

# FROM THE MAINTENANCE WORKER TO THE BIOMEDICAL OPERATOR

for optimal use of all the medical equipment

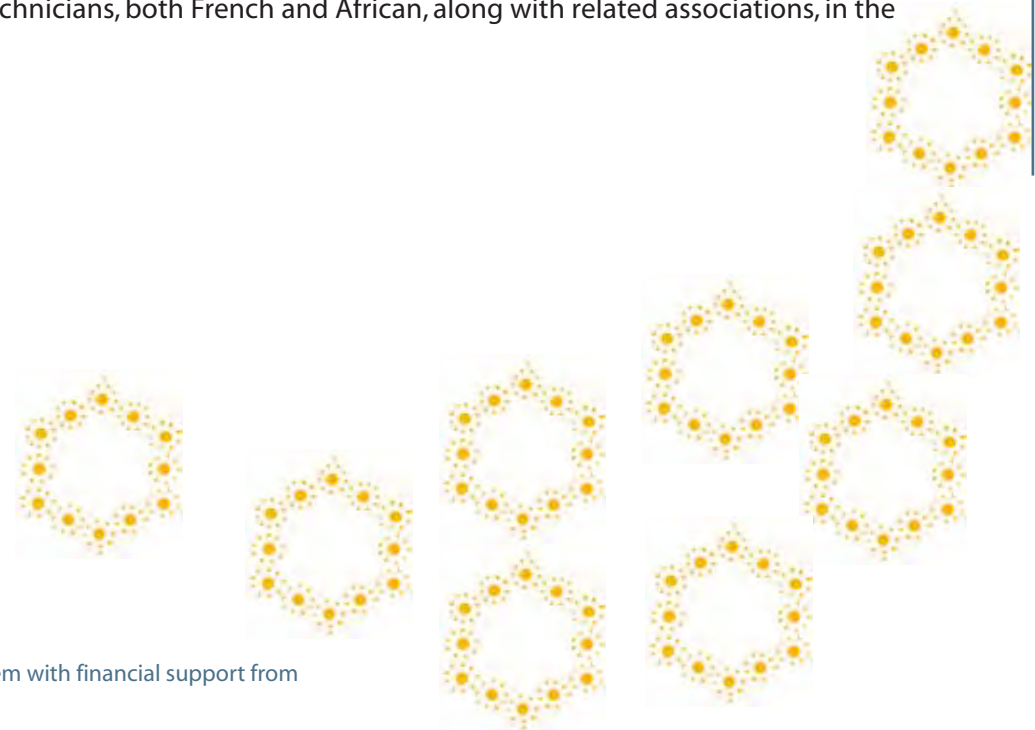


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The increasing sophistication of medical equipment and the introduction of new technologies in healthcare services render it necessary to have internal human resources who are able to choose the appropriate equipment, to install, operate and maintain it all, as well as train its users. The specialist skills exist and are those of biomedical engineers and technicians. However, following a study carried out in Francophone African countries by the Association for the Promotion of Hospital Biomedical Engineers (APIBH), 73% of biomedical personnel or those carrying out similar tasks, feel they do not receive enough recognition and 81% of the administrative staff of health facilities feel that they do not know enough about these new professions.

This document aims, therefore, to provide those carrying out biomedical tasks with more information about their special sphere of skills, and what they are able to bring to African hospitals. It also provides arguments to convince administrative leaders and policy makers of the important sums for which there should be provision in the budget for maintenance of each facility, in order to ensure the reliability and longevity of the medical equipment. This study was carried out at the request of APIBH by biomedical engineers and technicians, both French and African, along with related associations, in the context of a working group\* managed by Humatem (France).



\* Working group called "Medical Devices in the Actions of International Cooperation" run by Humatem with financial support from the Rhone-Alpes region.



