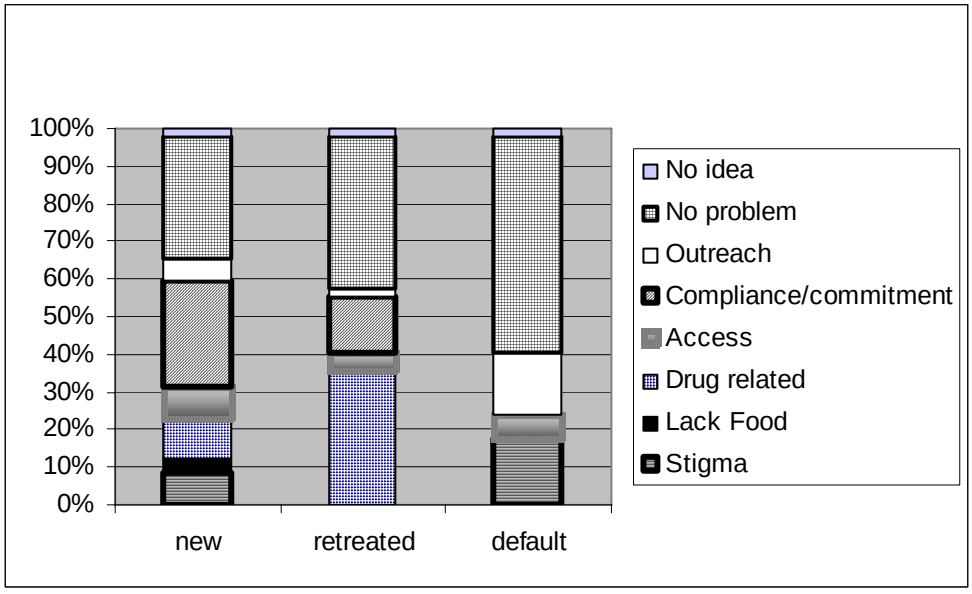


The tracing of defaulters could be improved by setting up a diary for appointments. At the start of the treatment, the nurse could record the name of the patient on the pages corresponding to the dates of the follow up visits. During each day, the nurse could single out the names of the patients who did not come as scheduled and alert the tracing teams, the CHWs, the volunteers or the family members so that defaulters are brought back to the clinics. The nurses themselves could trace the defaulters, in case transport is available at the clinic.

The three bars in Figure 5 show the problems faced by the staff for new cases, retreated and defaulters. All the nurses who were present in the clinic on the day of the survey were interviewed for a total sample of 96 nurses. About 65%, 60% and 40% of the staff reported some problems respectively with new patients, retreated and defaulters. The bars represent the proportion of problems reported by the nurses, for example, among new cases, stigma was reported as a problem by less than 10% of nurses. The most frequent problems are categorized as follows:

(a) Compliance and commitment. This term included identification of the TB contacts, attendance to voluntary counseling, compliance with the schedule, completion of the 6 month treatment and avoidance of interruption when patients improved;
(b) Drug related problems included side effects and the too many tablets to be taken. The most frequent problems with retreated patients were side effects of streptomycin such as pain and the need to attend the daily injection;
(c) The stigma was related to unwillingness to accept the diagnosis of TB, with the subsequent fear of being recognized as TB patients, which resulted in providing an incorrect address;
(d) Access included poor physical conditions not allowing to reach the clinic, lack of transport and living far away from the clinic; and
(e) Lack of outreach services included insufficient number of DOT supporters, CHWs, Volunteers and no access to transport to reach the defaulters.

Figure 5 Problems in the management of TB patients



According to the nurses interviewed, the most frequent problems affecting the TB services were related to insufficient human resources. Figure 6 shows that two thirds of the staff mentioned the following problems in order of importance: (a) shortage of staff specifically dealing with TB, high turnover and poor supervision; (c) lack of transport for the laboratory and wrong communication from the laboratory about the smear diagnosis, (d) lack of food supplement for the patients and (e) no isolation cells for TB patients in prisons. The solutions were specular to the above problems and included more staff dedicated full time to TB, more training, transport, tracing teams, mobile clinics and incentives for volunteers, lab transport and improved quality of the lab results, community awareness, food supplements and isolation cells for prisoners.

