COST BENEFITS OF DIAGNOSTIC CONNECTIVITY

WHAT IS DIAGNOSTIC CONNECTIVITY?

Connectivity moves data from diagnostic instruments consistently, reliably and in real-time to the right person at the right time for maximum clinical and economic impact. Only delivering data to a dashboard, while engaging to the user, is not a healthcare solution. The data must be delivered to the decision-maker directly and in the right form, whether an SMS to a clinician or patient, a report to a supervisor, or a set of supply-chain optimization suggestions to a logistics manager.

Diagnostic connectivity is much more than routers and SIM cards

A true connectivity solution involves:

- moving the most critical data in the most cost effective way to promote the most important outcomes while limiting data costs;

- the ability to use instant, automatic messaging, to alert appropriate staff about certain diagnoses or device functions;

- a software platform that healthcare providers and other stakeholders can easily use and understand;

- intimate knowledge of diagnostic and clinical guidelines in order to know what data is most critical to which person, based on disease and demographics;

- the ability to "see" the network of devices and understand how they and their users are performing;

- strong interpretation of device data, including inventory usage and operational conditions;

- a strong understanding of what medical and operational information will be most important to improving health outcomes and saving money;

- comprehensive support and training to ensure connectivity up-time and worker proficiency;

- the commitment to provide upgrades and updates when device makers change their instrument's software, which is frequent.

Don't devices come "connected" from the manufacturer?

Based on our interviews with established medical device makers, they spend an average of $3 - $5 million to create dashboards and platforms with data handling capabilities to move diagnostic information. These platforms are designed for landscapes with well-established internet access, reliable power and highly skilled staff. Device makers do not focus on solving local internet challenges or creating platforms for local health system staff. In addition, ministries of health don't want a different dashboard for every device and disease, and have reasonable concerns about losing control of their electronic data.

A manufacturer-agnostic and disease-agnostic solution makes sense. At SystemOne, we focus exclusively on connectivity, connecting any device for any disease, routing data to the right people at the right time and ensuring that benefits and cost savings spread through the health system.
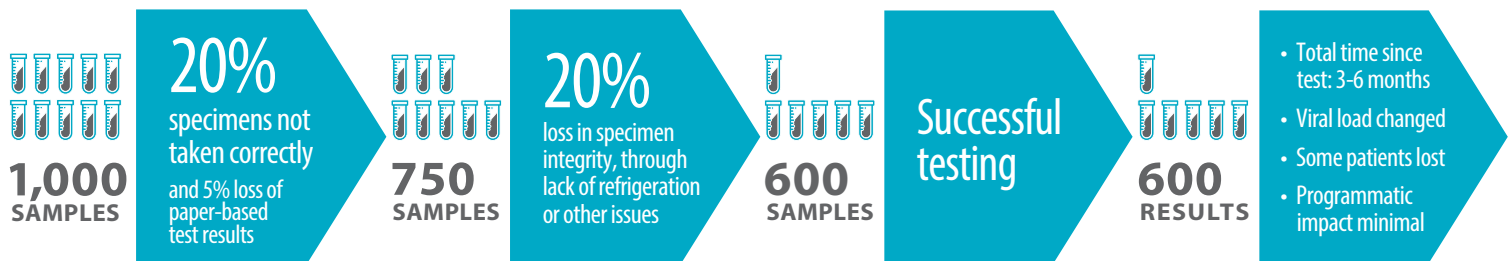
Most importantly, we believe it's critical to offer value to MOH planners, supply chain managers, doctors and patients beyond the diagnosis. Using diagnostic device data, it's important to help optimize the health system far beyond the diagnostic result of the device.

WHAT ABOUT THE COST?

The cost of connectivity is returned many times over in programmatic savings. The following examples from Zimbabwe and Uganda illustrate some key areas of system optimization and cost savings.

Example 1: Centralized HIV Viral Load Testing in Uganda

In this example, we spoke to a manufacturer of a centralized diagnostic device to learn about the costs of HIV Viral Load testing without connectivity, using paper-based reporting.

1,000 SAMPLES → **20%** specimens not taken correctly and 5% loss of paper-based test results → **750 SAMPLES** → **20%** loss in specimen integrity, through lack of refrigeration or other issues → **600 SAMPLES** → **Successful testing** → **600 RESULTS** →
- Total time since test: 3-6 months
- Viral load changed
- Some patients lost
- Programmatic impact minimal

Costs associated with this centralized testing model:

- Cost of courier service: $40,000/month
- Test loss and patient impact loss: minimum of 40%
- Scale: 1,500 tests per day and growing, at $56/test ($16 reagents, $40 for associated necessities).

Comprehensive cost/ valid HIV-VL test:	Time to deliver results:
$78.40	3-6 months

However, for TB results reporting, Uganda has shown major improvements in reporting rates from GeneXpert testing sites due to the introduction of the GxAlert connectivity solution (Sama, 2017). In August 2016, only 35% reporting rates were achieved from 13 sites. Through GxAlert, non-reporting GeneXpert sites were identified remotely, challenges investigated and solutions implemented to improve reporting. By March 2017, reporting rates had improved to 100%.

