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Evaluation of a standardized recording tool for sputum smear microscopy for acid-fast bacilli under routine conditions in low income countries

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SUMMARY

SETTING: Laboratories performing sputum smear microscopy for tuberculosis in Benin, Malawi, Nicaragua and Senegal.

METHODS: Analysis of computerized laboratory registers to ascertain workload, yield from serial smear examination, and demographic characteristics of examinees.

RESULTS: Data from more than 60 000 examinees in 42 laboratories showed that the average number of smears examined per day ranged from 4 to 19 (mean 6) per country. To find one case of tuberculosis, on average 21 smears of suspects were examined (range 8 to 50). Of all cases with ultimately at least one positive result, 87% were already positive on the first examination. Demographic characteristics of cases differed considerably by country and gender. In 35 of 42 laboratories, males were more frequently found to be cases than females, and with increasing age an increasingly larger number of female than male suspects had to be examined to identify one case.

CONCLUSIONS: This study demonstrates the usefulness of a standardized recording system for results of acid-fast microscopy in obtaining essential information for program management and on demographic characteristics of persons presenting for examination.

KEY WORDS: tuberculosis; diagnosis; microscopy; planning; epidemiology

DIRECT MICROSCOPIC EXAMINATION of sputum for acid-fast bacilli remains a cornerstone for the diagnosis of tuberculosis in both industrialized and low income countries. The identification of acid-fast bacilli in a sputum specimen is highly specific for the diagnosis of tuberculosis in either setting[1–4] and has excellent sensitivity in identifying sources of transmission of *Mycobacterium tuberculosis* in the community.[5,6]

In collaborative tuberculosis programs of the International Union Against Tuberculosis and Lung Disease (IUATLD), a standardized laboratory register for recording results of acid-fast microscopy is used.[7] Because this register is readily accessible, it was used in this study to ascertain the workload of laboratories in various settings, to assess the yield from sputum smear microscopy for acid-fast bacilli, and to describe the demographic characteristics of patients both suspected and confirmed as having tuberculosis.

MATERIALS AND METHODS

The IUATLD tuberculosis laboratory register[7] assigns a single line to each examinee for whom a unique laboratory serial number is recorded, starting with the number 1 at the beginning of each year. This is followed by the date when the first specimen was received, the name, address, age, and gender of the examinee, two columns to classify the examinee as a suspect of tuberculosis presenting for diagnostic examination or as a tuberculosis patient with a bacteriologic follow-up examination, and three columns to record the results of the first, second, or third examination respectively. Two additional columns provide space for the technician's signature and for remarks.

All the laboratories in the four countries selected (Benin, Malawi, Nicaragua, and Senegal) utilize the Ziehl-Neelsen technique of staining for acid-fast bacilli.[8] Because the diagnosis of extra-pulmonary tuberculosis in these countries is usually based on a set

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of clinical criteria and not on bacteriologic examination (with the exception of Nicaragua, where bacteriologic examination is commonly performed for extra-pulmonary lesions that are accessible), virtually all specimens examined are sputum samples from patients presenting with symptoms pertaining to the respiratory tract, or sputum samples taken from patients with extra-pulmonary tuberculosis for testing in order to exclude concomitant pulmonary tuberculosis.

The national tuberculosis programs in Benin, Malawi, Nicaragua, and Senegal were requested to identify all laboratories where the principle of recording the results in the registers was followed, and where age and gender of examinees were recorded in at least an estimated 85% of cases. The protocol required that from these, a random sample of at least 10 completed registers, each from a different laboratory, be selected for data abstraction and computerization. This approach was, however, not practically feasible in some countries, and systematic sampling in predefined regions was therefore chosen instead.

A single protocol was followed by the participating countries, specifying procedures for data collection and coding. A standardized Epi Info questionnaire (Epi Info, version 6, Centers for Disease Control and Prevention, Atlanta, GA) was supplied on diskette to each program to abstract the information on the following eight variables from each laboratory register: laboratory serial number, date of registration, age, gender, type of patient (suspect or follow-up), first, second, and third result of microscopic examination.

After completing the computerization of a register, the program manager was requested to check, independently from the data entry person, a random sample of 10% of all records for erroneous coding. The laboratory serial number was used for identification of the selected records in the physical register. The data entry persons had been offered a 50% increase in pay for each laboratory register containing fewer than 3% errors in the random sample.

