Safety in Mines Research Advisory Committee

Final Report

TECHNOLOGY TRANSFER OF SIMRAC PROJECT HEALTH 611 TO ENHANCE CLINICAL PERFORMANCE:

PROCESS-BASED PERFORMANCE REVIEW FOR THE DIAGNOSIS OF PULMONARY TUBERCULOSIS

DR JILL MURRAY

National Centre for Occupational Health, Department of Health.
School of Public Health, Faculty of Health Sciences, University of the Witwatersrand

DR MICHELLE WONG

Respiratory Unit, Department of Medicine, Chris Hani Baragwanath Hospital.
School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand

DR MARK HOPLEY

Respiratory Unit, Department of Medicine, Chris Hani Baragwanath Hospital.
School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand

PROF PETER LOWE

SIMHEALTH 808
May 2002

EXECUTIVE SUMMARY

Recent SIMRAC research in the mining industry[1] (SIMRAC Project Health 611) reviewed the autopsy findings and medical records of miners who died in 1999, and clearly demonstrated that significant problems exist with regard to the diagnosis of pulmonary tuberculosis (TB) in these men. Clinicians failed to diagnose TB in 44% of cases coming to autopsy, incorrectly ascribed TB as the cause of death in 29%, and only correctly ascribed TB as the cause of death in 27% of cases. The omission of accurate, appropriate and timeous clinical history, examination and diagnostic tests were identified as major contributing factors to delayed, mis- and missed diagnosis.

The results of this study, although not unique to the mining industry, indicated a need to provide the health care workers with an effective means of developing successful practice habits which would improve clinical performance.

The purpose of this project was to identify, produce and distribute appropriate material to facilitate implementation of best practice with regards to TB in the mining industry. Although improvement in knowledge is essential, a structured, constructive and ongoing evaluation of health care workers' clinical performance is crucial to the success of the TB program. Feedback based on autopsy findings in individual patients is an invaluable resource. Although primarily focussed on TB, the process of performance based review will also contribute to improved clinical practice related to other diseases, particularly respiratory conditions related to HIV infection.

This project has developed innovative methods and technology to meet the needs of the end-users (doctors as well as allied health care workers such as nurses and laboratory technologists). A review of the literature identified process based performance review, undertaken by clinicians' themselves, to be one of the most effective ways of developing successful practice habits. Process based performance review involves the identification of clinically important actions that ought to have been carried out in a particular condition, followed by a periodic review of whether these actions have actually been carried out.

A single page flow sheet for review of medical records together with knowledge of the autopsy findings was produced. The flow sheet format was chosen because this provides an efficient mechanism for constructive evaluation of clinical actions and has actually been shown to change clinicians' behaviour. The flow sheet identifies essential components in the history, physical examination and investigation for TB. The literature pertaining to these topics was reviewed and concise one page topic summaries prepared to accompany the flow sheet.

The process of performance based process review as developed by this project is sustainable and participation is incentive driven through the mechanism of continuing professional development points, which are a legal requirement for ongoing registration with the Health Professions Council of South Africa.

The products (a manual in paper format and a CD version of the performance review process, four posters and a bookmark) were piloted with doctors from the gold, coal and platinum industries and from small and large medical centres. They have been distributed and enthusiastically welcomed by the end-users.

IMPORTANT RECOMMENDATIONS INCLUDE:

1. **Process based performance review should be an ongoing process at the mine health care centres**

2. **The reviews should be monitored and evaluated to assess their impact**

3. **The topic summaries should be updated as new information is published**

ACKNOWLEDGEMENTS

This research project was funded by the Safety in Mines Research Advisory Committee (SIMRAC) of the Mines Health and Safety Council. Guidance, stimulation and intellectual support was provided by Prof. Mary Ross throughout the project.

Prof. David Rees, Head of the National Centre for Occupational Health (NCOH) enabled the researchers to devote considerable time and effort to this project.

