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A COMPARATIVE ASSESSMENT OF PUBLIC AND PRIVATE DOTS LABORATORIES IN THE LAGOS STATE TB CONTROL PROGRAMME

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RUNNING TITLE: A COMPARATIVE ASSESSMENT OF MYCOBACTERIUM LABORATORIES IN LAGOS STATE

ABSTRACT

Background: The purpose of the laboratory services within the framework of the NTP is to provide bacteriologic evidence for the diagnosis, follow-up of TB patients and to document cure at the end of treatment. However to be fully functional, laboratory commodities should be available as needed. This study compared the laboratory hygiene practices and availability of laboratory equipment and other consumables for making diagnosis of TB in public and private DOTS laboratories in Lagos State.
Methods: A descriptive comparative cross sectional study comparing availability of commodities in public and private laboratories involved in TB services in Lagos State.
Results: Seventeen DOTS laboratories and 34 laboratory scientist/technician were recruited for this study. About three quarter and two thirds of the public and private DOTS laboratories respectively had reagents for smear microscopy. A significantly higher proportion of the public DOTS laboratories had separate area for TB work and separate table for smear preparation ($p < 0.05$). A higher proportion (71.4%) of the laboratory scientist/ technicians at the public compared with 38.5% of those at the private DOTS laboratories had good knowledge of the laboratory diagnosis of TB.

Conclusion: Laboratories involved in TB service are not functioning optimally and need to be strengthened.

Key Words: Laboratory, DOTS, Consumables, Hygiene.

UNE EVALUATION COMPARATIVE DES LABORATOIRES DE DOTS PUBLICS ET PRIVES DANS LE PROGRAMME DE LUTTE CONTRE LA TUBERCULOSE DANS L'ETAT DE LAGOS.

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TITRE COURANT : UNE EVALUATION COMPARATIVE DES LABORATOIRES DE MYCOBACTERIUM DANS L'ETAT DE LAGOS.

RESUME
Contexte : L'objet des services des laboratoires dans le cadre du NTP est de fournir les preuves bactériologiques pour le diagnostic, de suivre les patients tuberculeux et de documenter la guérison a la fin du traitement. Toutefois, pour être pleinement fonctionnel, les produits de laboratoire devraient être disponibles au besoin. Cette recherche comparait les pratiques hygiènes de laboratoire et la disponibilité des équipements de laboratoire et autres consommables pour faire le diagnostic de la tuberculose aux laboratoires de DOTS publics et prives dans l'État de Lagos.
Méthodes : Une étude transversale comparative et transversale descriptive comparant la disponibilité des produits aux

laboratoires publics et prives concernes a fournir aux services tuberculeux dans l'état de Lagos. Résultats : Dix – sept laboratoires de DOTS et 34 scientifiques/techniciens ont été recrutés pour cette recherche. Environ trois quarts et deux tiers des laboratoires de DOT publics et prives ont eu réactif respectivement pour la microscopie des frottis. Une proportion significativement plus élevée des laboratoires de DOTS publics a eu un espace séparé pour les travaux de la tuberculose et une table séparée pour la préparation des frottis (p<0,05). Une proportion élevée(71,4%) des scientifiques/techniciens des laboratoires publics comparativement a 38,5% de ceux des laboratoires de DOTS prives avaient une bonne connaissance de diagnostic laboratoire de la tuberculose. Conclusion : Les laboratoires qui ont concerné a fournir les services tuberculeux ne fonctionnent pas de la façon optimale et doivent être renforcés.
Mots– clés : Laboratoire, DOTS, consommables, Hygiène.

INTRODUCTION

Sputum smear microscopy for acid-fast bacilli (AFB) is of vital clinical and epidemiological importance in the diagnostic process for tuberculosis (TB).(1) It is the most cost-effective method of diagnosing TB patients. The detection of AFB in pulmonary secretions identifies those patients with the greatest potential for transmission of mycobacterium tuberculosis.(2) Sputum smear microscopy offers the triple advantages of speed, simplicity and low cost.(3) The purpose of the bacteriological services within the framework of the National Tuberculosis Programme (NTP) is to diagnose and follow-up of TB patients as well as document cure at the end of treatment.(3) This makes the laboratory to be considered as one of the pillars of the NTP.(4) However to be fully functional, a laboratory service requires that laboratory commodities are available as needed. These commodities include equipment and supplies, such as laboratory reagents, diagnostic kits and other consumables.(5)

Studies from Ghana, India, Kinshasa and Uganda has shown that the laboratory services was the weakest component of the TB programme because of poor smear preparation, poor staining technique, poor documentation of smear results, lack of feedback from the NTP and poor availability of laboratory reagents and supplies (6-10) In addition some directly observed treatment short course (DOTS) laboratories in Ghana, Uganda and Iran were found to be in a deplorable and deteriorating conditions and laboratory hygiene requirements were poor.(6,10,11)