After completion of data entry, a variable was added to identify the laboratory, then all files from a country were combined and a variable added to the combined data set to identify the country.

Epi Info and commercially available software (FoxPro relational database management system for MS-DOS®, Microsoft Corporation, USA, and SYSTAT,® Evanston, IL) were used to analyze the data.

For the purpose of analysis, an *examinee* was defined as any patient with at least one recorded result of sputum smear examination for acid-fast bacilli; a *suspect* was defined as a patient not currently on anti-tuberculosis treatment presenting for a diagnostic examination; a *follow-up patient* was defined as any patient currently on anti-tuberculosis treatment with a bacteriologic follow-up examination during treatment; a *case* was defined as any patient presenting for diagnostic examination with at least one positive result for acid-fast bacilli (including new cases and relapse cases).

The data set allowed the calculation of the average number of smears performed per working day, the proportion of suspects among examinees, the incremental gain from serial smear examinations among suspects, utilizing a published methodology,[9] and a demographic characterization by age and gender of suspects and cases.

RESULTS

It was not possible to adhere to strict random selection of laboratory registers as required by the protocol. In Benin, all five major laboratories from four of the six départements (administrative regions) were selected; the two northern administrative areas were excluded because of difficulties in accessibility. In Malawi, nine laboratories were selected from all three regions, but in a non-random fashion. In Nicaragua, 17 laboratories were selected randomly after excluding laboratories known to identify only a very small number of cases. In Senegal, 11 laboratories of the five regions (out of 10) which had first implemented the laboratory register were selected in a non-random fashion. From each of these laboratories, one completed register was obtained for computerization, giving a total of 42 laboratory registers (Table 1).

Validity checking of data entry showed that in none of these registers did the number of errors checked on a 10% random sample exceed 3%.

Workload in the laboratories

As a first question the workload of the laboratories was assessed. After eliminating all records in each register without any result, a total of 62 141 records were available for analysis (Table 1). The total number of smears performed and the total number of days covered in each laboratory register were calculated. To obtain the average number of smears performed per working day in each laboratory, it was assumed that 10 public holidays were evenly distributed over the entire year, and that laboratory examinations were otherwise performed 5 out of 7 days per week, during each week of the year.

All laboratories combined covered 37 343 days (102.3 years) of observation. The number of working days in this period was estimated to be 26 650.5, during which time a total of 152 848 smears were recorded. The average number of smears performed per working day was thus 6.0, with a range from 4.0 in Nicaragua to 19.3 in Malawi (Table 1). Within each country, the range for individual laboratories was considerable: 4.4 to 27.5 in Benin, 4.8 to 92.4 in Malawi, 0.9 to 11.6 in Nicaragua, and 4.4 to 19.3 in Senegal.

Table 1 Summary of findings from tuberculosis laboratory registers in Benin, Malawi, Nicaragua, and Senegal

Category	Benin	Malawi	Nicaragua	Senegal	Total
No. of laboratories participating	5	9	17	11	42
No. of records with at least 1 result	7 304	14 415	30 801	9 626	62 141
No. of records specified as suspect or follow-up	7 211	13 376	30 553	9 272	60 412
No. of records specified as suspects	3 757	9 548	23 929	5 815	43 049
No. of records with complete information	3 081	7 950	20 792	5 096	36 919
No. of smears recorded	16 067	36 560	76 708	23 513	152 848
Observation period (working days)	1 214.4	1 891.0	19 102.4	3 442.7	26 650.5
No. of smears examined per working day	13.2	19.3	4.0	6.8	6.0
No. of smears examined among suspects	9 603	25 128	61 416	14 492	110 639
No. of new cases	1 207	1 655	1 233	1 084	5 179
No. of smears examined per case	8.0	15.2	49.8	13.4	21.4
Proportion of cases among suspects (%)	32.1	17.3	5.2	18.6	12.0
Proportion positive on 1st examination (%)	85.3	96.9	78.9	84.3	87.2
Incremental yield with 2nd examination (%)	12.1	2.4	13.9	12.7	9.6
Incremental yield with 3rd examination (%)	2.6	0.7	7.2	3.0	3.2

Suspects and follow-up examinees

A total of 1 729 records (2.8%) of the 62 141 examinees had not recorded the type of examinee, i.e., whether the examinee had come as a new suspect or for a follow-up examination during treatment. The second data set thus contained the 60 412 records (97.2% of the first set) for which this specification was made. Among these examinees, the observed proportion of suspects among examinees was 52.1% in Benin, 71.4% in Malawi, 78.3% in Nicaragua, and 62.7% in Senegal. Overall, 74.3% of all smears were done for the examination of suspects and, conversely, 25.7% for follow-up examinations.