We are deeply appreciative of the unceasing diligence and cooperation of the laboratory and mortuary staff, clerical assistants and pathologists at the NCOH.

To the many persons who have made valuable contributions to this study, we gratefully acknowledge our debt. We, however, remain responsible for all inaccuracies or errors in this report.

- Prof. Brendan Girdler-Brown, University of Pretoria, who gave generously of his time and expertise with review of the flow sheet, the critically appraised topics and the literature review.
- Dr Lucille Blumberg Clinical Microbiologist, Tuberculosis Laboratory, National Health Laboratory Service & University of the Witwatersrand, who reviewed the flow sheet and the critically appraised topics.
- Dr Ismael Ganchi from Gold Fields Ltd. who hosted a seminar
- Dr Lettie La Grange from Amplats who hosted a seminar
- Drs C Biden, J Greeff, O Mphofu, J Mtshali, L Page-Shipp, and M Thomson, who attended a workshop at NCOH
- Dr Jim Phillips who administered financial matters with the WITS health consortium
- Vanessa Wiseman who assisted with the design of the posters and bookmark
- Jenny Robers and Corinne Pynejames who organised production of the paper-based version of the manual, posters and bookmark.

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Glossary

A

Academic detailing.
"Detailing" is often used to promote pharmaceuticals. Academic detailing involves the same face-to-face transfer of information with the intention to improve clinical performance

Audits
Collection and correlation of information using chart reviews, reviews of electronic data in a computerized medical record system, or visual observation.

C

Case management.
Managed health care, where an organization determines whether and how much their benefit structures cover, in a financial sense, the actions of the health care worker.

Computerized decision-making.
The use of computers to aid in making medical decisions.

F

Feedback.
The provision of information, often gathered in an audit, to health care workers. The information fed back varies by the content, source, timing, format and involvement of recipients. Aspects of feedback can be enhanced to make it more applicable to the intended intervention.

I

Information mailing.
The mailing of unsolicited information.

O

Opinion leaders.
Acknowledged experts thought to have particular influence.

P

Patient education.
Strategies that inform the patient about what constitutes appropriate medical care.

Performance review.
The assessment of what health care workers are actually doing, and how well they are doing it.

Physician incentives.
Economic incentives intended to change behavior.

T

Traditional CME.
Lecture based continuous medical education of the type often used at conferences. Essentially a passive education strategy.

1. INTRODUCTION

Recent SIMRAC research in the mining industry (SIMRAC Health 611[1]) reviewed the autopsy findings and medical records of miners who died in 1999, and clearly demonstrated that significant problems exist with regard to the diagnosis of pulmonary tuberculosis (TB) in these men. Clinicians failed to diagnose TB in 44% of cases coming to autopsy, incorrectly ascribed TB as the cause of death in 29%, and only correctly ascribed TB as the cause of death in 27% of cases. The omission of accurate, appropriate and timeous clinical history, examination and diagnostic tests were identified as major contributing factors to delayed, mis- and missed diagnosis.

Rectifiable aspects in the clinical and investigative approach to TB include a heightened awareness of the presenting features of the disease, particularly in the HIV co-infected patient in whom manifestations are protean[2]. Failure to suspect TB and to perform the most appropriate investigations are the main reasons for delays in the diagnosis of TB. Missed opportunities for the earlier detection of TB need to be highlighted, with the primary health care setting being an important target, as this is often the patients' first port of call

The omission and/or inadequate performance of routine, standard and simple diagnostic tests (e.g. collection of sputum specimens) have been identified as other correctable practices in the approach to TB control. The smear negative patient with TB [3,4] deserves special consideration, as such patients are likely to be misdiagnosed or to suffer the consequences of delayed diagnosis.