# Let's talk about biomedical human resources...

There are two parts to the biomedical operator's (engineer or technician) job:

## Definition and organisation

- Advise on the investment policy
- Participate in the acquisition process
- Draw up maintenance policies
- Organise maintenance

## Execution

- Installation of new devices (both purchased and donated)
- Maintenance of existing equipment
- Carry out training and follow-up
- Liaison between medical teams, suppliers and administration

In each hospital, the distribution of medical activities between engineers and technicians is influenced by:

- the structure of the health facility
- the technical resources available
- the human resources employed
- the strategy and medical mission of the facility

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## Be careful, there can be confusion!

The biomedical technician is sometimes confused, wrongly, with the biomedical analysis technician, traditionally called laboratory assistant, who carries out analyses in a laboratory to screen for illnesses, diagnose or monitor the treatment of a disease. And yet, the biomedical field is a real profession, of which the skills required include, in a hospital setting, the maintenance and management of all the medical equipment.

« Here in Africa, the biomedical operator is still often referred to as the maintenance man. But it is a simplistic term because it only refers to the operational side, whereas the skills of biomedical personnel go way beyond just using a screw driver! »

## The role of biomedical personnel

### Biomedical technician

- Takes delivery of technical apparatus and carries out the installation of new equipment (both purchased and donated)
- Carries out quality control of the equipment
- Participates in the provision of training for user staff
- Participates in the design and monitoring of maintenance planning
- Carries out preventive and corrective maintenance\*
- Ensures traceability of maintenance work
- Prepares orders of accessories and spare parts, stock management
- Monitors and up-dates the inventory of all equipment
- Helps to identify possible risks in order to ensure the safety of patients and staff

> **The on-site operator of the facility's maintenance policy**

### Biomedical engineer

- Provides the expertise and structure of the investment policy
- Supports the procurement process (purchases, donations, refits, etc.)
- Draws up technical specifications
- Supervises the team of biomedical technicians
- Designs training courses
- Organises and manages the service
- Defines and monitors implementation of the maintenance policy
- Executes and monitors the maintenance schedule
- Keeps up with technology and regulations
- Monitors risks (risk analysis\* and management of incidents)
- Manages equipment updates

> **Liaises with the management team, as well as the medical and paramedical team, suppliers and other service providers**

▶ **The biomedical team comprises engineers and technicians. Their duties are largely complementary and they work together on a daily basis.**

“ Ever since the hospital acquired its own biomedical maintenance service, there have been far less breakdowns and problems around managing all the equipment. ”



\* See Glossary



# Financial Value of a biomedical strategy

## Working towards better cost management...

Choosing to include biomedical skills makes it possible to optimise the management of all your medical equipment.

### Improve procurement

- Better definition of medical requirements (close collaboration with the medical teams to define priorities)
- Optimisation of the quality/cost ratio of investments by better management of selection criteria (features, maintenance contracts, etc.), on-site experience and contact with professional network
- Reduction in the time required for new equipment to be operational (training of user staff and coordination with the suppliers)
- Efficient management of the purchase of spare parts and accessories

### Improve maintenance

- Reduce the number of breakdowns due to incorrect use, and thus reduce cost of repairs
- Reduce the amount of time essential medical equipment is non-operational
- Thanks to the ability and rapidity of diagnosis and action by the biomedical team, reduce the expenses incurred by frequently having to call on external service providers
- Increase the life of equipment

- ▶ **Reduction in the frequency with which medical equipment needs to be renewed**
- ▶ **Reduction in operating costs**
- ▶ **Optimal returns on medical equipment**

“The Director of the hospital called on my team to install a newly acquired suction device for the surgical unit. I noticed that this suction device was not intended for use in a surgical unit. As it had already been paid for, the Director asked me which service could use it. A pity he didn't ask me before he bought it...”

“The hospital's Yag laser machine, worth €18,000, had a problem with impact calibration. Assistance by a service provider abroad only took 5 minutes but cost €800 in call-out costs. Had the facility had a biomedical operator it wouldn't have cost anything at all, and the user, advised by the biomedical employee, could have carried out the straight forward adjustment on their own.”

“Without carrying out a diagnosis, a service provider drew up an estimate for repairs which was twice the purchase price of the equipment. The estimate was accepted because no-one had asked the biomedical operator to monitor the provision of external services.”

