Designing Patient-Centered Diagnostic Networks

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Why Diagnostics?

- **Diagnosis is the first step on the path to treatment and the foundation of disease control and prevention**. As William Osler, sometimes described as the father of modern medicine, said in 1892: “There are three phases to treatment: diagnosis, diagnosis and diagnosis.”

- Diagnostic tests guide clinical decision-making. By helping to ensure the use of appropriate treatments, diagnostics improve the efficiency of health care spending, and help us to fight antimicrobial resistance by guiding the appropriate use of antibiotics.

- Diagnostic tests are also the foundation of disease surveillance and elimination.

- Foundation for Innovative New Diagnostics website. “Why Diagnostics?”

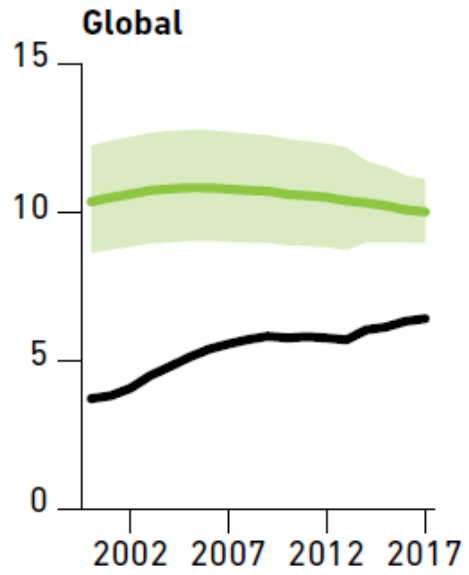
FIND
Because diagnosis matters

The 90-90-90 targets to help end the AIDS epidemic

http://www.avert.org/professionals/hiv-around-world/global-response/targets

Global problem of “missing cases”; lack of access to diagnostics an important driver

Only 64% of TB cases detected and notified: 3.6 of 10 million TB cases missed in 2017



Green – estimated number of incident cases per year (millions)
Black – number of notified TB cases, all forms, per year (millions)

Source: WHO, Global Tuberculosis Report, 2018.

25% of people with HIV are not diagnosed.

Of those on treatment in SSA, 50% don’t have the latest monitoring test (Viral Load).

We need to provide better access to diagnostics

Scaling up access requires multiple interrelated elements along a cascade to all work together





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This slide adapted from Clement B. Ndongmo, PhD, MPH, AIMLS - Senior Technical Laboratory and VMMC Advisor, GHSC-PSM.
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Design Objective – v1

Increase access to diagnostics, cost-effectively

Spectrum of approaches to providing Access

Centralized Hybrid Decentralized

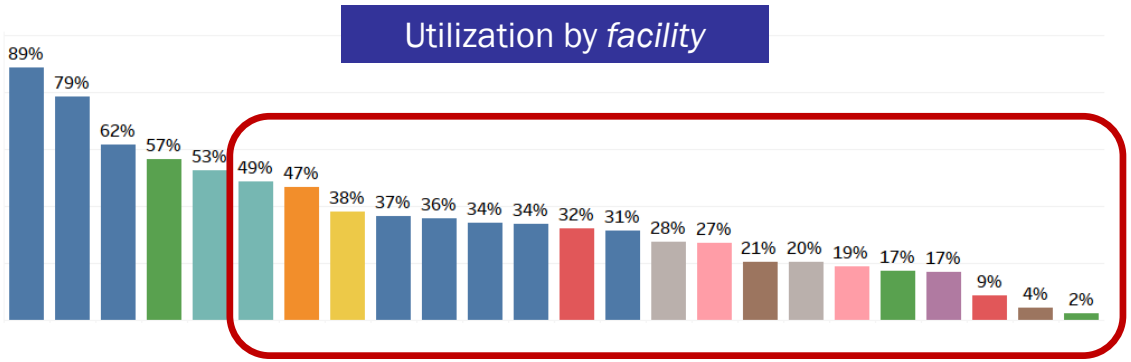
A powerful starting point – Network Optimization: How many machines? Where to put them? How to refer samples?