Yield of acid-fast bacilli

The third data set contained only records of the 43 049 examinees (71.3% of the second data set) known to be tuberculosis suspects. This data set allowed the calculation of the number of suspects that had to be examined to identify one case and the number of smears that needed to be performed among suspects to identify one case of tuberculosis. The incremental gain from serial sputum smear examinations was also calculated from this data set.

On average, 12.0% of all new suspects examined were found to have at least one smear positive for acid-fast bacilli (Table 1). However, while this proportion was only 5.2% in Nicaragua, it was 32.1% in Benin. In Malawi (17.3%) and Senegal (18.6%), the yield was intermediate (Figure 1). The number of smears that was performed to identify one case among suspects was 21.4, ranging from a low of 8.0 in Benin to a high of 49.8 in Nicaragua (Table 1). The range of smears performed by different laboratories to identify a case was particularly wide in Nicaragua, ranging from 27 to 106 smears.

Utilizing a methodology published elsewhere,[9] the incremental gain from successive serial smears was calculated. On average, of all cases expected to be positive if three examinations had been performed, 87.2% were positive already with a single examination. The second examination added another 9.6%, and the final examination 3.2%. These findings were similar in Benin and Senegal, but deviated considerably in Malawi and Nicaragua. In Malawi the second and third examinations were reported to add virtually nothing to a single examination, while in Nicaragua, the third smear still added 7.2% not found on the first two examinations (Table 1).

Demographic characteristics of suspects and cases

To analyze the demographic characteristics of suspects and of the cases amongst them, only the data from the 36 919 records of suspects with complete information on age and gender were included (85.8% of the third data set).

In all four countries, the greatest proportion among all suspects was found in young adults, with little difference between the genders (Figure 2). While in Benin, Nicaragua, and Senegal the elderly (≥ 65 years of age) still constituted some 10% of all suspects, this proportion was practically nil in Malawi.

Age- and gender-specific distributions of cases among suspects showed, in contrast, large differences between countries. In all countries, a higher proportion of male suspects turned out to be cases compared to females, but there were big variations by age (Figure 3). In Benin 40% of all young adult suspects were found

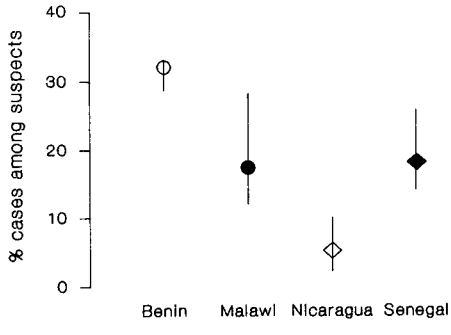

Figure 1 Proportion of suspects identified as tuberculosis cases in Benin, Malawi, Nicaragua, and Senegal. Symbols indicate mean proportion of cases among suspects, vertical lines represent the range in the proportion of cases among suspects in the different laboratories of the country.

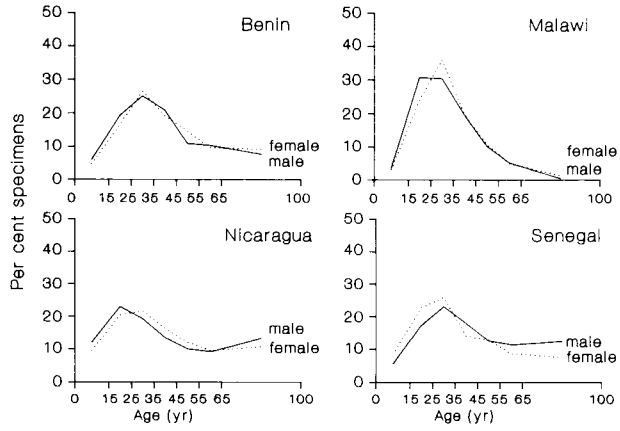

Figure 2 Age-specific, proportional distribution of tuberculosis suspects among males and females, in Benin, Malawi, Nicaragua, and Senegal.