Figure 6 Factors affecting the TB programme

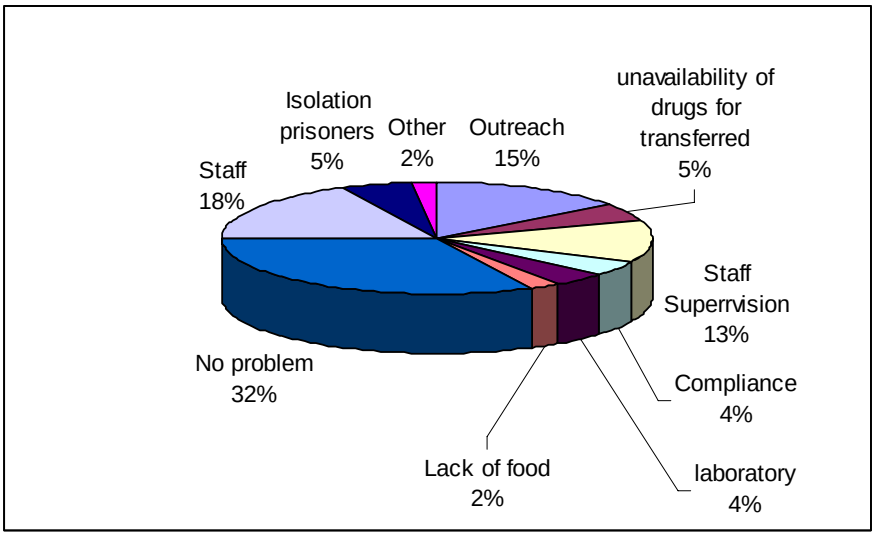


Figure 7 shows the profile of the staff. About 3 every 4 nurses received training in TB, about one in four received refresher training and about half were trained in data management. Respectively 80% and 50% defined correctly what a new case and a retreated case were, slightly more than 60% knew the definition of extrapulmonary case, about half of the staff knew the correct definition of transfer and failure but only one in four nurses knew the correct definition of cure, completion and interruption. The most common message given to a new TB case included the duration of the treatment and the need to comply with the treatment schedule. About 40% of the nurses mentioned to new TB cases that TB could be treated, that contacts needed to be brought to the clinic and that treatment could be associated with side effects. A minority of nurses described to new patients how TB is diagnosed, transmitted, that is critically important to come back monthly and the support to be obtained through DOT.