The advent of AIDS has altered the conventional view of the manifestations of TB and has resulted in a resurgence of extrapulmonary and miliary TB[5]. This is frequently unrecognised by the health care worker. These sites of infection provide an often neglected opportunity to detect TB by the use of simple and easily learned techniques, e.g. fine needle aspiration of lymph nodes. Concurrent medical illnesses, particularly in the setting of HIV-infected patients[5], may obscure the consideration of TB as a possible diagnosis, or may result in an apparent poor response to TB therapy.

Consideration of drug resistant TB also requires increasing emphasis, particularly in those patients with a history of previous therapy for TB and in those where standard treatment fails[6,7].

Thus, the results of the SIMHEALTH 611 study, although not unique to the mining industry, indicated a need to provide the health care workers with an effective means of developing successful practice habits, which would improve clinical performance.

2. OBJECTIVE OF THE PROJECT

The purpose of this project was to effect technology transfer of SIMRAC Health 611 by identifying, producing and distributing appropriate educational material to facilitate implementation of best practice with regards to the diagnosis of pulmonary TB in the mining industry.

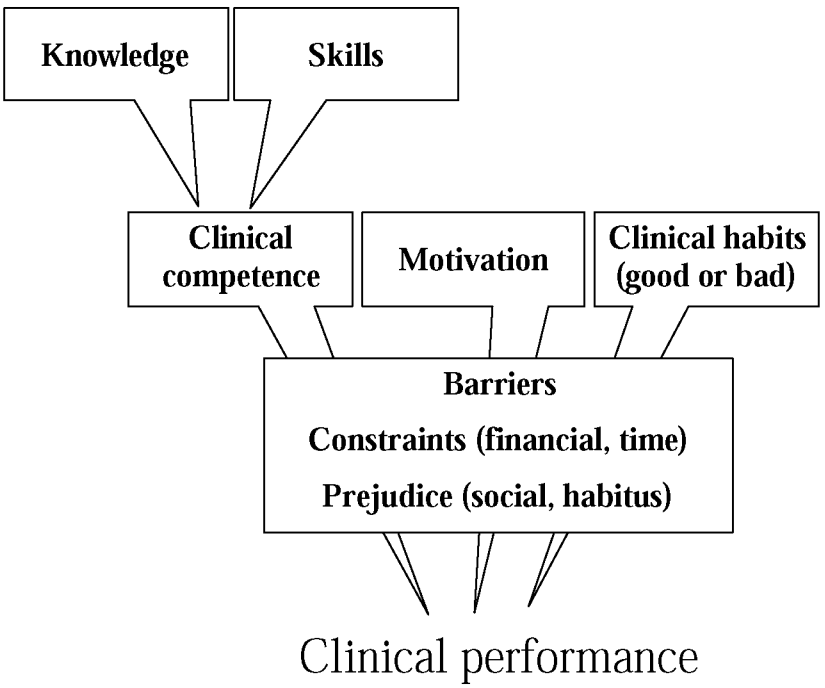
3. METHODS

3.1 Choice of Process Based Performance Review:

The initial intention was to provide informational material to increase knowledge in an attempt to improve clinical performance. However a review of the literature showed that this approach would be unlikely to succeed as knowledge alone does not ensure improved clinical competence i.e. the ability to care for patients[8]. By way of example, a group of doctors identified important clinical actions in the diagnosis and management of several diseases[9]. The performance of the same group of doctors' was then assessed by "sham" patients in a clinical setting. The inconsistency between knowledge and performance was demonstrated by the fact that 30% - 45% of the important actions were not carried out.

There is an extensive literature indicating that changing clinical performance is not easy[10, 11,12]. While knowledge is a necessary precondition for correct clinical performance, other factors are also essential (figure 1).

Figure 1 Components of Clinical Performance



Adapted from Sacket DL[13]

Numerous methods aimed at improving patient care are in use. However when these are evaluated, many have not proven successful in changing doctors behaviour or clinical outcomes (table 1).