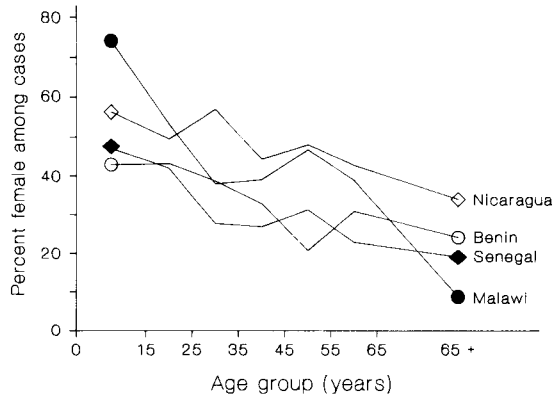

Figure 4 Proportion of female tuberculosis cases among suspects, by age, in Benin, Malawi, Nicaragua, and Senegal.

to be cases, with relatively small differences between the genders. In contrast, the yield decreased significantly with increasing age, and in the oldest age group, the yield of cases among males was almost double that among females. In Malawi, the yield of cases remained more evenly distributed throughout the age groups, and similar findings were obtained in Nicaragua. In Senegal, similar to the findings in Benin, the yield was highest among adults and lowest at the extremes of age, but except for those aged under 25, the yield was clearly higher among male than among female suspects.

The age-dependent difference for the gender-specific proportion of cases is summarized in Figure 4. Except for children, in whom the genders contributed equally to cases, the proportion of females among cases decreased with increasing age. In 35 of the 42 laboratories examined females constituted a higher proportion among tuberculosis suspects than among cases (Figure 5). In other words, the efficiency of examination for acid-fast bacilli was greater among males than among females. This phenomenon becomes particularly pronounced with increasing age of the suspect (Figure 6). While in the group under 25 years of age an approximately equal number of females compared to males needed to be examined to identify one case of tuberculosis, the relative number of females compared to males that had to be examined to identify one case increased steadily with age.

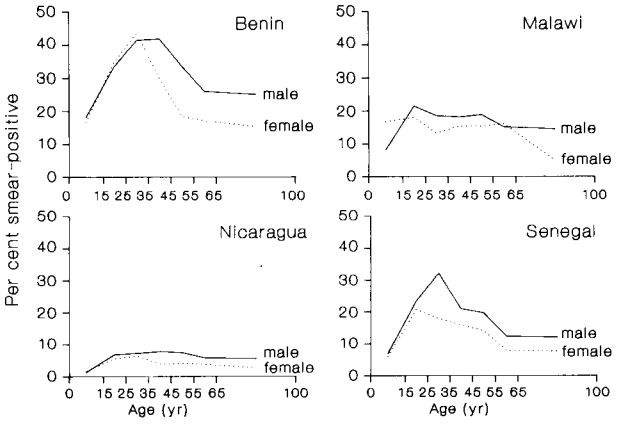

Figure 3 Proportion of tuberculosis cases among tuberculosis suspects, by age and gender, in Benin, Malawi, Nicaragua, and Senegal.

DISCUSSION

This study provides a comparison of findings in laboratories examining sputum specimens for acid-fast bacilli in socio-economically and culturally divergent countries that nevertheless utilize the same standardized approach to recording results from acid-fast microscopy. Such a comparison appeared necessary because each of these countries uses a system of ordering of supplies for diagnosis on an equally standardized approach based on the number of notified tuberculosis cases.[10] Furthermore, this analysis allowed an estimation of the workload from sputum smear microscopy in the different laboratories, which is important in planning for needed human resources, an assessment of the efficiency of sputum smear examinations, and a characterization of examinees.