Figure 7 Staff Profile of the 96 nurses interviewed by the survey

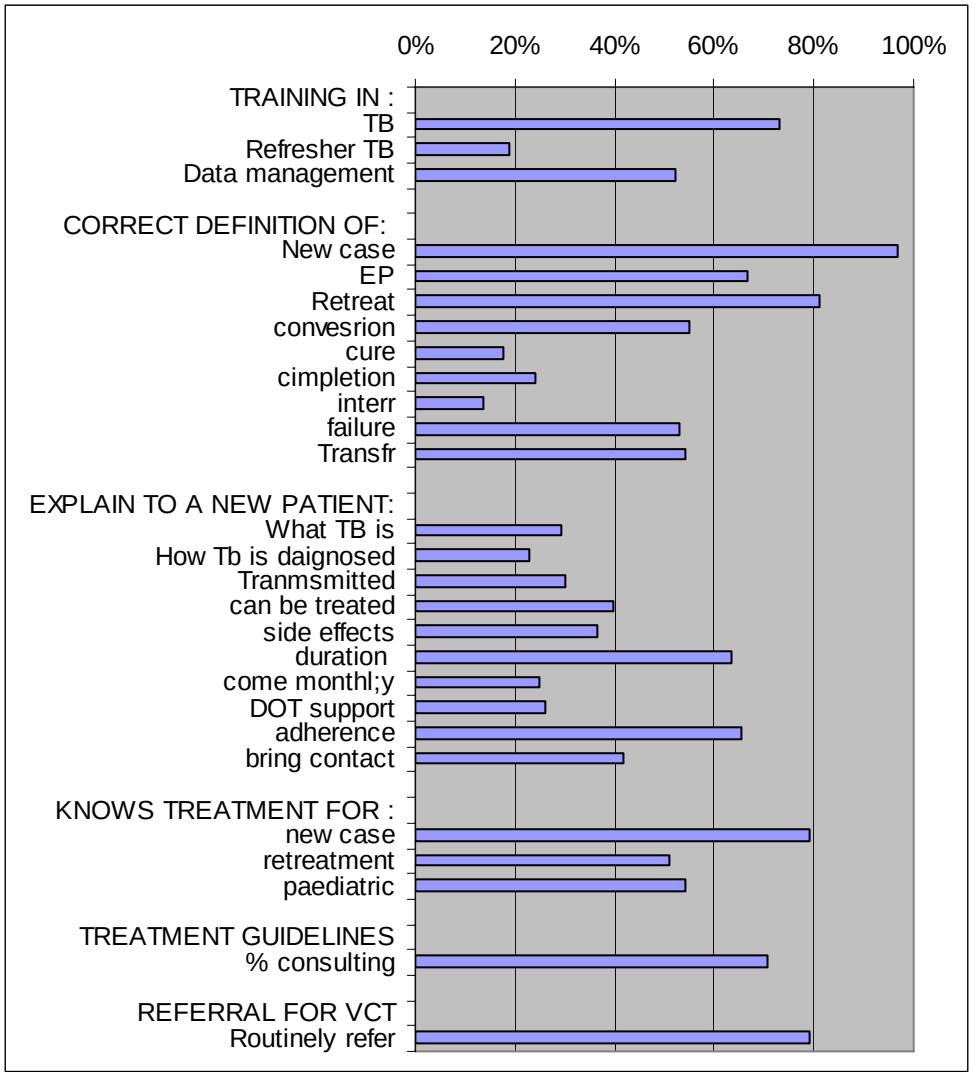
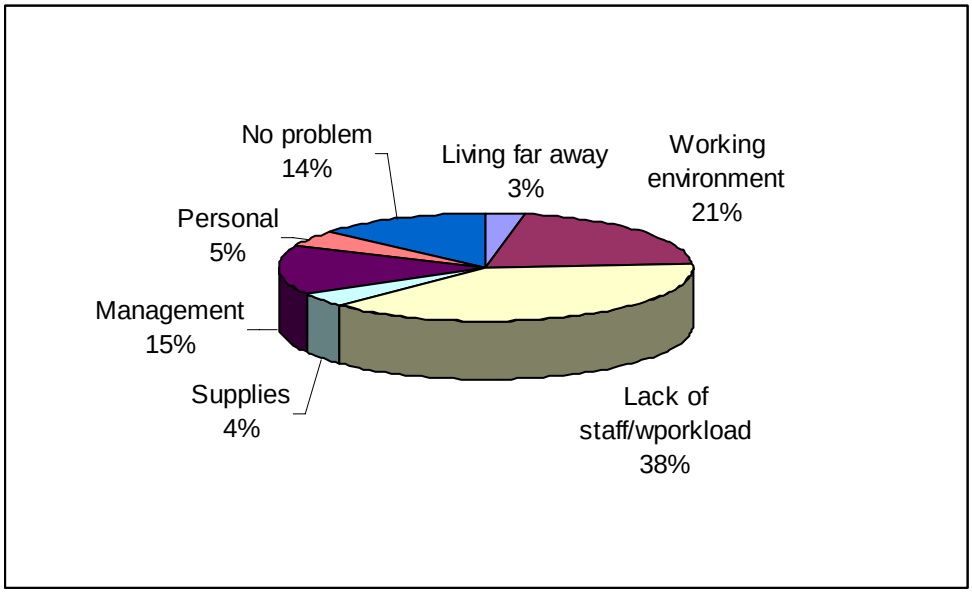


Figure 8 list the major demotivating factors for the nurses (Figure 8). Only 14% of nurses mentioned that they did not have any complaint. More than one third (38%) mentioned shortage of staff leading to overload and lack of preparation of many nurses to properly do their job as major demotivating factors in working with TB. The second most common problem was related to the working environment which included being shouted in public by other nurses, dealing with difficult patients, not seeing improvement in the patients' conditions, dealing with pediatric patients, experiencing disrespect from prisoners and lack of support from prison warden. Lack of management support included lack of incentives to live in rural area, lack of promotion, lack of delivery of promises from the DOH and no consideration for the nurse's problems.

Figure 8 Complaints



Variables influencing impact

This part of the analysis is related to the factors influencing success rates among the patients attending individual clinics. In this case the unit of analysis is each clinic with more than 30 patients, the factors are the variables characterizing the clinic, and the outcome is the proportion of the patients in each clinic being cured and completed treatment. To have a measure of outcome in a clinic required a reasonable number of TB patients completing the cycle of TB treatment near the time when the survey started. All the TB patients who started treatment between June 2004 and March 2005 were included to allow sufficient number of patients per clinic, which had completed the treatment by the month of September 2005 when the survey started. The unit of analysis was the clinic, the dependent/outcome variable was the success rate of its patients and the independent/predictor variables were the characteristics of the clinics. The success rate of each clinic was the proportion of the patients registered in the above-mentioned period, which were cured or completed treatment. Many of the total 8 mobiles and 44 fixed clinics, which were visited to validate the register and to collect information on programme activities accumulated a very small sample of TB patients. Because small samples are associated with wide confidence intervals, only the clinics with more than 30 patients were included for a total of 22 clinics.

