

Not all microscopes are equal

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SUMMARY

A functional microscope is the most important and most expensive piece of equipment required for smear microscopy. Global Fund monies have provided a unique opportunity to equip laboratories in low-resource countries, but these funds must be spent wisely. Cheap microscopes are superficially appealing. However, higher-quality microscopes generally have better optics and last longer.

International agencies should consider establishing a purchasing service to assist countries in their microscope procurement. Such a system would provide quality assurance and increased purchasing power.

KEY WORDS: tuberculosis; microscope; microscopy; quality

DIAGNOSIS provided by a quality-assured sputum smear microscopy service is one of the elements of the DOTS strategy for tuberculosis (TB) control.¹ A functional microscope is the most important and expensive piece of equipment required for smear microscopy. Furthermore, laboratories in many low-income high-burden countries may have to use the same microscope for at least a decade. The Global Fund for AIDS, TB and Malaria (GFATM) has approved unprecedented funding of over US\$7 billion for TB control to 78 countries.² A common theme in over 90% of the funded projects for which information is available has been the strengthening of laboratory infrastructure. GFATM monies have enabled many countries with a high TB burden to purchase the microscopes sorely needed by their National TB Control Programmes (NTPs). Purchasing microscopes is an attractive option for GFATM funding, which requires rigorous reporting against performance indicators. However, there is an emphasis on quantity and no direct measure of the quality of microscopes purchased with GFATM funding.

AIM

Unfortunately, there are many poor quality microscopes out in the market place. The authors have witnessed the potential pitfalls in microscope procurement while reviewing TB services in countries around the globe, and offer the following personal observations to assist NTPs in their deliberations when ordering new microscopes.

DISCUSSION

Quality costs money! Cheap microscopes are superficially appealing because they allow programmes to provide more microscopes to more laboratories. NTPs, their governments and donors must accept that a quality microscope is more expensive. While spending more does not necessarily guarantee high quality, spending less almost always guarantees inferior quality. Inferior quality optics compromise a technician's ability to read paucibacillary slides because much of the field of view is not in focus. Poor build quality creates gaps between components, allowing fungus or dust infiltration, further degrading the field of view. The mechanical stage and the coarse/fine adjustment may be stiff or erratic in movement, and pinion racks wear all too quickly. Premature breakdown of the stage sliding mechanisms, slide holding clip or electrical components such as the on/off switch, fuses and transformers are other common weaknesses in these microscopes. Plastic condensers and eyepiece lenses are scratched more easily, and will be damaged irreparably when cleaned with xylol, which is continuously misused by many laboratory services. Microscopes purchased for low-income countries need to have glass lenses. At the same time, NTPs must strive to re-educate laboratory technicians about more appropriate lens-cleaning practices.

Although reputable manufacturers offer a wide range of quality products, some produce bottom-priced microscopes that are inferior and unsuitable for sputum microscopy. Some companies based in several

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Western countries also assemble microscopes from inferior components sourced from other countries. Disturbingly, there are reports of cheap, inferior quality microscopes being branded as high quality products, although an expert will quickly recognise such fakes. Procurement departments must evaluate demonstration models for optical quality, brightness and smooth mechanical operations. Assessment of weight may suggest that plastic components were used for essential parts—cost cutting at the expense of long-term function. A microscope used for sputum microscopy needs good quality optics (especially the 100 × immersion objective, preferably plan [flat-field] corrected), a good light source and a mechanical stage. Although less favoured, monocular microscopes may perform better with natural light and be preferable for small centres in remote areas with a low workload.

Procurement departments are also encouraged to purchase microscopes in bulk from one manufacturer. Multiple examples have been noted where laboratories have received two new microscopes from different manufacturers within a 12-month period. Universally, the higher-quality microscope was preferred, and the lower-quality brand degraded in a cupboard. Unused microscopes should be kept in a permanently air-conditioned store or in their original hermetically-sealed packing containing a drying agent. Procurement of different brands also does not allow laboratories to ‘cannibalise’ parts from one microscope to keep another functional.