The study is not truly representative of the work of all laboratories in the four countries studied; it was not feasible to choose a strict random sample of laboratory registers, as not all laboratories had complete registers that were accessible for examination at the time of the study, and not all were equally well kept. The selected registers thus came from laboratories with generally longer experience and better than average recording discipline. Nevertheless, the large number of registers selected and the wide range of differences encountered would indicate that these laboratories represent a reasonably wide experience of sputum smear microscopy for acid-fast bacilli in these countries. The quality of data entry was verified to be of high standard, and the analysis presented here thus reflects very

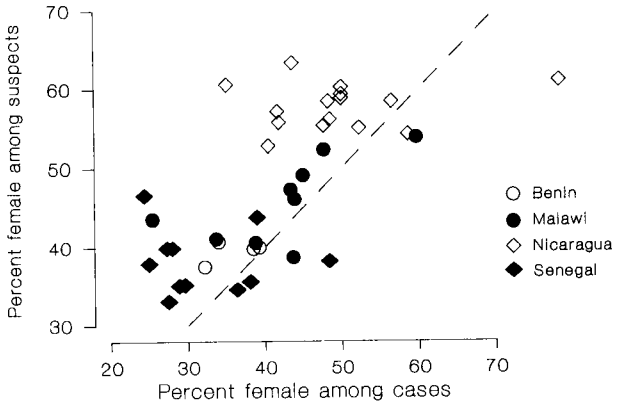

Figure 5 Correlation between the proportion of females among tuberculosis suspects and the proportion of females among tuberculosis cases, by laboratory, in Benin, Malawi, Nicaragua, and Senegal.

closely the activities and findings recorded in the different laboratories.

For tuberculosis program managers it is important to know whether laboratories are over-worked or underchallenged. Laboratories not seeing a sufficient number of specimens, and few positive specimens, might deteriorate in their quality of reading.[11] On the other hand, it is conceivable that the quality of work might suffer if too large a number of specimens has to be examined every day. Over-worked laboratory technicians might tend to examine serial specimens from the same suspect with diminishing diligence, and thus may fail to discover paucibacillary cases. The incremental return of cases diminishes rapidly with each subsequent sputum smear examination and is remarkably constant in various studies.[9,12,13] An analysis of the incremental yield from serial smears under routine laboratory service conditions may point out weaknesses in the system. At one extreme, results might be recorded for three specimens, even if only a single one has been properly examined, and this will necessarily show up in such an analysis. There is indication for such practices in some of the laboratories examined here.

In order to plan the required amount of laboratory supplies rationally, it is practical for national programs to base their estimate on the number of reported sputum smear positive tuberculosis cases. The rule of thumb has been applied that 10 suspects need to be examined with three smears each (plus three follow-up control examinations) to identify one case of tuberculosis.[7,10] In this study, the average proportion of suspects found to be cases was very close to this estimate, with 12%. However, the number of smears examined was much smaller than 30 in Benin, Malawi, and Senegal, thus providing for generous supply orders in these countries, while the same approach in Nicaragua would lead to important shortages. It is thus apparent that the rule of thumb approach is useful at the beginning of a program, but needs to be revised based on an actual analysis of laboratory registers similar to the approach chosen here to prevent ruptures of stock in laboratory supplies. An examination of the proportion of patients with a follow-up examination as compared to suspects showed that all the countries analyzed appear to adhere to the rule that a case of sputum smear-positive tuberculosis needs to have a bacteriologic follow-up examination at three points in time during treatment as recommended.[7]

The large differences between the four countries in the proportion of suspects found to be cases can be explained, at least partially, by differences in the laboratory network. At the extremes, Benin has relatively centralized laboratory services, while Nicaragua on the other extreme has a large, decentralized laboratory network. Centralization will result in more difficult access of patients to diagnostic services, and cases might be missed or diagnosed with considerable delays, while decentralized services might result in the examination of persons that do not fit the profile of a tuberculosis suspect. It is difficult to determine where the optimum balance between extreme centralization and decentralization of services lies, but it is likely to differ depending on the economic circumstances.