Most characteristics of the clinics had a weak association with their success rate. This may be due to the relative high success rates and the low variation across rural clinics. Also the GIS accessibility index, which for each clinic was estimated on the basis of the average distance from the main road and difficulty of the terrain to reach the clinic was not associated with probability of success among the patients attending a specific clinic. The characteristics of the nurses in terms of training, supervision, knowledge of TB treatment, age and length of service were not significantly associated with success rates. The availability of transport by the clinic to trace defaulters, the

presence of CHWs and volunteers involved in tracing the defaulters and many other variables were not associated with the success rate. This does not mean that these variables are not important to increase the success rate of a TB programme, but that these variables did not differ much across clinics in Umzinyathi.

The main factor explaining the variation in the clinics' success rate was the number of TB patients per year per nurse. Each clinic is plotted as a dot in Figure 9 according to the number of TB patients per nurse on the X-axis and the success rate on the Y-axis. The regression line explains 43% of the variation, which is quite high for an individual variable. The remaining 53% of unexplained variation is due to the other variables such as the socioeconomic conditions of the patient, education and other factors that were not collected by the survey and therefore are not known.

Figure 9 can be used to predict the expected success rate given the number of TB patients per nurse. The ratio of TB patients per nurse is obtained by diving the annual number of new and retreated TB patients a clinic has had in the most recent year by the total number of enrolled (excluding nurse assistants) and professional nurse. This ratio is put on the X axis of Figure 9 from where a vertical line is drawn till it reaches the regression line and from this point a horizontal line is drawn till it reaches the Y axis, where the expected success rate for that clinic is obtained. For example a clinic with 80 TB patients per year and two nurses will have 40 TB patients per nurse and this ratio is associated with an expected success of about 70%. An increasing number of patients, without a change in staffing, produce a higher number of patients per staff. This is reflected by increasing values of X, which moves towards the right, and a decline in success rate because of the decreasing values of Y.

The predictions are associated with margins of error. Figure10 shows the same regression line of Figure 9 surrounded by the upper and lower margin of error. These margins become wider as the values of X increase, meaning that the margin of error in predicting success rate increase for high values of patients per nurse. The wider confidence intervals for high values of X are due to the small sample of clinics with high number of patients per nurse. Figure 10 provide an example of how to use the graph, with an annual TB cases per nurse being associated with an expected success of 70%, with a margin of error of slightly less than 60% and more than 80%. As the nurses increase and the number of patients remains stable, there will be an increase in success rate and a higher certainty around the estimates.

These graphs can be used to plan human resources so that the present ratio of patients per nurse declines to more favorable levels. Although the relationship between a proxy of workload and the effectiveness of the TB programme is not surprising, this analysis has provided a way of using a simple indicator for management purposes. The graph could be used to estimate where each clinic stands in terms of manpower, the risk associated with workload, the number of extra nurses that would be required to reach more favorable ratios of patient per nurse.