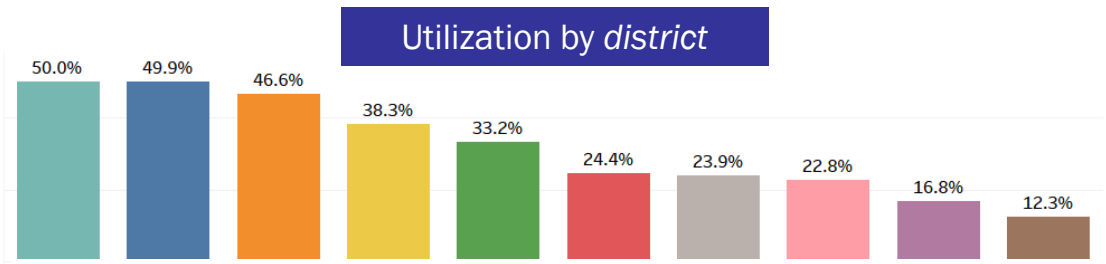
- A proposed solution: purchase many diagnostic machines and distribute them widely across country

BUT

- Budgets are constrained

“Puzzling” factor: In current state available machines are underutilized





- Underused machines could be addressed by better referral flows.
- Low demand machines with utilization <X% (average daily tests <Y) could be replaced by better suited smaller or POC machines.

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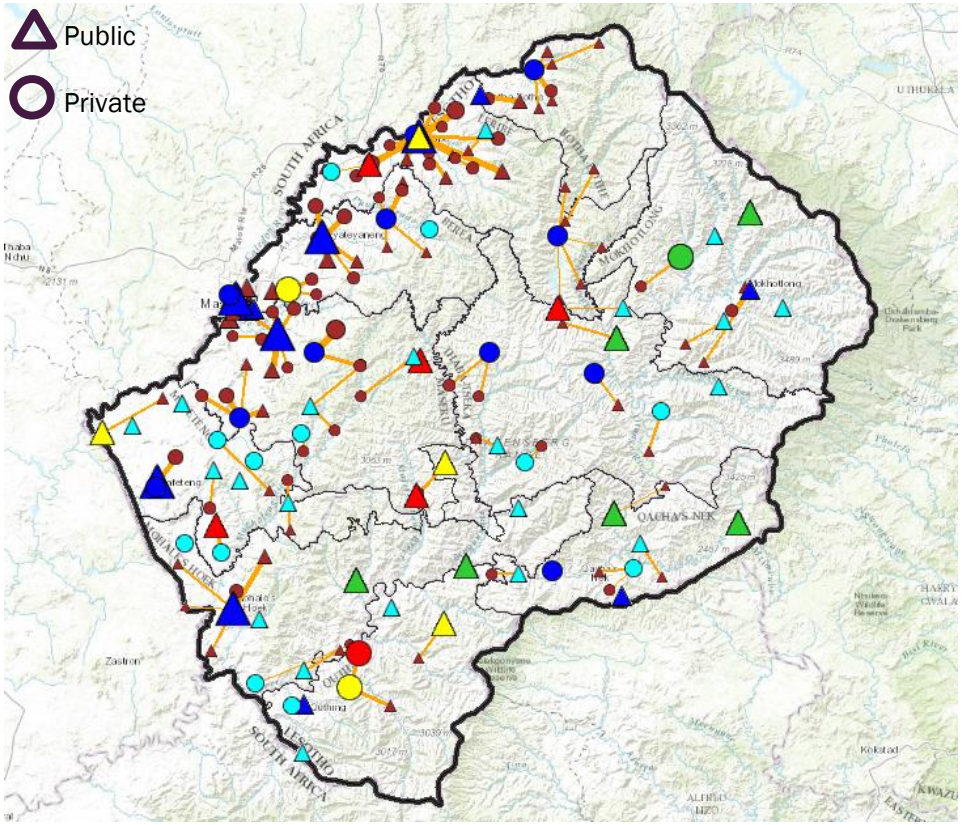
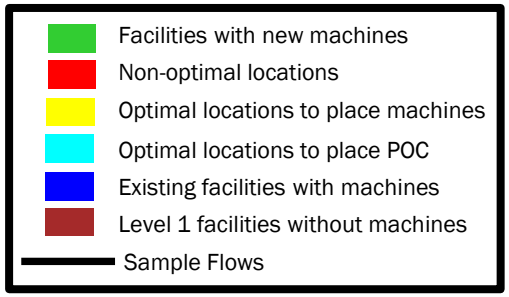
FIND Because diagnosis matters