Table 1 Methods for changing doctors' clinical performance

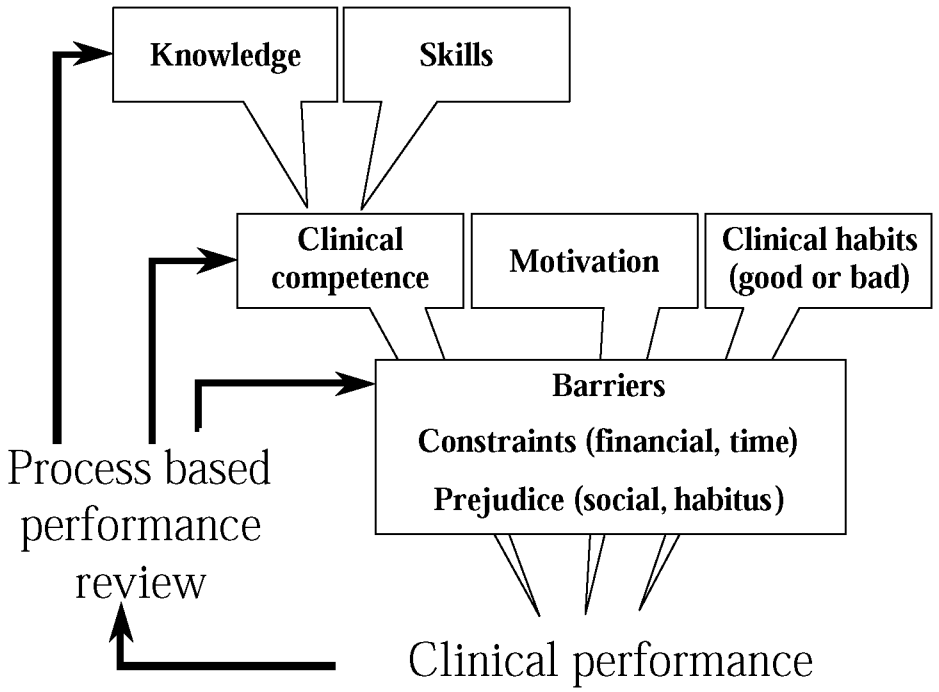
What does not work	What has been shown to work
Traditional CME	Performance review by clinicians themselves
Information mailing	Feedback
Retrospective feedback	Physician incentives
Case management	Opinion leaders
Audits	Patient education
	Academic detailing
	Computerized decision-making

In Performance review, health care workers retrospectively review a patient's records to evaluate what they are actually doing and how well they are doing it. Performance review undertaken by health care workers themselves, together with feedback in the form of autopsy reports was selected as an excellent and practicable way of achieving the goal of improving clinical performance.

Performance review of the diagnosis and management of disease, can evaluate either the outcome of clinical care or the process of care itself. The actions (or omissions) of doctors and allied health care workers are only one factor in determining the outcome of care. Additional factors are the nature of the illness, diagnostic tests available, treatment options and patient adherence to treatment. For these reasons focusing on the process of care is a simpler but very effective way of improving clinical performance

In fact, process-based performance review (PBPR), undertaken by clinicians themselves[8,13], has been show to be one of the most effective ways of improving clinical performance (Figure 2).

Figure 2 Performance Based Review and Clinical Performance



3.2 Choice of flow sheet format

Having chosen PBPR as the method to improve clinical performance it became necessary to select the most effective tool for guiding the review. Few doctors ever gather, much less critically appraise, evidence of their own clinical performance. Review of the clinical records unless structured, has the potential to be counter-productive. For example outcome-based review of clinical records can turn into a finger-pointing exercise.