Fig 9 Prediction of success rate on the basis of the number of patient per nurse

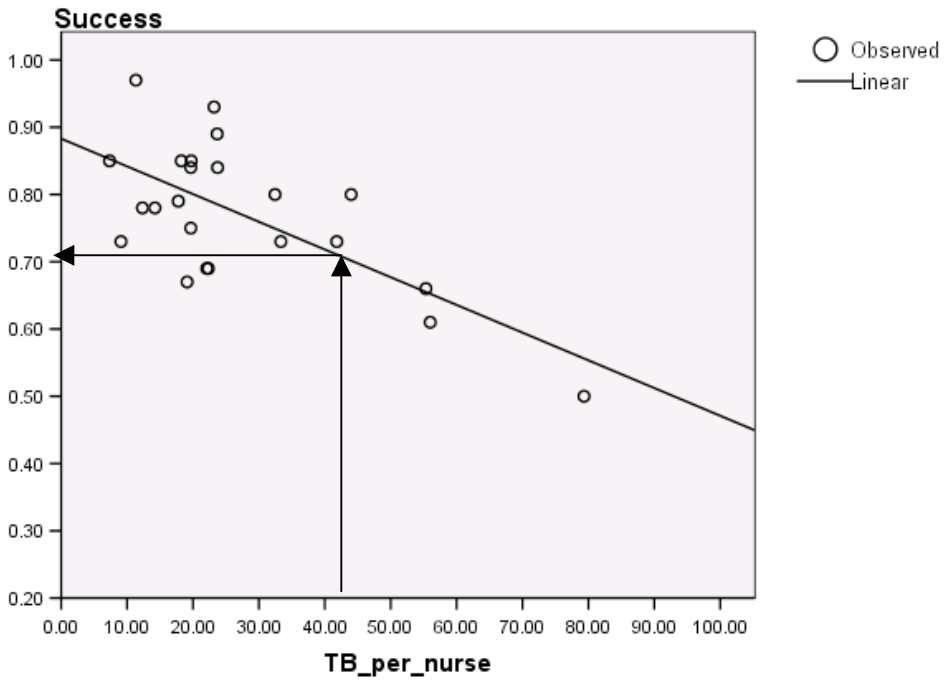
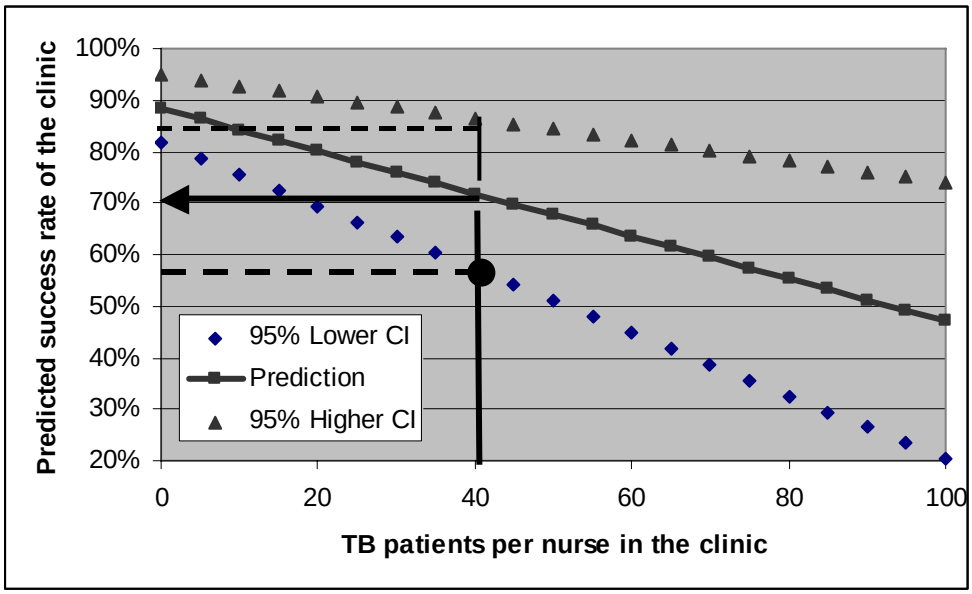


Figure 10 Margin of error around the prediction



Discussion

The results of the analysis have provided a profile of the TB programme in Umzinyathi. Although most clinics are in rural areas, they are relatively safe and have running water and electricity. With the exception for the clinics attached to the four hospitals, the number of patients in rural clinics is manageable. The clinics of the four district hospitals are the most crowded with an average of about 400 TB patients per year and an average success rate of 60%. The average rural clinics have 59 annual patients and success rate of 79%, varying from a minimum 50% to a maximum of 100% and with three quarters of the clinics above 70% success rate.

Most clinics have an average of about 1 TB visit per day and relatively few defaulters. Defaulters are difficult to trace because of missing or wrong addresses and by the fact that the nurses or the CHWs cannot accompany each new patient home, and therefore the tracing team cannot find the place where the defaulters live. The other problem is the lack of a monitoring system to alert the nurse about the visits missed by the patients. Any patient should be given a date that should be written down on a diary, so that at the end of the day the patients who did not come are targeted for tracing. This requires a better coordination with tracing teams, CHWs, volunteers and, in case the clinic has access to transport, the nurses themselves could trace the defaulters.

The annual number of TB patients per nurse explained more than 40% of the variation in success rate. This can be used to assign more resources to the most crowded clinics by increasing the staff till a point where it is associated with a reasonable success rate. There is still a substantial unexplained variation of the success rates due to the fact that the survey has been focused on the clinics only and even the information on the outreach activities had to rely on the interview with the nurses and not on the observation of such activities. What is still missing from the picture is a more detailed quantification of the outreach strategies. The fact that CHWs and volunteers are involved in tracing the defaulters should be better quantified by interviewing a representative sample of CHWs. Similarly, each tracing team is covering several programmes and it is always difficult to quantify the time spent on tracing TB patients. The most difficult information is related to the TB patients themselves because only age and gender are collected by the TB register and nothing is known on their household environment, socioeconomic conditions and other factors influencing higher risk for default. The ideal situation would be to interview a representative sample of TB patients through a household survey, but this is likely to be hampered by the lack of address of TB patients. This might be possible if in the future, the nurses identify the correct address of all the new patients.