Design the network: optimize instrument number, placement, and referral flows



Recommendations:

1. 50+% of new machines in country should be **moved**.
2. Adjust **referral flows** across district borders.
3. **Drop** the other Y machines planned for purchase.
4. Z **POC machines** should be added



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What's nice about Network Optimization?

Searches for best balance of cost components – taking care of **Cost-Effective** part of objective

Fixed Operating Costs

- Site Costs
- Equipment Costs
- HR/Technician Costs

Transport Costs

- Sample transport

Per Test Costs

- Reageant/Cartridge
- Results Printing

Reducing transport cost will in itself drive towards reducing distance, starting to address **Access**

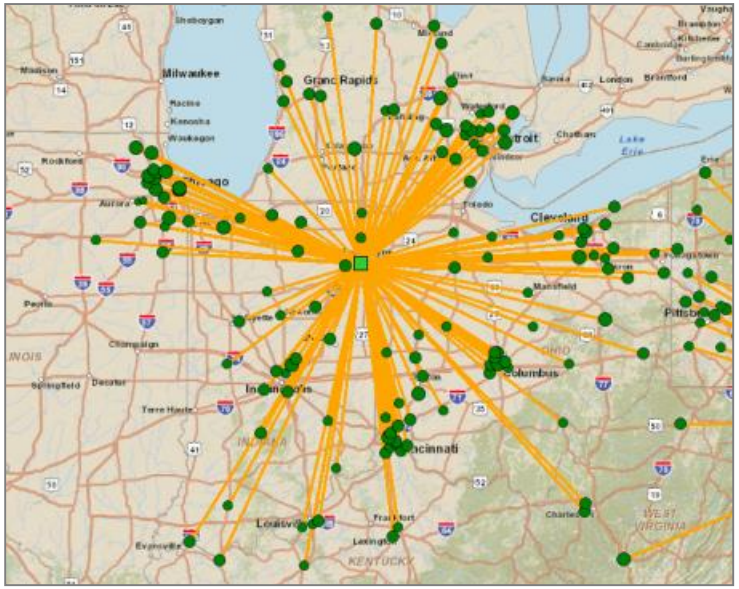
What's the correct transport cost? Different transport costs will lead to different "optimal" answers

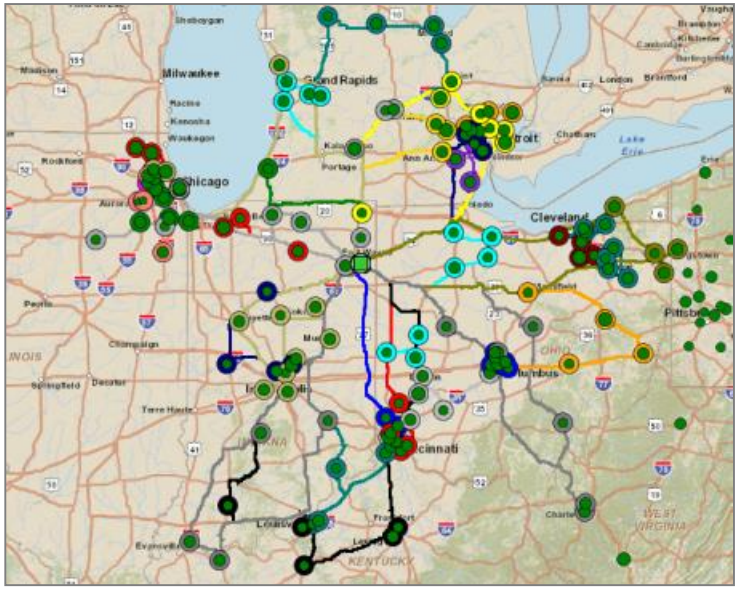
What transport mode are we using?