The Lagos State TB and Leprosy control programme (LSTBLCP) commenced in 2003 with the collaboration between the State Government, International Union against TB and Lung Diseases (IUATLD), World Health Organization (WHO), Canadian International Development. At the end of 2012, there were 218 DOTS centers and 55 microscopy centers in both the public and private DOTS facilities. One of the challenges of the LSTBLCP was the shortage of DOTS laboratories and personnel.(12) Given the important role laboratories play in the TB control programme, it is necessary to assess their functionality, therefore, this study compared the availability of laboratory equipment and other consumables for making diagnosis of TB and the laboratory hygiene requirements available at the public and private DOTS laboratories.

METHODS

Study Setting

Lagos State is located in South west Nigeria and it is the commercial nerve centre of the country. There are 20 Local Government Areas (LGAs), and 37 Local Council Development Area (LCDAs) in the state. A report showed that the current population of Lagos State is about 21 million.(13) DOTS laboratories could either be located in a DOTS facility or serve only as microscopy center where only smear microscopy is done. However not all DOTS center have a laboratory. TB patients managed in a DOTS facility without a laboratory were usually referred to the nearest DOTS laboratory for smear microscopy. Each DOTS facility is expected to have a list of the microscopy centers under the LSTBLCP. The Lagos State TB and Leprosy Control Programme supplies reagents and consumables for sputum AFB freely to microscopy centers under the programme.

Study design

A descriptive comparative cross sectional study was conducted to assess the availability of laboratory equipment and other consumables for laboratory diagnosis of TB in Lagos State between September 2011 and October 2012. A sampling frame of DOTS facilities provided by the Lagos State programme officer was used to select, 34 DOTS centers that were involved in the DOTS programme for at least 2 years using the systematic random sampling technique. All the seventeen DOTS laboratories in the selected DOTs facilities and all consenting laboratory scientists/ technicians working in the selected laboratories were recruited into the study.

A structured pretested questionnaire and a check list were used to obtain data. The questionnaire was administered on all consenting laboratory scientists/technicians working in the selected DOTS laboratories. It was used to collect data on knowledge of the staining method used in the laboratory identification of mycobacterium tuberculosis and knowledge of safety measures. A

check list was used to assess the availability of consumables and medical supplies in the laboratories and also the laboratory hygiene requirements put in place to protect the health workers working in the laboratory from TB infection.

Evaluation of the knowledge of laboratory scientists/technicians

A scale was formed from 20 questions assessing the knowledge of TB diagnosis and safety measures. Each correct answer to each question was scored 1 mark while each wrong answer was scored zero. Using the criteria established in a study conducted in Lagos among nurses,(14) laboratory scientist/technician who obtained scores of less than 50% were classified as having "Poor" knowledge, those who obtained scores of 50% - 74.9% were classified as having "Fair" knowledge while those whose scores were 75% and above were classified as having "Good" knowledge.

Ethical clearance was obtained from the health research and ethics committee of the Lagos State University Teaching Hospital. In addition permission was obtained from the Commissioner for Health of Lagos state to collect data from the DOTS facilities. Written consent was obtained from the respondents before administration of questionnaires.

Data analysis

Data was entered and analysis was done using the Statistical Package for Social Sciences (SPSS) version 19. Mean and standard deviation of numerical variables were determined while percentages of numerical and categorical data were determined. Chi square and Fisher's exact test were used to compare categorical variables where applicable. The confidence interval was set at 95% for the statistical tests.

RESULTS

Seventeen DOTS laboratories (11 public and 6 private) and 34 laboratory scientists/technicians (21 public and 13 private) were recruited for this study. Table 1 shows the laboratory equipment and consumables available at the public and private DOTs laboratories at the time of assessment. Although all the DOTS laboratories studied had functional microscopes, about three quarters and two thirds of the public and private DOTS laboratories respectively had reagents (carbol fuschin, acid alcohol and methelene blue) for smear microscopy.