### More suitable donations

The biomedical operator is also the main contact for donation partners whom he briefs on the real requirements of the health facility. He is the technical referee. Able and exacting, he will know how to obtain functional devices and refuse inappropriate donations.

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Focus on what is never assessed...

Example: A Medical Imaging developer

**Without maintenance...**

**the device inevitably requires readjustment at the end of a year's guarantee:**

- increase in the use of development products (up to 2 litres/day): loss of €3,500/year
- increase in water used
- increase in the use of X-ray film (linked to the poor drying quality of the film which causes a poor quality image): loss of €5,000/year
- unusually early deterioration of the device which lasts 1 year instead of 5: loss of €12,000.

**10 images taken for just one that is any good, is also:**

- unusually early deterioration in the tube of the X-Ray machine
- a risk of too high a rate of irradiation for patients and staff
- de-motivated employees
- the hospital gets a bad reputation.

**With maintenance,**

**the device remains calibrated and operational**

- 1 maintenance kit/year: €150
- one half day's work for a trained biomedical technician

« In the hospital, biomedical work is often seen, wrongly, to be a cost centre. And yet, it isn't an investment without returns! Savings can be considerable even if it's always difficult to put a figure on financial losses or the loss of earnings relating to an unfortunate event that has been avoided. »

Example: a scanner

Initial hypothesis:

- 20 scans a day: annual profit of €640,000
- Scanner tube to be changed about every 3 years depending on the manufacturer's data: €20,000 + €3,500 manufacturer's labour costs
- Delivery time for the tube following the order: 90 days

**With no biomedical staff**

Average time the machine is out of order following:  
a tube breakdown: 110 days

**Average loss of earnings every 3 years: €220,000**

**With biomedical staff**

Regular technical assessment makes it possible to:

- Forecast expiry of the tube
- Anticipate the order for a new tube
- Plan the conditional maintenance \*
- Reduce the machine's down time (7 days)

**Average loss of earnings every 3 years, which is inevitable and inherent in the deterioration of the device: €14,000**



\* See Glossary

# For major savings... a small investment in the biomedical field

Like all medical services, biomedical personnel insist on working in the best possible conditions and ensuring their work is effective.

## Some provision needs to be made for the development of a biomedical activity

- One or more salaries (depending on the size of the team)
- Investment and a location to set up a workshop
- An operational budget
- A training budget

« The biomedical service is rather like insurance. One has to take it out because, for the Director, safety and serenity at the hospital are priceless. »

« The fundamental question regarding maintenance is: do it in-house or have someone from outside do it? The biomedical personnel hold all the cards regarding the best strategy and making the right choice. »

« The biomedical service cannot resolve all the problems, but will make it possible to ask the right questions. »

► It is when drawing up the specifications prior to purchasing medical equipment that the level of autonomy that the facility wishes to have regarding maintenance should be considered, whilst at the same time taking account of the supplier's recommendations.

## Different measures depending on the aims of the establishment

### The basic measures... which resolve up to 70% of breakdowns

- Tools (pincers, keys, screwdrivers, hardware, etc.)
- Measuring tools (multi-metre, T° probe, pressure gauge, etc.)
- A room with work benches, shelves for storage and electrical components
- A stock of supplies (cables, light bulbs, batteries, etc.) and spare parts
- A computer and a means of communication (tools to keep up with technological innovations and regulations)

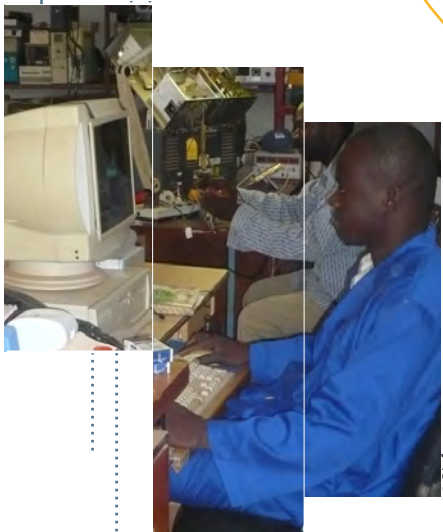
- > These basic measures allow the biomedical personnel to fix most breakdowns, because most of them are due to incorrect handling.
- > Recourse to external companies (service providers, suppliers) remains necessary for quality control\* and to resolve more complicated breakdowns diagnosed by the biomedical personnel.