Point-to-point transport or multi-stop routes?

What's the right frequency?

Do all of these vary in different regions of the country? What about for different facilities?





Is transport cost reduction sufficient for “Access”? How do we define “Access”?

Candidate definition for Access:

Samples can be collected, sent to be tested, and results can be returned

Candidates for more specificity:

- At least one machine per Administrative area?
- Maximum allowable distance from health facility to diagnostic machine?
- Maximum allowable turnaround time?

Constraints

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Design Objective – v2

Increase access* to diagnostics, cost-effectively

*Access: Samples can be collected, sent to be tested, and results can be returned in a timely manner

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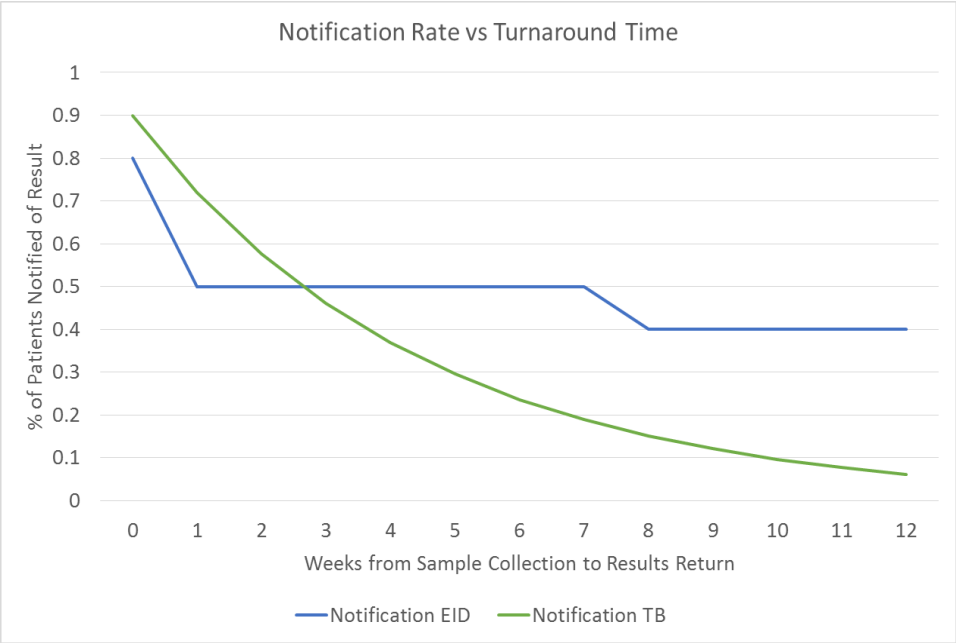
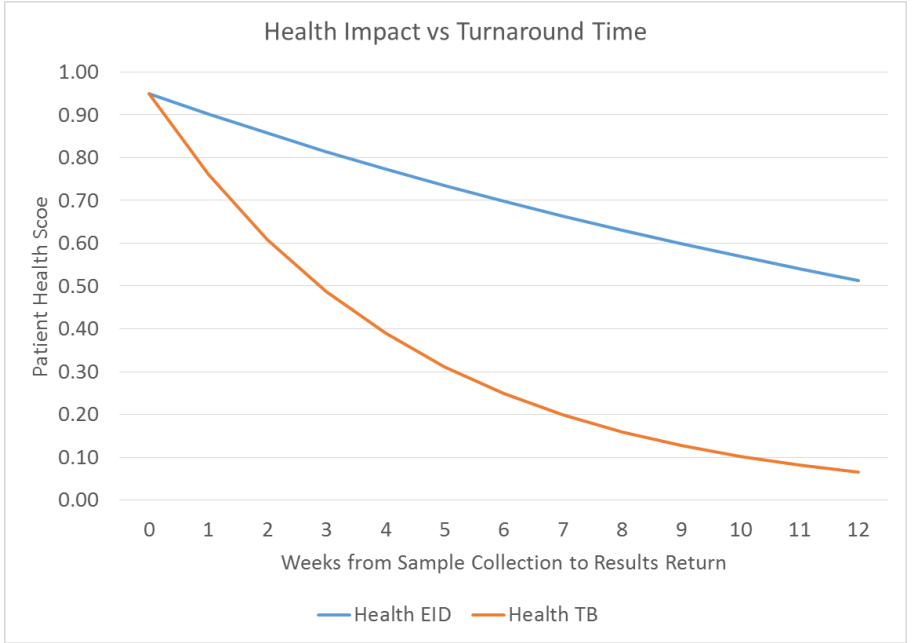
What is a “timely” manner for results return?
What is an acceptable Turnaround time (TAT)?