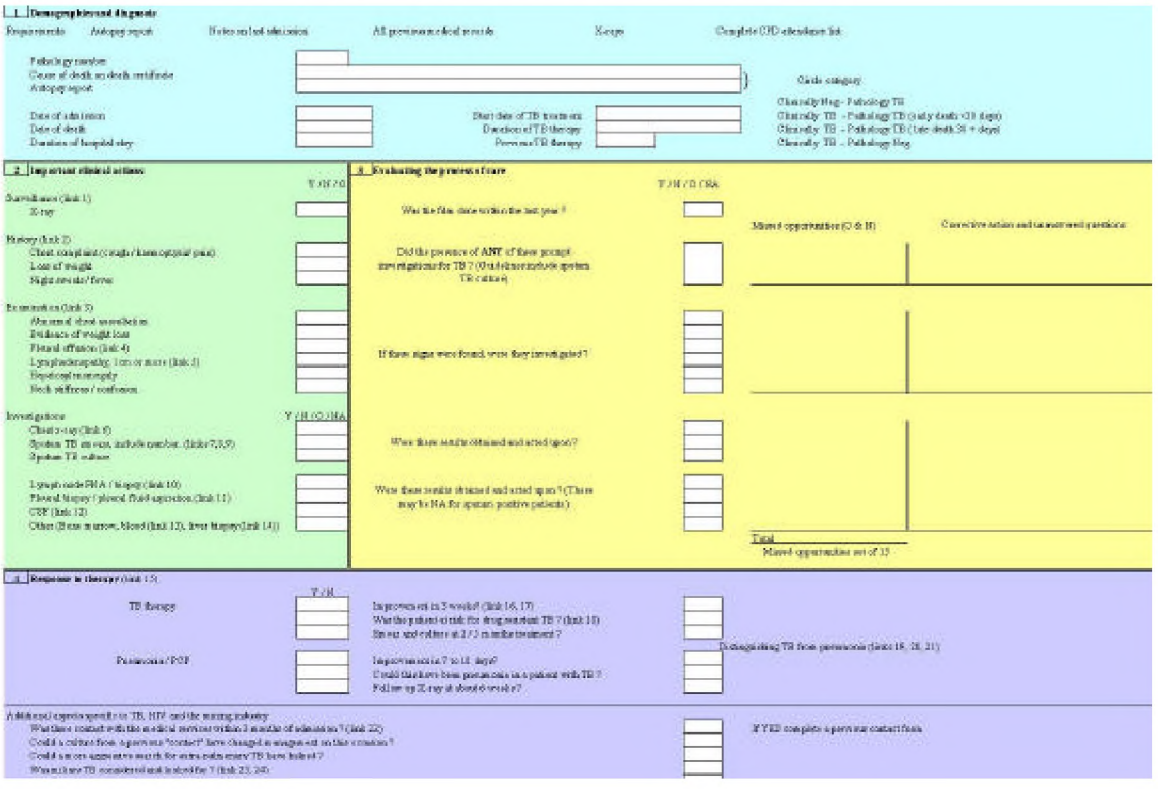
Flow sheets are an efficient mechanism for constructive evaluation of clinical actions and, when used in conjunction with feedback, have been shown to change both physician behaviour and compliance with guidelines. Clinical situations where flow sheets have been proven to improve patient outcomes include: congestive cardiac failure, burns, pneumonia, myocardial infarction, urinary tract infections, upper gastrointestinal bleeds, chronic obstructive pulmonary disease, hypertension, headache, otitis media, bronchitis, and anticoagulation[14-20].

3.3 Content and design of the flow sheet:

While flow sheets exist for the review of many clinical conditions, there is no existing model for the evaluation of the diagnosis of PTB, highlighting practical and important aspects of the process of care and also identifying missed opportunities in the diagnostic process. Development of the flow sheet by the project team was guided by a review of the TB literature and the findings of SIMRAC Project Health 611.

The a flow sheet was developed to provide a means of (1) identifying important clinical actions of why, when and how to perform essential components in the history, physical examination, investigation and treatment for TB, (2) reviewing whether these actions have actually been carried out, (3) quantifying missed opportunities to have made a timeous diagnosis of TB and (4) allowing health care workers to identify corrective measures which would be appropriate for their particular health care setting. When undertaken as a group activity, the review process leads to reflection and discussion as to missed opportunities that can be avoided in the future.