The quantitative indicators presented in this Issue have provided a solid baseline for planning TB activities in Umzinyathi. The characteristics of the clinics, the number and type of staff, the number of CHWs and volunteers, the training and supervision, the staff knowledge on the TB treatment, the mechanisms used to trace the defaulters, the problems affecting the staff and the potential solutions and other information in this Issue can be used to identify what actions are more likely to improve activities. The ratio of TB patients per staff could be used to predict the number of staff required to reduce the number of patients per nurse to reasonable levels that are expected to increase the success rate. Last but not least the data has provided a baseline against which to monitor changes in programme activities.

ANNEX Organization of the TB programme in Umzinyathi

This Annex provides a short description of how the patient is recruited into the TB programme and how the district management of the TB programme works. Figure 1A shows an overall picture of the management structure of the district TB control programme. The TB manager, under the leadership of the District and the deputy managers, is supported by the surveillance officer who is responsible for capturing, validating and reporting data submitted by health facilities in the district. At the same level as the TB control manager are two PHC coordinators responsible for all PHC activities within the district. The district of Umzinyathi has been subdivided into sub-districts with one PHC coordinator covering the sub-districts of Nqutu and Endumeni and one PHC coordinator responsible for the sub-districts of Msinga and Umvoti. The PHC coordinators supervise PHC supervisors who are based at the 4 hospitals and who deal with the hospitals and the health facilities linked to them. The PHC supervisor receives sub district reports on TB activities from the TB coordinators who are responsible for submitting TB statistics, supervising tracing teams and training, together with the PHC trainer who is responsible for training nurses and other staff. The TB coordinator and the PHC trainer ensure that the tasks related to the training are implemented. The tracing teams, consisting of one or two people based at the four hospitals of Dundee, Greytown, Church of Scotland and Charles Johnson Memorial hospital (2), are supervised by the TB coordinator. The function of the teams is to trace all the patients that have not turned up for their appointments by signing an itinerary stating the facility that they will be visiting and by sending a report to the TB coordinator.

The different components of the TB services in the districts are represented in Figure 2A. The history and physical examination findings are first recorded on clinic/hospital cards at the end of which specific information is recorded onto the TB register. Patients are then provided with two containers in which they collect and bring back the sputum samples. Ideally the first sputum sample should be collected at the clinic in the presence of the health worker, however this may not usually be the case because of shortage of time on the part of the health workers and/or inability of the patient to produce sputum at that particular time. For patients that are unable to provide sputum, diagnosis is made by chest x-ray or clinically. At the initiation of therapy, patients are provided with explanation and education regarding TB, its causes, mode and prevention of spread, the importance of adherence to medication and the role of the DOT supporter.

Once therapy is initiated, patients are given monthly appointments for follow up. Smear tests for acid-fast bacilli are repeated after 2 months of therapy at which time the medication is changed from an intensive phase to a continuation phase therapy in case the smear becomes negative (smear conversion). Sputum tests are repeated after 6 months marking the end of therapy for patients who result smear negative (cure). Re-treatment occurs in case the smear remains positive after six month or in case of interruption. In these cases patients usually require a longer duration of treatment, i.e. three months of intensive therapy followed by five months of continuation phase therapy.

Figure 1A Management structure at the level of the district.