The study also identified some important epidemiologic findings that deserve further study. It is common to many countries that the notification rate of tuberculosis is higher among men than among women, and there is evidence that gender differences in the underlying prevalence of infection with *M. tuberculosis* among adults[14–17] can account, at least in part, for this finding. There might also be differences in the risk of progression from infection to disease between males and females, as indicated in some studies from industrialized countries.[18] Nevertheless, concerns exist that women might have less access to tuberculosis diagnostic services than men. This study can not answer the question of accessibility to examination, but it does reveal that failure to examine women is not the only possible reason for their smaller contribution to cases. Rather, this study indicates that women are being ex-

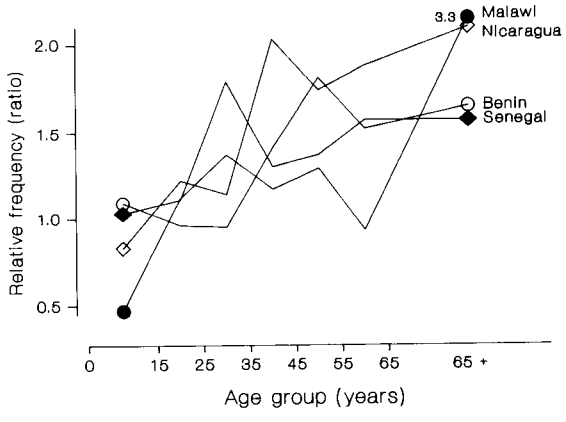

Figure 6 Relative frequency of female compared to male tuberculosis suspects examined to identify one tuberculosis case, by age, in Benin, Malawi, Nicaragua, and Senegal.

amined relatively frequently, but that cases are found less frequently amongst women than among men. This may indicate that women have a larger prevalence of non-specific respiratory symptoms than men, and that the prevalence of such conditions increases with increasing age. The differences in the proportion of cases among suspects are also possibly related not only to differences in the structure of the laboratory network, but to differences in the prevalence of non-specific respiratory symptoms as well. Clearly, a characterization of what constitutes a tuberculosis suspect in actual practice, and a determination of the final diagnosis in such suspects, might help to elucidate the phenomenon.

In summary, this study demonstrates that a wealth of information exists in various countries that can be used for planning purposes—information that is readily accessible and inexpensive to obtain and analyze. Such an analysis may also unravel epidemiologic enigmas that may help to formulate more specific epidemiologic hypotheses which should be pursued in more targeted studies.

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References

1 Shinnick T M, Good R C. Diagnostic mycobacteriology laboratory practices. Clin Infect Dis 1995; 21: 291–299.
2 Braun M M, Kilburn J O, Smithwick R W, et al. HIV infection and primary resistance to antituberculosis drugs in Abidjan, Côte d'Ivoire. AIDS 1992; 6: 1327–1330.
3 Aber V R, Allen B W, Mitchison D A, Ayuma P, Edwards E A, Keyes A B. Quality control in tuberculosis bacteriology. 1. Laboratory studies on isolated positive cultures and the efficiency of direct smear examination. Tubercle 1980; 61: 123–133.
4 Githui W, Kitui F, Juma E S, Obwana DO, Mwai J, Kwamanga D. A comparative study on the reliability of the fluorescence microscopy and Ziehl-Neelsen method in the diagnosis of pulmonary tuberculosis. East African Med J 1993; 70: 263–266.
5 Shaw J B, Wynn-Williams N. Infectivity of pulmonary tuberculosis in relation to sputum status. Am Rev Tuberc 1954; 69: 724–732.
6 Grzybowski S, Barnett G D, Styblo K. Contacts of cases of active pulmonary tuberculosis. Bull Int Union Tuberc 1975; 50: 90–106.
7 Enarson D A, Rieder H L, Arnadottir T, Trébucq A. International Union Against Tuberculosis and Lung Disease. Tuberculosis guide for low income countries. 1996; 4th ed. Frankfurt, Germany: pmi Verlagsgruppe GmbH.
8 International Union Against Tuberculosis and Lung Diseases. Technical guide for sputum examination for tuberculosis by direct microscopy. Bull Int Union Tuberc Lung Dis 1978; (Suppl No 2): 4–16.
9 Ipuge Y A I, Rieder H L, Enarson D A. The yield of acid-fast bacilli from serial smears in routine microscopy laboratories in rural Tanzania. Trans Roy Soc Trop Med Hyg 1996; 90: 258–261.
10 Rieder H L, Enarson D A. A computer-based ordering system for supplies in National Tuberculosis Programs. Tubercle Lung Dis 1995; 76: 450–454.
11 Smithwick R W. Laboratory manual for acid-fast microscopy. 1976; 2nd ed: 1–40. Atlanta, USA: U.S. Public Health Service.
12 Urbanczik R. Present position of microscopy and of culture in diagnostic mycobacteriology. Zbl Bakt Hyg A 1985; 260: 81–87.
13 Blair E B, Brown G L, Tull A H. Computer files and analyses of laboratory data from tuberculosis patients. II. Analyses of six years' data on sputum specimens. Am Rev Respir Dis 1976; 113: 427–431.
14 Medical Research Council. National tuberculin survey 1949–50. Background and methods of survey. Lancet 1952; 1: 775–785.
15 Roelsgaard E, Iversen E, Blocher C. Tuberculosis in tropical Africa. An epidemiological study. Bull WHO 1964; 30: 459–518.
16 National Center for Health Statistics. Tuberculin skin test reaction among adults 25–74 years. United States, 1971–72. Data from the National Health Survey. DHEW publication No (HRA) 77–1649 1977; Series 11 (No. 204): 1–40.
17 Baily G V J, Narain R, Mayurnath S, Vallishayee R S, Guld J. Trial of BCG vaccines in south India for tuberculosis prevention. Tuberculosis Prevention Trial, Madras. Ind J Med Res 1980; 72(suppl): 1–74.
18 Rieder H L, Cauthen G M, Comstock G W, Snider D E, Jr. Epidemiology of tuberculosis in the United States. Epidemiol Rev 1989; 11: 79–98.

