

## How can detection of infectious tuberculosis be improved? Experience in the Somali region of Ethiopia

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### SUMMARY

In early 1999, 48% of pulmonary tuberculosis (PTB) cases detected in the Somali region of Ethiopia were smear-positive. Actions at the laboratory level and peer-review of smear-negative PTB diagnoses were proposed. Clinicians knew, but did not adhere to, the algorithm recommended by the National Tuberculosis Programme for these diagnoses, partly due to the costs involved to patients. Challenging clinicians, in a non-threatening

way, to become more clinically rigorous proved successful, and the proportion of smear-positive PTB increased to 65%. Operational research is needed to assess the feasibility of these widely-recommended smear-negative PTB diagnosis guidelines.

**KEY WORDS:** tuberculosis; diagnosis; control; practice guidelines

THE PROPORTION of smear-positive pulmonary tuberculosis (PTB) among registered PTB cases is a standard indicator for assessing a National Tuberculosis Programme (NTP); the target of the World Health Organization (WHO) is at least 65%,<sup>1</sup> taking into account the natural history of the disease, programme priorities (smear-positive PTB), and the fact that it is difficult to diagnose smear-negative PTB. When this indicator is particularly low (e.g., below 50%) it is usually interpreted as indicating an 'over-diagnosis' of smear-negative PTB, with adverse consequences for the patients, who receive unnecessary treatment, and for the community, as precious re-sources are wasted.

Among patients screened by microscopy for PTB, 80–90% have a negative smear result ('smear-negative PTB suspects'), of which only a minority actually have smear-negative PTB. Differential diagnosis is difficult, particularly in resource-constrained countries. Algorithms for the diagnosis of smear-negative PTB are part of most NTPs' guidelines.<sup>2,3</sup> They usually involve prescribing smear-negative PTB suspects a period of treatment with a broad spectrum antibiotic to treat possible bacterial infection, repeated sputum smears if the patient does not improve, and finally chest X-ray before deciding on the diagnosis.

In 1999, only 44% of the PTB cases registered in Ethiopia were smear-positive.<sup>4</sup> In this paper we dis-

cuss how the problem of a low proportion of smear-positive PTB cases enrolled in an NTP has been tackled in a rural area of Ethiopia.

### MATERIAL AND METHODS

The Somali National Regional State, one of Ethiopia's most underdeveloped regions, has a total population of more than 3 million, with only nine inhabitants/km<sup>2</sup>.<sup>5</sup> Jijiga, the capital and largest town (population 66 000), hosts Karamara Hospital, one of the few health facilities that is more or less functional in the region. The hospital has a team of 20 physicians; it suffers from a poor infrastructure, low staff morale, and chronic shortages of basic supplies. Until recently (and at the time of this study) it was the only health facility in the region (apart from a refugee programme in a different zone) where microscopic diagnosis for PTB and a regular supply of short-course chemotherapy drugs were available to the NTP, thanks to the support of Médecins Sans Frontières (MSF). A survey performed in 1998 showed that 25% of smear-positive PTB patients were co-infected with the human immunodeficiency virus (HIV). In 1999, 1258 patients were enrolled in the TB programme in Karamara Hospital.

A pilot evaluation found that smear-positive PTB cases made up only 48% of the 216 new PTB cases put on treatment during the first quarter of 1999;

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10% of the PTB cases had no smear result recorded, and were therefore registered as 'smear-negative PTB'. There were delays of up to 10 days in handling a request for sputum examination, and no system was in place for quality control of smear microscopy. Poor diagnostic procedures (clinical examination, X-ray reading) were observed. Under the assumption of 'over-diagnosis' of smear-negative PTB, an intervention was proposed. The general objective was to improve the quality of the diagnosis for patients with smear-negative PTB, while the specific objective was to increase the proportion of smear-positive PTB among the total number of PTB cases registered. The intervention included specific actions at the laboratory level, and a proposition to peer review the diagnosis of smear-negative PTB cases. This peer review was to be implemented step-by-step through a participatory process. Efforts at documenting the intervention would not go beyond routine procedures.

