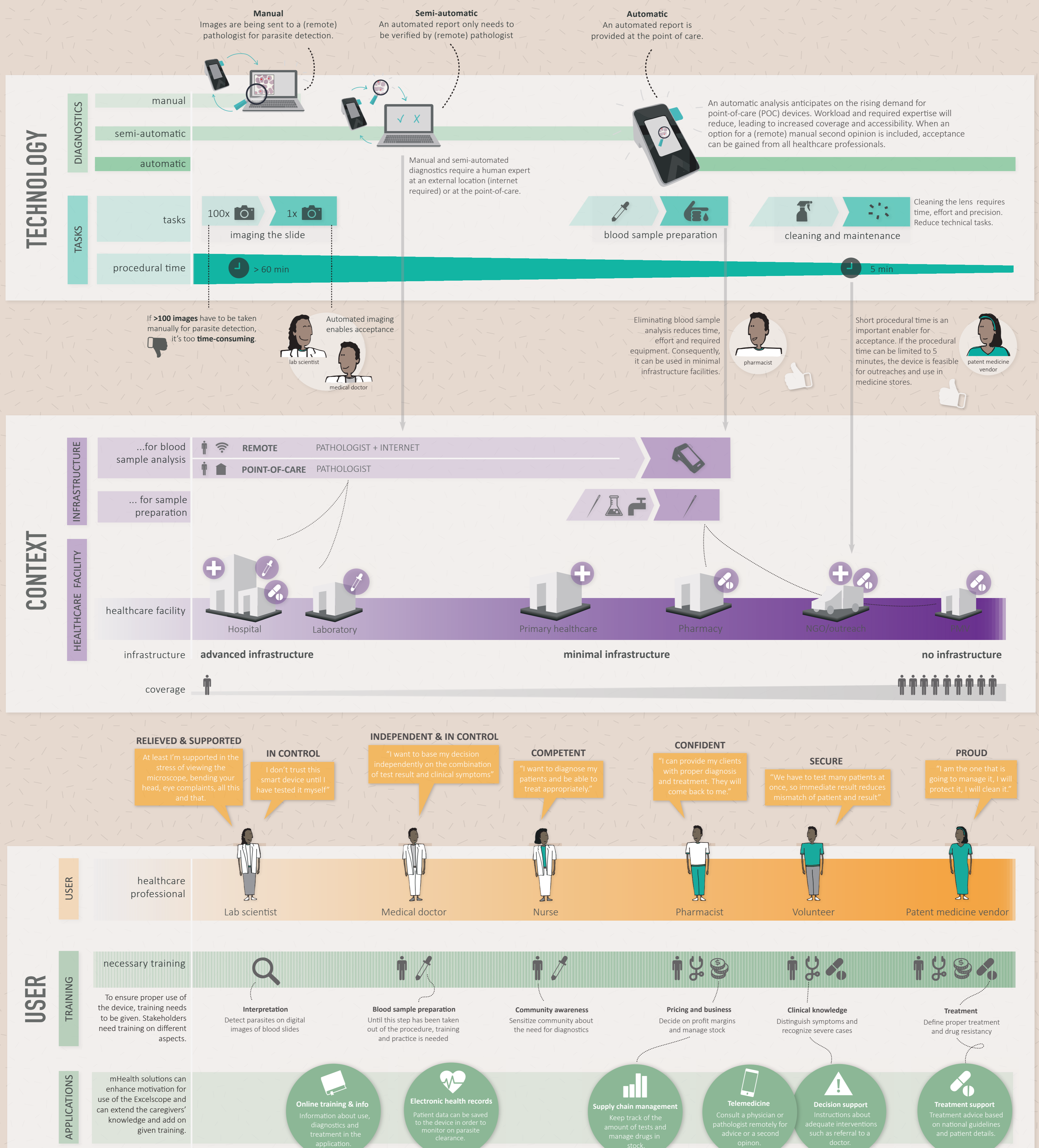# A ROADMAP FOR DEVELOPMENT OF THE EXCELSCOPE

Use and acceptance of a smart malaria diagnostic device by healthcare professionals in Nigeria

In Nigeria, over 90% of the population is at risk of malaria infection, leading to 60% of the outpatient visits in Nigerian healthcare facilities. Accurate diagnostics are not available for the mass and drugs can be bought without prescription, leading to misdiagnosis, overtreatment and drug resistance.