Figure 3 Process-Based Performance Review for the Diagnosis of Pulmonary Tuberculosis Flow Sheet



It was important to avoid producing a "laundry list" and to make the review appropriate for the SA mining industry. Thus, for example, surveillance for TB was included but lung biopsy, which may not be practicable, was excluded. Information from Health 611 helped to identify which of these clinical actions would have the greatest impact on the care of patients in the mining industry.

The flow sheet contents are designed to:

- emphasize clinical actions which are key determinants of outcome
- determine whether or not these actions have been performed
- indicate whether programmatic changes are required
- heighten awareness of the presenting features of TB in HIV co-infected patients
- select the most appropriate diagnostic investigations in varying clinical scenarios
- manage the smear negative (including miliary) patient with possible TB
- detect concurrent pulmonary illnesses particularly in the setting of HIV co-infection
- appropriately investigate for drug resistance
- diagnose TB by the use of simple techniques e.g. lymph node aspiration

3.4 Critically appraised topics (Links)

The literature review on which the construction of the flow sheets was based was utilised to make concise one- page summaries, with selected references, to accompany and inform the review process. A means of quick reference to these topic summaries has been incorporated in the flow sheet as 'links'. There are 25 topic summaries (table 2).

Table 2 Critically appraised topics (Links)

1. Surveillance
2. History
3. Examination
4. Pleural Effusion
5. Lymphadenopathy
6. Chest Radiographs
7. Sputum Examination
8. Improving the Yield from Smear Examination
9. New Diagnostic Techniques
10. Lymph node aspiration Technique
11. Pleural Biopsy Technique
12. Cerebrospinal Fluid Findings in TB Meningitis
13. Mycobacterial Blood Cultures and Bone Marrow Examination
14. Liver Biopsy
15. Pneumonia and TB Overview
16. TB Treatment Response
17. TB Treatment Response Flow Chart
18. Multi-drug Resistant TB
19. Pneumonia and TB co-exist
20. Sputum Smear Negative TB Misdiagnosed as Pneumonia
21. Pneumonia Misdiagnosed as TB
22. Why a Review of Contact with Medical Service Prior to the Terminal Hospital Admission is Important
23. Miliary TB
24. Miliary TB Flow Chart
25. Empirical Treatment for TB

Figure 4 Example of a Critically Appraised Topic (link 8)

Link 8
Improving the yield

IMPROVING THE YIELD FROM SMEAR EXAMINATION

It is important that your laboratory belongs to a reputable quality control programme.

Smear positive patients may not be detected through sputum smear examination for a number of avoidable reasons:

1. SPECIMEN COLLECTION

- Three sputum specimens should be collected, ideally in the early morning and on consecutive mornings.
- It is often more convenient to collect the first specimen when the patient is first seen: the patient is then given two labelled containers and asked to collect the second and third as early morning specimens.
- Each specimen should ideally consist of at least 5 ml of purulent material.
- Supervision of the initial collection presents an opportunity to teach the patient what to do and what represents an appropriate specimen.
- Nebulisation, deep breathing, and chest physiotherapy may be required in order to obtain an adequate specimen.

2. TECHNICAL ASPECTS

- Reliance on Z-N staining technique: Use of techniques such as fluorochrome-stained smears and homogenisation and concentration of sputum increases the diagnostic yield.
- Poor microscopy/microscopist: lack of quality assurance or control measures: in a study in Tanzania, 1/3 of sputum specimens defined as smear negative, in a local laboratory, were found to be smear-positive in a reference laboratory.
- Overloaded microscopy service.

3. ADMINISTRATIVE AND CLERICAL ERRORS

NOTE that diagnostic delays caused by waiting for additional sputum specimens can be decreased by performing additional diagnostic tests. Fine needle aspiration or biopsy of a lymph node, and pleural biopsy are the most cost effective of the additional tests available.