### Additional measures... to increase autonomy with regard to suppliers.

When a solid foundation has been established it becomes possible to broaden the field of action of the biomedical workshop by investing progressively in testing equipment and training courses.

Each category of medical equipment has its specific testing tool: testers for electrical safety, a syringe plunger, sphygmomanometer, defibrillator, diathermy knives, oxygen analysis and respirators, control of haemodialysis generator, etc. (from €400 to €10,000 each plus 10 to 15% of their value should be budgeted for their annual calibration.)

\* See Glossary







# Impact on the improvement in the quality of healthcare

## Better care...

When there is a biomedical team:

- since the equipment is checked regularly, a number of serious breakdowns are avoided
- the safety norms are respected
- with the setting up, internally, of a system of risk analysis and management of incidents, the facility is covered by legal guarantees should a problem occur
- the hospital could envisage acquiring a more efficient technical platform thereby broadening its scope of diagnosis and healthcare

## ► Higher quality treatment and the patient risk is reduced.

« A dental chair could not be used for eight months supposedly because of a lack of funds. In fact, all that it needed was for the motor to be repaired (€40). When the use of this same chair brings in €40 or more, and when you calculate the number of patients who could have been treated during this long period of inactivity, you realise that it is an enormous loss of income for the hospital. »

« Neglecting maintenance can have serious consequences for our patients and our staff and raises the question of the civil liability of the hospital. »

« The quality of care partly depends on the quality of the technical platform. A good technical platform depends on those who buy the devices, the commitment of those who use them, the skills and the means of those who maintain them. »

« In this clinic there are very very good beds. One would like to be ill just to sleep in them! But in the operating unit, the scialytique is broken and since there is no biomedical personnel, it is lit by a storm lamp! »

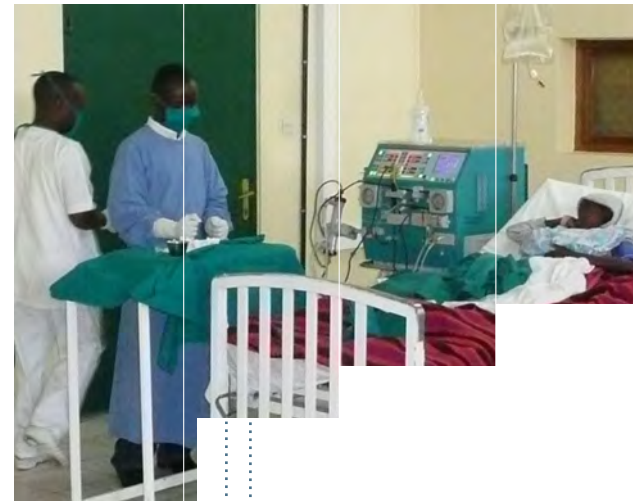
## Permanent access to healthcare...

Less breakdowns means more patients treated.

And when they are inevitable, breakdowns are managed quickly thanks to the presence of qualified biomedical staff.

- > Instruments immobilised for less time.
- > Satisfied patients because they wait less!

## ► Ensuring the quality of treatment gives the health facility credibility and a good reputation



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# Where to find these skills?