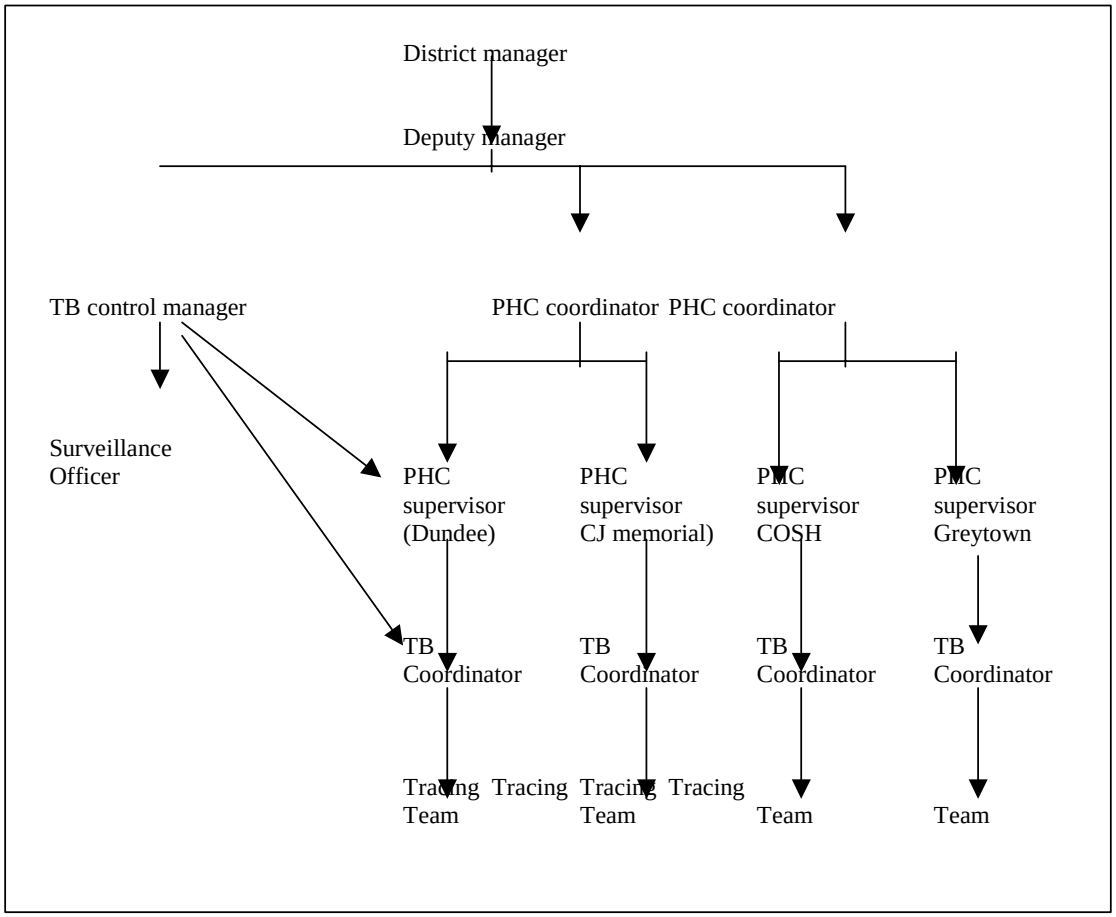
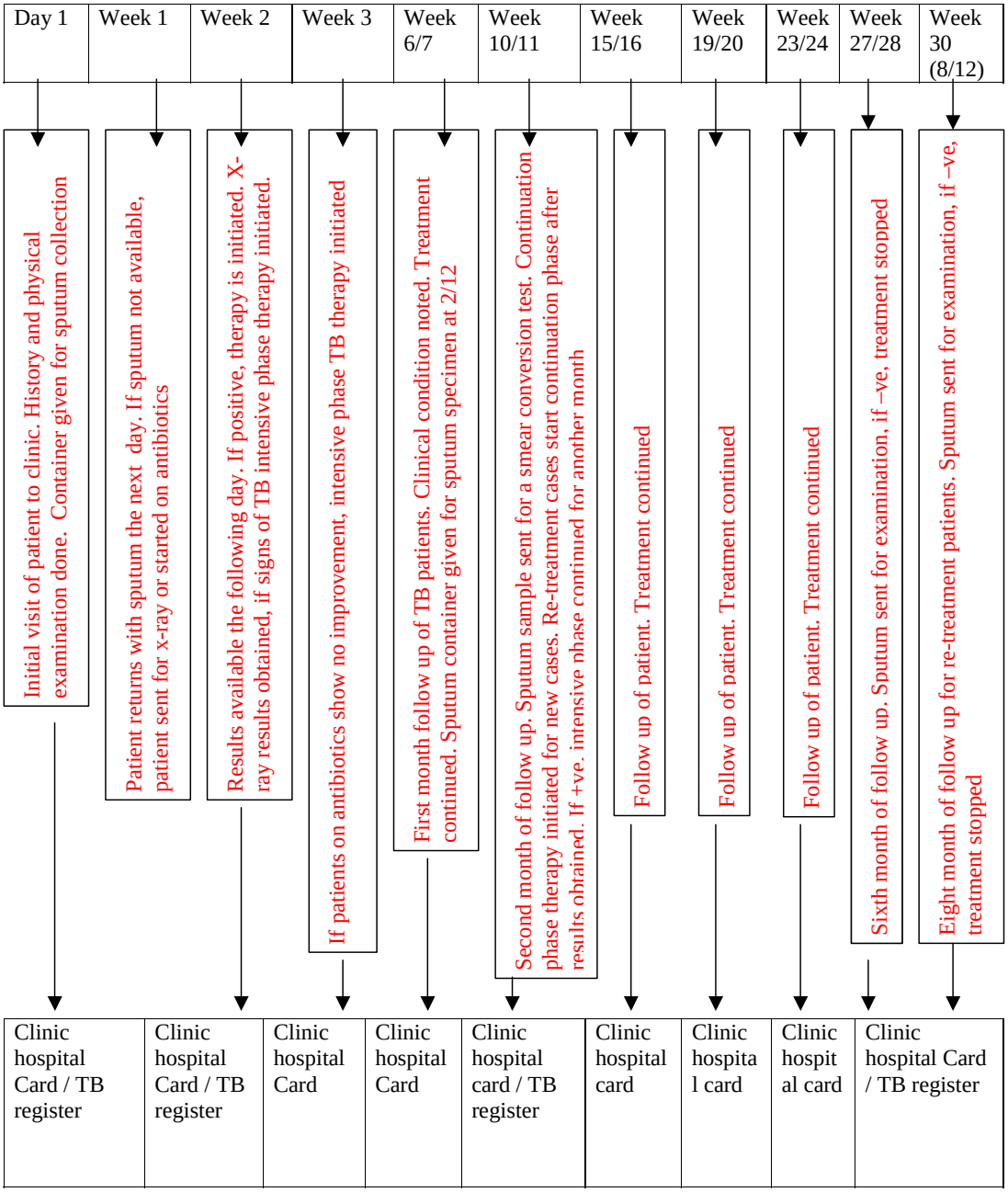