Example 2: Decentralized CD4 Testing in Zimbabwe

In Zimbabwe, we learned:

326 DEVICES → **60%** not operating at any given time → **15 PERSON TEAM** DOING "CIRCUIT" TO CHECK MACHINES →
- No way to know which are working and which aren't
- No way to know what errors need to be addressed beforehand
→ **60% DEVICES NOT OPERATING** →
- Lack of throughput
- Devices offline
- Patient care suffering
→ **MINIMAL PROGRAMMATIC IMPACT** →
- Impact for patients: low
- Reputational impact for donor: high
- Reputational impact for device maker: high
- Financial impact for device maker: high

The costs associated with this decentralized testing model include:

- Cost of a 15-person team checking machines each month: ≈$30,000/month ($2k/mo salary)
- # of patients unable to be tested because of inoperative devices – unknown

A well-designed and implemented connectivity platform would bring the data right to the supervisors, clinicians and technicians, rather than each person needing to go to, or search for, the data.

Connectivity, if skillfully implemented and appropriately utilized, can have a dramatic positive effect on these example systems, such as:

- Significant reduction in time to treatment, improving patient outcomes and helping minimize the spread of disease.

- Reduction in instrument error rates due to lack of training on instrument-based issues, resulting in a reduction of loss-to-follow-up cases requiring re-testing.

- Insights into laboratory workflow and workload to ensure optimal use of instruments, assays and shift-workers.

- Prevention of both stock-outs and over-stocking of facilities, improving ROI of the instruments and investments in assays/tests.

- Monitoring adherence to clinical guidelines and algorithms.

- Collation of patient and demographic information leading to improved disease-surveillance, outbreak detection and patient identification.

The returns are even greater on social and economic levels. According to the Stop TB Partnership, "each dollar invested in TB yields US $85 in return."

"For the first time, we were able to respond to a case of drug-resistant TB within hours."

— Clinician in Papua New Guinea

"Based on the data, we're able to make important changes to our algorithm. In addition, we can identify and ensure treatment for hundreds of DR-TB cases that we didn't know about because of paper reports and poor transportation."

— TB Program Manager in Pakistan

The Bottom Line:

Supposing an MoH installs 50 diagnostic devices, such as the GeneXpert in a country, and plans on running 2,000 tests per year on each device. The expenses in the first five years could be as follow:

Year 1 | Cost of devices	$850,000
Year 1 | Cost of cartridges	$1,000,000
Year 2-5 | Cost of cartridges	$4,000,000
Total:	**$5,850,0000**

Based on a 5-country study, SystemOne estimates that 40%-60% of cartridges go to waste because they are unused or expired. Some labs run out of cartridges while others have unused inventory that could be used elsewhere.

A 50-device, 5-year GxAlert connectivity solution would cost less than 5% of the cartridge costs. The inventory management impact alone would pay for the system many times over as we've found that cartridge waste can often exceed 50%. Add to that the economic impact of knowing how devices are performing, when warranties are about to expire and calibrations are needed... the return-on-investment is without compare. And this, without even calculating the most important impacts: increased disease detection, accelerated response and reduced time to treatment.

OVER 40 COUNTRIES AND 30 MILLION RESULTS OF EXPERIENCE

After implementing SystemOne's connectivity solutions worldwide, we have seen dramatic results.

Here are a few examples:

Nigeria:

In Nigeria, SystemOne's connectivity platform GxAlert is being used to reduce the turnaround time for reporting of GeneXpert Rifampicin resistant TB cases to the TB government supervisor, state program manager and national program enrollment officer through automated SMS alerts. Since implementation of the GxAlert SMS system, the proportion of drug-resistant TB patients on treatment has significantly increased from 20% in 2014 to 85% in 2015 (Kehinde, 2015; Mustapha, 2015).

Mozambique:

The implementation of GxAlert in Mozambique has led to positive benefits including the ability to rapidly assess GeneXpert data using any computer with internet access, the ability to remotely monitor the performance of deployed GeneXpert machines and cartridge consumption in real-time, the ability to create automated summary reports and automatically formulate lists of patients who were diagnosed TB positive (Beste, 2016).

In 2016, more than 8,000 SMS notifications were sent to key personnel to notify them of TB positive results reported in 2,000 patients (Cowan, 2016).

Ethiopia:

GxAlert is being utilized in Ethiopia to identify problems encountered in remote GeneXpert testing sites and ensure appropriate troubleshooting. By monitoring instrument error rates and error codes centrally, the Ethiopian Public Health Institute has been able to identify sites with high errors and intervene through on-site troubleshooting and refresher training. Since the adoption of GxAlert, the unsuccessful test rate has been steadily decreasing from 18% in 2014 down to 12% in 2017 (Mengesha, 2017). This decrease represents a significant economic and health impact.

Refs:

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