## Ideal career path

### Biomedical technician

Technical pre-requisites  
(Baccalaureate or baccalaureate + 2)  
+ wide variety of technical skills, rigour and teaching skills  
+  
One or two years' specialist training in biomedical techniques from 1 to 2 years  
+  
On-site experience in a hospital environment  
+  
Continuous training throughout professional career (specific training on instruments, generally provided by suppliers)

### Biomedical engineer

Engineering degree, Master's or equivalent (Baccalaureate + 4 at least)  
+ logistics, management and negotiation skills  
+  
Experience of field work (internships)  
+  
One or two years' specialist training in biomedical engineering (Baccalaureate + 5)  
+  
Continuous training throughout professional career (management of hospital projects, invitations to tender, participating in conferences)

## Internal restructuring: a very motivating solution for staff

Electricians, electronics engineers, electrical engineers or others, who are motivated and with strong potential, can progress towards biomedical posts by means of additional training courses, but this requires expenditure. Depending on the status of the person concerned, the context and the type of training required, the funds could be obtained from:

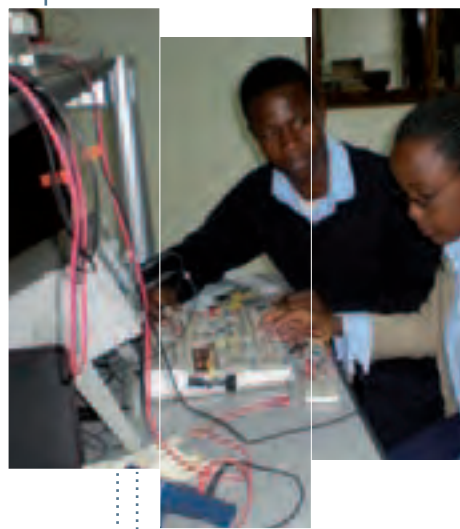
- within the facility
- from the Ministry of Health
- from an NGO or other international aid programmes

## Sharing skills: an interesting option to investigate

The post of inter-facility technician or medical engineer could be created with the following advantages:

- sharing the salary, investment and training costs
- more weight in negotiations with suppliers thanks to grouped procurement
- considerable savings in time and money

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In view of the evolution of medical technologies, continuous training is essential. It allows people to update their knowledge and skills. Today, only a few biomedical or similar training courses are available on the African continent, but programmes are being created or strengthened. You are advised to contact the appropriate authorities to find out about the training organisations, course content and quality of the courses on offer.

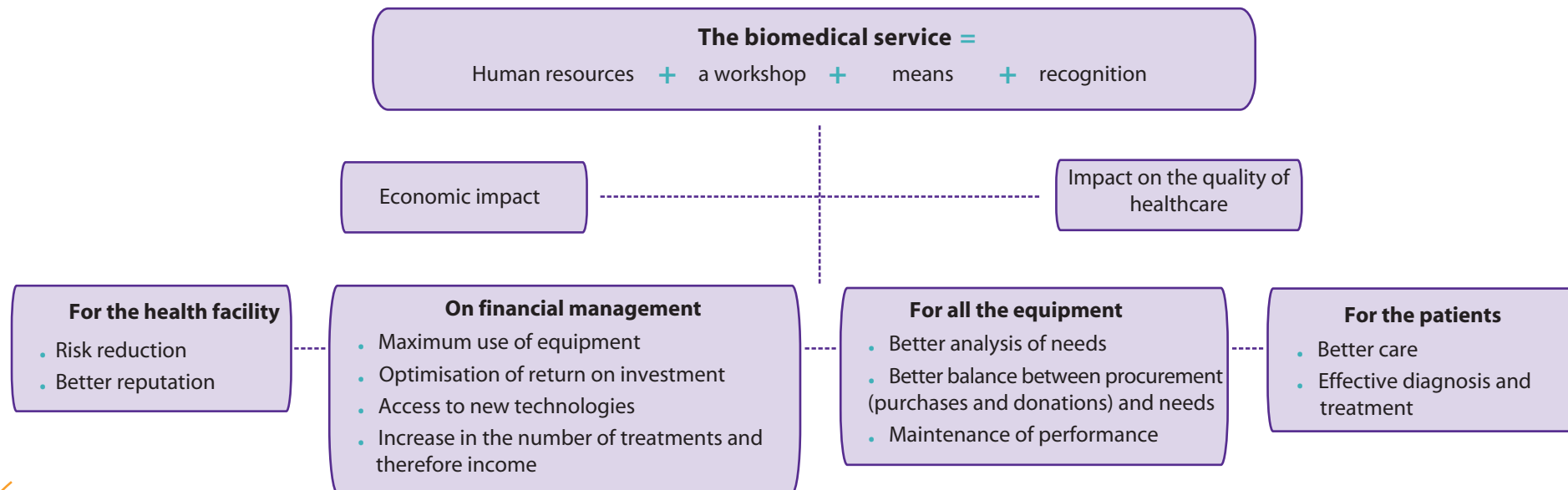
### Training on the devices must be part of the negotiations with the supplier when the equipment is acquired!