RÉSUMÉ

CADRE : Laboratoires pratiquant l'examen microscopique direct de l'expectoration pour la tuberculose au Bénin, au Malawi, au Nicaragua et au Sénégal.

MÉTHODES : Analyse des registres computérisés du laboratoire pour apprécier la charge de travail, le rendement de l'examen direct répétitif d'expectorations et les caractéristiques démographiques des sujets examinés.

RÉSULTATS : Des données provenant de plus de 60 000 sujets consultant dans 42 laboratoires montrent que le nombre moyen de lames examinées par jour varie de 4 à 19 (moyenne 6) selon les pays. Pour trouver un cas de tuberculose, l'on a du examiner en moyenne 21 frottis de suspects (extrèmes 8 à 50). De tous les cas pour lesquels au moins un résultat positif a été obtenu, 87% étaient déja positifs lors du premier examen. Les caractéristiques démographiques des cas varient considérablement d'un pays à l'autre et d'un sexe à l'autre. Dans 35 des 42 laboratoires, l'on a trouvé plus fréquemment des cas chez les hommes que chez les femmes, et plus l'âge augmente, plus augmente le rapport du nombre de sujets féminins aux sujets masculins devant être examinés pour identifier un cas.

CONCLUSION : Cette étude démontre l'utilité d'un système standardisé d'enregistrement des résultats de la bacilloscopie (recherche de germes acido-résistants), en vue d'obtenir des informations essentielles pour la conduite des programmes et sur les caractéristiques démographiques des sujets se présentant pour examen.

RESUMEN

MARCO DE REFERENCIA : Laboratorios que practican exámenes microscópicos directos de expectoración para el diagnóstico de la tuberculosis en Benin, Malawi, Nicaragua y Senegal.

MÉTODO : Análisis de los registros computarizados de laboratorio para apreciar el volumen de trabajo, el rendimiento de las baciloscopias repetidas y las características demográficas de los sujetos examinados.

RESULTADOS : Los datos provenientes de más de 60 000 sujetos examinados en 42 laboratorios mostraron que el número promedio de láminas examinadas por día se sitúa entre 4 y 19 (promedio 6), según el país. Para encontrar un caso de tuberculosis se ha debido examinar en promedio 21 láminas con expectoración de sujetos sintomáticos (valores extremos : 8 y 50). El 87% de todos los casos para los cuales por lo menos un resultado era positivo habían sido ya positivos en un primer examen. Las características demográficas variaban considerablemente según el país y el sexo. En 35 de los 42 laboratorios se encontraron casos de tuberculosis más frecuentemente en los hombres que en las mujeres y con el aumento de la edad, aumentaba el número de mujeres sintomáticas, con respecto al número de hombres, que había que examinar para encontrar un caso de tuberculosis.

CONCLUSIÓN : Este estudio muestra la utilidad de un sistema estandarizado de registro de los resultados de la baciloscopia para obtener una información fundamental para el manejo de programas y sobre las características demográficas de los sujetos que se presentan para ser examinados.