## RESULTS

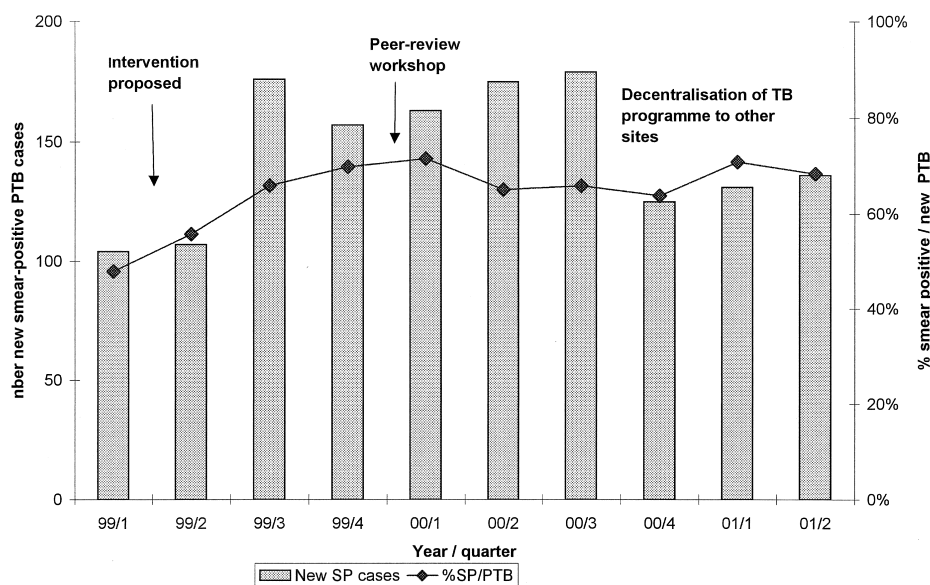
After the intervention was proposed in April 1999, an experienced laboratory technician was added to the team, a quality control system for smear microscopy was implemented, and the NTP staff in Jijiga actively started preparing a workshop to bring together all the hospital clinicians to discuss the problem of smear-negative PTB and the peer review method for improving the quality of the diagnosis.

The workshop took place in January 2000. The clinicians acknowledged that there was a problem; they were aware of the NTP guidelines for the diagnosis of smear-negative PTB, but they had not been using them. They felt they took too long to comply

with, and were 'a source of frustration' for them and for the patients, partly because of the significant patient costs involved (transport, recurrent visits, a course of antibiotics bought at a prohibitive price from a private pharmacy, X-ray). The algorithm also conflicted with what some clinicians had learnt during their medical education (e.g., in case of suspicion of PTB, and smear-negative results, the patient should undergo chest X-ray without delay). The clinicians welcomed the peer review project, and the workshop was unanimously considered a success.

The proportion of PTB cases where smear examination was not done, or the result not registered, dropped to 3% in the last 6 months of 1999 (16/492); smear examinations were processed within 2 days. The positivity rate among smears checked for PTB increased (from 12% in the first quarter of 1999 to 18% in the last quarter of the same year). Contrary to what had been decided, very few cases (9/100) of smear-negative PTB were 'peer-reviewed' in the 3 months following the workshop; in two cases the diagnosis was rejected by the peer group. Several events took place in Jijiga at that time that put high pressure on the staff—among others, a severe famine crisis, and the extension of the TB programme to other areas.

The desired outcome of this project, an increase in the proportion of smear-positive PTB, occurred when attention was brought to the problem, and before formal implementation of the peer review was attempted—and failed. The effect was sustained: in 2000 and 2001, the proportion of smear-positives was over the target threshold of 65%. An increase in the total number of cases also occurred around the same time (Figure).



**Figure** New cases of smear-positive pulmonary tuberculosis enrolled in Karamara Hospital, Jijiga, Ethiopia, 1999–2001. PTB = pulmonary tuberculosis; SP = smear-positive.

## DISCUSSION

This operational study did not record more than routine data, and therefore lacks precisely documented and quantified process indicators. Our objective to increase the desired proportion of smear-positive PTB in the programme was reached, but we have only hypotheses to explain this success. It is unlikely that the proportion of smear-negative PTB patients in the population attending the hospital would have changed so suddenly. The main reasons for the observed trends are therefore to be found in the technical performance of smear examination and/or the criteria used in practice for the diagnosis of smear-negative PTB. It is well recognised that the sensitivity of sputum smear microscopy performed under routine conditions is often sub-standard.<sup>6</sup> Improved quality of microscopy certainly contributed to the increase in the proportion of smear-positive PTB. NTP staff also believed that the clinicians had felt challenged, in a non-threatening way, in their clinical skills, and that in the long process of preparing the peer review workshop they had become clinically more rigorous, and were paying more attention to the NTP guidelines for the diagnosis of smear-negative PTB.