Table 1: Laboratory equipment and consumables available at DOTS laboratories

Laboratory equipment and consumables available	DOTS laboratories		χ2	p
	Public n = 11(%)	Private n = 6 (%)		
Binoculars Microscope	10 (90.9)	6 (100.0)	0.58	1.000[x]
Flourescent Microscope	1 (9.1)	0 (90.0)		
New Slides	4 (36.3)	4 (66.7)	1.43	0.3348[x]
Sputum containers	11 (100.0)	4 (66.7)	4.16	0.0415[x]
Carbol fushin	8 (72.7)	4 (66.7)	0.07	1.000[x]
Acid alcohol	8 (72.7)	4 (66.7)	0.07	1.007[x]
Methylene blue	8 (72.7)	4 (66.7)	0.07	1.007[x]
Immersion oil	7 (63.6)	4 (66.7)	0.02	1.000[x]
Cotton wool	8 (72.7)	6 (100.0)	1.99	0.5417[x]
Spirit lamps	10 (90.9)	6 (100.0)	0.58	1.000[x]
Water	8 (72.7)	6 (100.0)	1.99	0.5147[x]
Wooden rack	8 (72.7)	5 (83.3)	0.24	1.000[x]
Request form	9 (77.8)	4 (83.3)	0.50	0.5840[x]
Labeling materials	11 (100.0)	5 (83.3)	1.95	0.3529[x]
NTP lab register	11 (100.0)	5 (83.3)	1.95	0.3529[x]

Note: x = Fisher's Exact test

A higher proportion of the private DOTS laboratories (66.7%) compared with 36.3% of the public DOTS laboratories had new slides (p = 0.3348). About 83% of the private DOTS laboratories had labeling materials for the sputum cups. A significantly lower proportion of the private DOTS laboratories (66.7%) had sputum containers (p = 0.0415)

A significantly higher proportion of the public DOTS laboratories had a separate area for TB work and separate table for smear preparation (p <0.05). Less than half of the public and private DOTS laboratories decontaminated sputum cups before disposal. About 73% of the public and 67% of the private DOTS laboratories had waste bin with covers as shown in Table 2.

The majority of the laboratory scientists/technicians at the public and private DOTS laboratories were between 35 and 44 years. The mean age of the public laboratories scientists/technicians were significantly higher (39.0 ± 3.8 years) than those of the private laboratories (35.5 ± 5.2 years). A significantly higher proportion (76.9%) of the laboratory scientists/technicians at the private DOTS laboratories had no previous training (p < 0.05) as shown in Table 3

Table 4 shows that a higher proportion of the laboratory scientists/ technicians at the public DOTS laboratories had correct knowledge of the quickest diagnostic method for TB, number of sputum specimen required to make the diagnosis of TB, the mode of sputum collection for AFB, the uses of smear microscopy, the staining methods for AFB and the most appropriate place for the collection of sputum for AFB. About 14% of the laboratory scientists/technicians at the public and none at the private DOTS laboratories were aware that sputum container should be decontaminated before disposal. Table 5 shows that a higher proportion (71.4%) of the laboratory scientist/ technicians at the public compared with 38.5% of those at the private DOTS laboratories had good knowledge of the laboratory diagnosis of TB and disposal of sputa (p > 0.05).

TABLE LABORATORY HYGIENE REQUIREMENTS AVAILABLE AT DOTS LABORATORIES

Available laboratory hygiene	DOTS laboratories Public n=11 (%)	Private n = 6 (%)	χ^2	p
Separate area for TB work	10 (90.9)	2 (33.3)	6.20	0.028[x]
Separate table for smear preparation	11 (100.0)	1 (16.7)	12.99	<0.001[x]
Smear preparation done with the window opened	8 (72.7)	5 (83.5)	0.24	1.000[x]
Airflow in opposite direction to where smearing is performed	3 (27.3)	2 (33.3)	0.07	1.000[x]
Decontamination of used slides	0 (0.0)	1 (16.7)	1.95	0.3529[x]
Decontaminate used sputum cups	5 (45.5)	2 (33.3)	0.24	1.000[x]
Wearing of lab coats in the lab	11 (100.0)	1 (16.7)	12.99	0.0009[x]
Availability of Disinfectants	10 (90.9)	6 (100.0)	0.58	1.000[x]
Cleaning of work area after smearing	10 (90.9)	5 (83.3)	0.21	1.000[x]
Availability of waste bin with cover	8 (72.7)	4 (66.7)	0.07	1.000[x]

Key [x] Fisher's exact 2:

TABLE 3: SOCIO DEMOGRAPHIC CHARACTERISTICS OF LABORATORY PERSONNEL AT DOTS LABORATORIES

Variable	DOTS laboratories			
	Public n = 21 (%)	Private n = 13 (%)	χ^2	p
Age group				
<40	15 (71.4)	11 (74.6)	0.78	0.4438[x]
40 years and above	6 (28.6)	2 (15.4)		
Mean age	39.0 ± 3.8	35.5 ± 5.2		
Gender				
Male	4 (19.0)	6 (46.2)	2.84	0.1297[x]
Female	17 (81.0)	7 (53.8)		
Cadre				
Laboratory scientist	11(52.4)	4 (30.8)	1.52	0.2174
Laboratory technician	10 (47.6)	9 (69.2)		
Had previous training				
Yes	16 (76.2)	3 (23.1)	9.19	0.002
No	5 (23.8)	10 (76.9)		