For simple equipment, the biomedical technician should take the technical training course and be trained in the use of the device. He will thus become a reference and in turn will be able to train users should there be staff changes or refresher courses.

« Maintenance is everyone's pet hate in the hospital. One forgets that each machine has its own characteristics and, just like a doctor who is a specialist, a technician also needs to be trained to better understand the different breakdowns. However, technician's training is often left to one side in favour of that of the user... »



Nowadays, biomedical personnel are essential colleagues in health facilities. They contribute to the good reputation of the establishment, support modernity and are key players in the profitability of all the medical equipment. As a cornerstone of the medical team, they ensure the reliability of the devices the team needs for carrying out diagnoses and dispensing quality care.

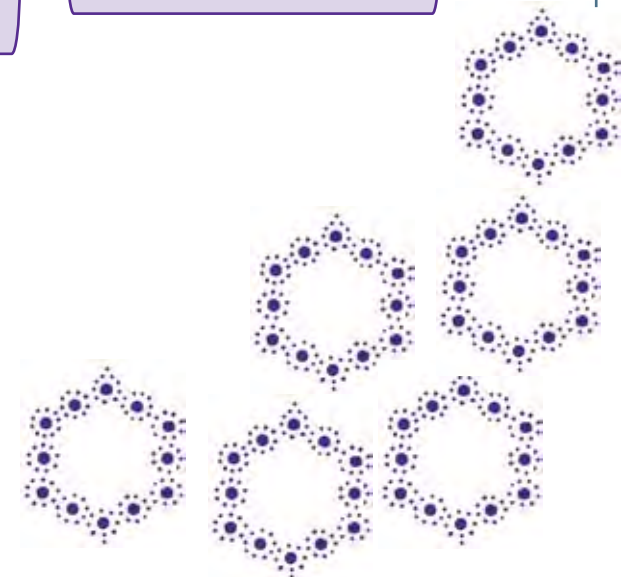


« Today, health programmes in Africa are being reformed. It's the right moment to seize the opportunity and obtain from our Ministries the means necessary for the creation of biomedical services in hospitals, all the more so because this type of service is one of the conditions required by donors and international aid organisations. »

« All over the world these new professions are being developed, schools are opening and the profession is getting organised. We should jump on the bandwagon to avoid being left behind... »

### It's not enough to have biomedical staff!

There also needs to be a sufficient margin for manoeuvre for them to be able to function. Their role will depend on the trust and resources granted by their direct hierarchical superior, ideally the Director of the establishment.





# Glossary

## Monitoring technology

This is looking towards the future, seeing and analysing advances in technology, new equipment, trends and perspectives in the biomedical field.

## Quality control

Quality control of a medical device is defined as encompassing all the actions required to assess and maintain its operation.

## Preventive maintenance

Preventive maintenance means planned action to reduce the risk of a breakdown of medical equipment and to maintain it in maximum working order.

## Corrective maintenance

Corrective maintenance means action following a breakdown which is intended to make the medical equipment work for a long time (as opposed to just fixing it and only providing a temporary solution).

## Conditional maintenance

Conditional maintenance means planned action carried out prior to a breakdown (ex: a spare part with a known service life which is coming to an end) with the object of ensuring the medical equipment continues to function for a long time.



# Personal data



# Personal data



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This document was jointly produced by a group of African and French people working in the biomedical field and/or international cooperation who met at a working group entitled "Medical devices in the Actions of International Cooperation" run by Humatem. The quotations are extracts from research on the management constraints of biomedical teams in Africa carried out in 2007 by Jean-Yves SAGBO (APIBH) supported by Humatem.

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