But how effective are these guidelines? They should ideally be validated and optimised in each country,<sup>7</sup> as the sensitivity and specificity of a given algorithm will vary depending on the differential diagnoses to be considered in a given country, and will be influenced by the prevalence of HIV. The pathogens targeted can also vary in their degree of resistance to the antibiotic used. We found only one study, in South Africa, which rigorously validated a trial-of-antibiotic algorithm for the diagnosis of smear-negative PTB;<sup>8</sup> validity was good, but the study had been conducted in a population that was included only after careful clinical and radiological selection, which of course boosted the results. This kind of selection is not possible everywhere; it much depends on local clinical performance, and the usual place of the X-ray in the algorithm is after antibiotic treatment, and not before.

The results of the South African study can hardly be extrapolated to situations like Karamara Hospital. It is probable that clinicians' adherence to the guidelines for the diagnosis of smear-negative PTB improved in Karamara Hospital, but this doesn't mean that improvements in patient adherence followed. It may have led to the exclusion of some smear-negative PTB patients from the diagnosis, and our hypothesis is that this factor also contributed, to an unknown extent, to a higher proportion of smear-positive PTB patients in the programme.

A number of factors could have contributed to the increase in overall PTB case detection concomitant with the increased proportion of smear-positive PTB cases: a health information campaign at population level had

been conducted in the last months of 1999, more suspects were referred for microscopy screening (perhaps also due to increased clinicians' awareness), and the delay in sputum processing decreased dramatically.

There is no magic bullet to solve the difficult problem of smear-negative PTB diagnosis in such a deprived environment. Some actions could improve the field performance of existing diagnostic guidelines, such as a better selection of patients entering the algorithm or making the relevant antibiotics more financially accessible to the patients. These antibiotics could be part of the resources provided by the NTP, or of the more comprehensive management of cough in adults (as in the WHO's Adult Lung Initiative<sup>9</sup>). The decision on the best place of X-ray in the algorithm (after the first set of negative sputum smears, or after the antibiotic trial) should not only be based on technical arguments (such as overall cost-effectiveness under the assumption that all health workers and all patients are perfectly compliant), but it should also incorporate elements such as the length of the overall algorithm and related patient's costs. The field performance of these guidelines remains an unexplored research issue. We could not find any study on physician or patient adherence to such guidelines.

Our experience shows that it was possible to increase very rapidly, and in a sustainable way, the proportion of smear-positive PTB cases in an NTP: in Jijiga it is now within the WHO-recommended range. However, this indicator, except when very low or very high, depends on too many factors to be a good proxy for 'quality of diagnosis'. Under-diagnosis and/or over-diagnosis of smear-negative PTB cases could still be real problems in this population with high HIV prevalence. The potential of the peer review method to improve the quality of diagnosis of smear-negative PTB patients needs to be tested under controlled conditions, allowing systematic data collection of process indicators. Operational research on the existing guidelines for the diagnosis of smear-negative PTB is urgently needed.

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#### R É S U M É

Au début de 1999, la bacilloscopie des frottis était positive dans 48% des cas de tuberculose pulmonaire (TBP) dans la région des Somalis en Ethiopie. On a proposé des actions spécifiques au niveau du laboratoire et une revue par des pairs des diagnostics de TBP à bacilloscopie négative des frottis. Les cliniciens connaissaient, mais n'adhéraient pas aux directives proposées par le Programme National contre la Tuberculose pour ce diag-

nostic, dû en partie aux coûts élevés pour les patients. Mettre au défi les cliniciens, d'une manière non menaçante, de devenir cliniquement plus rigoureux a réussi, et la proportion de TBP frottis-positif a augmenté à 65%. Une recherche opérationnelle s'impose pour évaluer la faisabilité des directives de diagnostic de la TBP frottis-négatif.

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#### R E S U M E N

En el primer trimestre de 1999, el 48% de los casos de tuberculosis pulmonar (TBP) detectados en la región de Somali, en Etiopía, tenían baciloscopias positivas. Se propuso acciones específicas a nivel del laboratorio y una revisión de los diagnósticos de los casos de TBP con baciloscopias negativas por otros miembros del equipo. Los clínicos conocían, pero no aceptaban, las directrices estándares propuestas por el PNT para el diagnóstico,

en parte debida a los altos costos que debe soportar el paciente. La proporción de TBP con baciloscopias negativas aumentó hasta 65%. El éxito de esta intervención se atribuye al desafío, sin amenazas, lanzado a los clínicos para trabajar de manera más rigurosa. Se necesita una investigación operacional sobre la viabilidad de las directrices para el diagnóstico de la TB pulmonar con baciloscopias negativas.

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