Note: [x] = Fisher's exact

TABLE 4: KNOWLEDGE OF LABORATORY SCIENTISTS/TECHNICIANS ON THE LABORATORY DIAGNOSIS OF TB AND DISPOSAL OF SPUTA

Knowledge Parameters	DOTS laboratories			
	Public n = 21 (%)	Private n = 13 (%)	χ^2	p
Fastest diagnostic method for TB				
Wrong response	2 (9.5)	5 (38.5)	4.11	0.057[x]
Microscopy (c)	19 (90.5)	8 (61.5)		
Number of sputum specimens required to make diagnosis of TB				
Wrong response	0 (0.0)	1 (7.7)	1.66	0.3825[x]
Two or three (c)	21 (100.0)	12 (92.3)		
Sputum collection schedule				
Wrong response	8 (38.1)	7 (53.8)	0.81	0.3687
SMS or SM (c)	13 (61.9)	6 (46.2)		
Uses of microscopic diagnosis in TB management				
Wrong response	3 (14.3)	2 (15.4)	0.01	1.000[x]
Diagnosis and follow up (c)	18 (85.7)	11 (84.6)		
Method for Staining				
Wrong response	0 (0.0)	1 (7.7)	1.60	0.3825[x]
ZN or AS	21 (100.0)	12 (92.3)		
Best area for sputum collection				
Wrong response	4 (19.0)	4 (30.8)	0.61	0.6795[x]
Open air (c)	17(81.0)	9 (69.2)		
Best disposal method for sputum containers				
Wrong response	18 (85.7)	13 (100.0)	2.04	0.2701 [x]
Burning after Disinfection (c)	3 (14.3)	0 (0.0)		

Foot Note: [x] = Fisher's Exact, C = correct, ZN = Ziehl Neelson, AS = Auramine Stain, SMS = Spot Morning Spot, SM = Spot Morning

TABLE 5: KNOWLEDGE OF LABORATORY SCIENTISTS/TECHNICIANS ON LABORATORY DIAGNOSIS OF TB AND DISPOSAL OF SPUTA

Variable	Laboratory scientist/personnel		x2	p
	Public DOTS n = 21 (%)	Private DOTS n = 13 (%)		
Good Knowledge	15 (71.4)	5 (38.5)	3.60	0.057
Fair knowledge	6 (28.6)	8 (61.5)		

DISCUSSION

Assessment of laboratories in the selected DOTS facilities showed that about a third of the laboratories assessed lacked reagents and slides for performing smear microscopy. In addition cotton wool, staining rack, spirit lamps and water were not available in a third of the public DOTS laboratories at the time of assessment. Although the LSTBLCP supplies the DOTS laboratories with reagents, proper coordination and consistency in the supply of these reagents cannot be ascertained. This could lead to the inability of some TB patients to do sputum test in some of the DOTS laboratories which may result in the spread of TB in the community and also deterioration in the health condition of undiagnosed TB patients. A study showed that TB laboratory services was the weakest component of the TB control strategy in Ghana.(6) Shortages of reagents and faulty microscopes in DOTS laboratories have also been reported in Ghana and India(7,8) which consequently had a negative effect on the quality of sputum microscopy.(8) In order to achieve the global targets of 85% cure rate,(15) a lot has to be put in place to make laboratory services functional and efficient.

This study showed that there were poor laboratory hygiene requirements at the public and private DOTS laboratories. Although the private DOTS laboratories were allowed to charge a token fee as service charge because reagents and consumables for sputum AFB are freely supplied to these facilities by the LSTBLCP, they may however compromise in provisions of the hygiene requirement in the laboratory in order to recover cost because they are profit driven. In addition poor funding of the health sector may also contribute to the poor laboratory hygiene practices observed in the public DOTS laboratories.

A higher proportion of the laboratory scientist/ technicians in the public DOTS laboratories assessed had good knowledge on the laboratory diagnosis of TB and disposal of sputa. Previous training by the LSTBLCP may be responsible for this finding. This study demonstrated that a significantly higher proportion of the laboratory scientists/technicians at public DOTS laboratories assessed had previous training compared with 23.1% of those at the private DOTS laboratories (p =0.002).

Limitations of study

This study was part of a study that assessed the tuberculosis management in public and private facilities providing DOTS treatment in Lagos state. The small number of the DOTS laboratories and laboratory scientist/technicians studied is a limitation. This was due to financial challenges. A large scale study assessing the laboratory services of the LSTBLCP in Lagos state is recommended.

Conclusion

There was suboptimal availability of laboratory reagents and consumables for making the diagnosis of TB and poor laboratory hygiene practices in both the public and private DOTS laboratories. The need to increase supplies of reagents and consumables for making the diagnosis of TB in Lagos State

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