A sufficient stock of consumables and replacement parts is necessary. Essential consumables include spare bulbs, fuses and immersion oil, and they should be available at any microscopy centre. Replacement parts include 100 × lenses, eyepieces, binocular heads and slide holding clips. For replacement parts to be utilised most effectively, the NTP should establish a simple repairs or ordering system operating through their laboratory network. Laboratory staff and TB District Officers must also be trained to recognise damaged microscopes promptly.

The authors have recognised another problem bedevilling TB microscopy in several countries: poor quality immersion oil (IO) compromises the performance of the optics. Organic oils in cedar oil evapo-

rate, leaving residues that require excessive force to clean the lens, which results in long-term damage. Alternatively, using thick oils diluted with xylol damages the cement holding the lenses in place, resulting in penetration of oil to the inside of the lens and a hazy view. Such oils are recognised by their strong aromatic smell or yellowish colour. In contrast, good microscopy oil is clear and has a faint smell of machine oil. Other oils such as liquid paraffin do not have the required refractory index (RI) above 1.5. If a clear glass rod placed in the oil bottle ‘disappears’, then the IO is likely to have the correct RI for microscopy.³ The success of reference laboratories in several countries in preparing and distributing quality reagents for sputum microscopy demonstrates that such systems work and could be extended to include the packaging and distribution of quality IO.

CONCLUSIONS

Procurement departments need to collaborate with their national and provincial laboratories to identify the optimal microscope package for their setting. The short-term cost savings provided by low-quality microscopes must be balanced against the long-term benefits in investing in high-quality microscopes. International agencies and non-government organisations should also consider establishing a purchasing service (as has been established for drug supplies with the Global Drug Facility) to assist countries in their microscope procurement. Such a system would have the dual advantage of quality assurance and increased purchasing power, leading to reduced costs for individual NTPs. The influx of GFATM money provides a unique opportunity to meet the long-term equipment needs of TB laboratory services in low-resource countries. Let’s get it right.

References

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- 2 Global Fund Against Aids, Tuberculosis and Malaria (GFATM). www.theglobalfund.org/en/ Accessed June 2005.
- 3 World Health Organization. The microscope; a practical guide. SEA/BME/2. New Delhi, India: WHO, 1999.

RÉSUMÉ

Un microscope en état de fonctionnement est la pièce d’équipement la plus importante et la plus coûteuse nécessaire pour l’examen microscopique des frottis. L’argent du Fonds Mondial de lutte contre le SIDA, la tuberculose et le paludisme a fourni une occasion unique d’équiper les laboratoires dans les pays à faibles ressources, mais ces fonds doivent être dépensés avec sagesse.

Les microscopes bon marché sont attirants à première vue. Toutefois, les microscopes de plus haute qualité ont généralement de meilleures optiques et durent plus longtemps. Les agences internationales devraient envisager d’organiser un service d’achat pour aider les pays à se procurer leurs microscopes. Un tel système pourrait assurer une garantie de qualité et un pouvoir d’achat accru.

RESUMEN

Un microscopio en buen estado de funcionamiento es la pieza más importante y más costosa del equipamiento necesario para la práctica de la baciloscopia. Los dineros del Fondo Mundial de lucha contra el SIDA, la tuberculosis y la malaria han proporcionado una oportunidad excepcional para equipar los laboratorios de países con escasos recursos, pero estos fondos deben invertirse en forma racional. Los microscopios de bajo costo son

atractivos a primera vista ; sin embargo, en términos generales los microscopios de mejor calidad poseen mejores sistemas ópticos y tienen una vida útil más prolongada. Los organismos internacionales deberían examinar la posibilidad de establecer un servicio de compra a fin de colaborar con los países en la adquisición de sus microscopios. Tal sistema proporcionaría una garantía de calidad y aumentaría el poder adquisitivo.