FALSE POSITIVE SMEAR RESULTS

False positive results may occur due to the presence of non-tuberculous mycobacteria (NTM) although the positive predictive value of a positive smear is 91% in South African gold mines. Errors of this type may be avoided by requesting identification of the organism. In addition, false positives may occur due to administrative errors. If a laboratory result does not "fit" with a patient's clinical appearance, then the test(s) should be repeated.

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3.5 Continuing Professional Development

Participation in the review process is incentive driven through the mechanism of continuing professional development (CPD) points, which is a legal requirement for ongoing registration with the Health Professions Council of South Africa.

The Wits Health Consortium has approved accreditation for the clinico-pathological case reviews to a maximum of 12 points per annum. In order to qualify for points, a CPD attendance register as well as the flow-sheet must be completed. A mechanism has been set up for manual submission of the completed flow sheet together with enquiries arising therefrom. This will enable the project team and consultants to evaluate the system on an ongoing basis.

4. TECHNOLOGY TRANSFER

4.1 End user input

A workshop, in which doctors from the gold, coal and platinum industries participated, was held. The discussion centred around the choice of the methodology (PBPR), the tool (Flow sheet) and the critically appraised topics. They welcomed the novel format, found it easy to use and assessed the content as excellent. In addition, the material was presented to a wide range of doctors attending the diploma course in Tropical Medicine and Hygiene at both the University of Pretoria and the University of the Witwatersrand.

4.2 Products

4.2.1 Process based performance review for the diagnosis of pulmonary tuberculosis manual in paper format and CD.

4.2.2 Four Posters:
The effect of HIV infection on tuberculosis
Sputum collection for the diagnosis of tuberculosis
Missed and misdiagnosed tuberculosis (Simhealth 611)
Miliary tuberculosis

4.2.3 Bookmark

4.3 Presentations

The proposed format of the project was presented at the Mine Medical Officers' Association Annual Conference in May 2001.

Two seminars, attended by a total of 96 people, were held to introduce the review process and distribute the material. A wide range of health care workers including doctors, nurses, physiotherapists and laboratory technologists attended. The seminars included "hands-on" practice using the flow sheet. The seminars were held at the Leslie Williams Memorial Hospital in Carletonville on the 18th March 2002, and at the Rustenburg Golf Course on 09th April 2002.

5. CONCLUSION

Recent SIMRAC research in the mining industry identified the omission of accurate, appropriate and timeous clinical history, examination and diagnostic tests for TB as major contributing factors to delayed, mis- and missed diagnosis.

The purpose of the current project was to effect technology transfer of this research by identifying, producing and distributing appropriate educational material to facilitate implementation of best practice with regards to the diagnosis of pulmonary TB in the mining industry.

Process based performance review, undertaken by clinicians' themselves, was identified to be one of the most effective ways of developing successful practice habits.

A single page flow sheet, highlighting essential components in the history, physical examination and investigation for TB and identifying missed opportunities was developed to guide the review process, with accompanying topic summaries of the pertinent literature. Participation is incentive driven through the process of CPD points.

The end-products have been demonstrated to mine health care workers and were well received. However the challenge will be to sustain this technology transfer by ensuring that the process of performance review becomes an ongoing process at the mine health care centres.

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7. RECOMMENDATIONS

7.1 Performance review

Process based performance review should be an ongoing process at the mine health care centres, with autopsy reports sent to the mines at regular intervals

7.2 Review analysis

The reviews should be analysed to evaluate the training products which have been produced and assess their impact

7.3 Critically appraised topics

The critically appraised topics should be updated as new information is published

7.4 E-mail or web-based consultation service

An e-mail or web-based consultation service for health care workers using the HEALTH 808 products should be established. This will allow a reduction in the time taken to answer queries and improve the use of the HEALTH 808 training products.

7.5 On-site assistance and review implementation

On-site assistance at the mines with entrenching and implementing the review process should be offered, so as to affect sustainable technology transfer.