The Excelscope is a smart malaria diagnostic device that leverages the functionalities of a smartphone to capture magnified images of a blood smear and provide a remote or automated diagnosis. For parasite detection and the provision of a diagnosis, different scenarios are possible. These scenarios were discussed with healthcare professionals in Nigeria to get insights in barriers and enablers for acceptance of a smart device. Technology, context and user are connected in the roadmap that shows the recommended development of the device.

TECHNOLOGY

Manual
Images are being sent to a (remote) pathologist for parasite detection.

Semi-automatic
An automated report only needs to be verified by (remote) pathologist

Automatic
An automated report is provided at the point of care.

DIAGNOSTICS
- manual
- semi-automatic
- automatic

An automatic analysis anticipates on the rising demand for point-of-care (POC) devices. Workload and required expertise will reduce, leading to increased coverage and accessibility. When an option for a (remote) manual second opinion is included, acceptance can be gained from all healthcare professionals.

Manual and semi-automated diagnostics require a human expert at an external location (internet required) or at the point-of-care.

TASKS
- tasks
  - 100x — imaging the slide — 1x
  - blood sample preparation
  - cleaning and maintenance
- procedural time
  - > 60 min
  - 5 min

Cleaning the lens requires time, effort and precision. Reduce technical tasks.

If **>100 images** have to be taken manually for parasite detection, it's too **time-consuming**.

Automated imaging enables acceptance

lab scientist
medical doctor

Eliminating blood sample analysis reduces time, effort and required equipment. Consequently, it can be used in minimal infrastructure facilities.

pharmacist

Short procedural time is an important enabler for acceptance. If the procedural time can be limited to 5 minutes, the device is feasible for outreaches and use in medicine stores.

patent medicine vendor

CONTEXT

INFRASTRUCTURE
...for blood sample analysis
- **REMOTE** — PATHOLOGIST + INTERNET
- **POINT-OF-CARE** — PATHOLOGIST

... for sample preparation

HEALTHCARE FACILITY
healthcare facility
- Hospital
- Laboratory
- Primary healthcare
- Pharmacy
- NGO/outreach

infrastructure: **advanced infrastructure** — **minimal infrastructure** — **no infrastructure**

coverage

USER

RELIEVED & SUPPORTED
At least I'm supported in the stress of viewing the microscope, bending your head, eye complaints, all this and that.

IN CONTROL
I don't trust this smart device until I have tested it myself!

INDEPENDENT & IN CONTROL
"I want to base my decision independently on the combination of test result and clinical symptoms"

COMPETENT
"I want to diagnose my patients and be able to treat appropriately."

CONFIDENT
"I can provide my clients with proper diagnosis and treatment. They will come back to me."

SECURE
"We have to test many patients at once, so immediate result reduces mismatch of patient and result"

PROUD
"I am the one that is going to manage it, I will protect it, I will clean it."

USER
healthcare professional
- Lab scientist
- Medical doctor
- Nurse
- Pharmacist
- Volunteer
- Patent medicine vendor

TRAINING
necessary training

To ensure proper use of the device, training needs to be given. Stakeholders need training on different aspects.

Interpretation
Detect parasites on digital images of blood slides

Blood sample preparation
Until this step has been taken out of the procedure, training and practice is needed

Community awareness
Sensitize community about the need for diagnostics

Pricing and business
Decide on profit margins and manage stock

Clinical knowledge
Distinguish symptoms and recognize severe cases

Treatment
Define proper treatment and drug resistancy

APPLICATIONS
mHealth solutions can enhance motivation for use of the Excelscope and can extend the caregivers' knowledge and add on given training.

Online training & info
Information about use, diagnostics and treatment in the application.

Electronic health records
Patient data can be saved to the device in order to monitor on parasite clearance.

Supply chain management
Keep track of the amount of tests and manage drugs in stock.

Telemedicine
Consult a physician or pathologist remotely for advice or a second opinion.

Decision support
Instructions about adequate interventions such as referral to a doctor.

Treatment support
Treatment advice based on national guidelines and patient details.

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