Figure 2A Patient flow diagramme



After most of the above information has been recorded onto the TB register, statistical information is sent to the district office monthly. All patients and/or family members attending the OPD clinic are screened for TB if they have a history of cough of 2 weeks duration. These suspect cases are provided with sputum containers and advised to collect and bring sputum the following day when the specimen is sent to the laboratory for sputum smear microscopy. The number of patients screened and their sputum results are all recorded on a separate cough or sputum register. The patients who test positive for TB begin treatment and are registered on the TB register.

The sections below describe the processes carried out in the diagnosis and treatment of TB patients in clinics. In Community Health Centers and hospitals the steps are similar but sputum and x-ray results may be obtained the same day, as the services are available within. Once diagnosed, patients are followed up for six months and the investigative and treatment process are documented onto the TB register. This statistical information is then sent to the district department of health.

1. TB Recording on the clinic/hospital cards

The initial step includes history taking and physical examination. This is recorded on blue clinic/hospital cards consisting of four pages, the first of which is devoted to basic demographic information of the patient namely the name, age, sex, address, race, and whether or not they are new or re-treated cases (see Figure 2A). The second page consists of information on smear results (pre-treatment, after intensive phase and end of treatment), the treatment regimen they are on, the weight, adherence and the name and address of DOT supporters. Clinical progress is recorded on the third page while the name and addresses of patient contacts and the steps carried out to prevent illness in the contacts, especially children who are under five years of age, is recorded on the last page.

2. Registration

After the history and clinical examination are recorded by professional nurses on clinic/hospital blue cards, all TB patients are registered on the TB register. After the end of the first visit, the nurse fills the registration of the new patient on a new row of the register. For each row, several columns are used to record the information of each patient in terms of registration number and date, gender, age, race, address, category (new and retreated), site of the disease (pulmonary and extra-pulmonary), treatment start date, sputum results at the pre-treatment, end of intensive phase and end of treatment stages. Outcomes such as the cure, treatment completion, failure, interruption, transfer, death and lack of information on outcomes are used to estimate the treatment outcome rates. Culture results are also recorded. Each page of the register consists of four carbon copies in white, green, yellow and pink color, each of which is torn at the end of each quarter and sent to the district office so that the quarterly data is entered into the TB electronic register.

Following registration, statistical information required by the district is sent by the health facilities by tearing off three of the sheets of the TB register. This data is entered at the district and sent electronically to the provincial department of health.
Patients who are being screened for TB at the clinic are registered on a separate cough or sputum register.

3. Sputum collection / transportation / results / diagnosis

Once sputum samples are brought back to the clinic, they are taken to the laboratories where they are tested and results made available the next day. Patients are instructed to return a day after submitting sputum samples for the results of the test and initiation of therapy. Referral to a nearby Community Health Center or Hospital is made for all patients requiring chest x-ray, following which TB medication may begin, depending on the results. If diagnosis is still undefined, antibiotics are given for 10-14 days and if the patient's condition does not improve within this time, TB therapy is initiated.

4. Initiation of therapy / patient education

Therapy is initiated for patients diagnosed with TB infection with dosage and selection of drugs varying according to weight and their new or re-treatment status. Sputum samples that remain positive after three months of intensive therapy will be sent for culture and sensitivity with a possible change of medication following the results.

At the initiation of therapy, patients are given adequate information/education regarding the cause of TB infection, its method of spread and how to prevent it from spreading to close contacts, especially to children under the age of five. Patients should be advised to bring all children less than five years of age for antibiotic prophylaxis to be taken for six months. The importance of adherence to medication should also be emphasized as well as the role of DOT supporters in the treatment of the infection.

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