Notification rates to patients



Health Effects as Patients wait for results



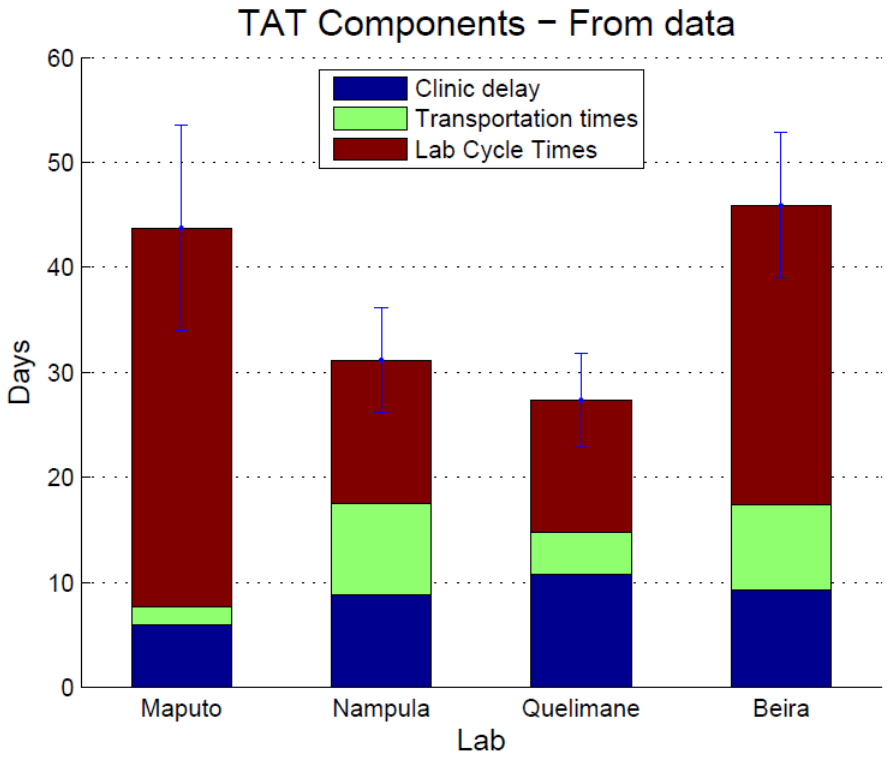
TAT is important and needs to be unpacked.

What are the components of TAT?

Turnaround Time

Lab Cycle Time:

- Stockouts of reagants/cartridges
- Machine outages
- Lab process (e.g. batching)



Source: Deo, Gallien, Jonasson (2017)

Centralized vs Decentralized?

- Do we assume a fixed probability of machine outage/stockout? OR
- Do we assume those are improving with points of control?

Centralized Decentralized

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Does having machine on-site increase testing?

What's the right machine to use? Sensitivity, Specificity, more!

Do patients dropout at lower rates in monitoring with TAT?

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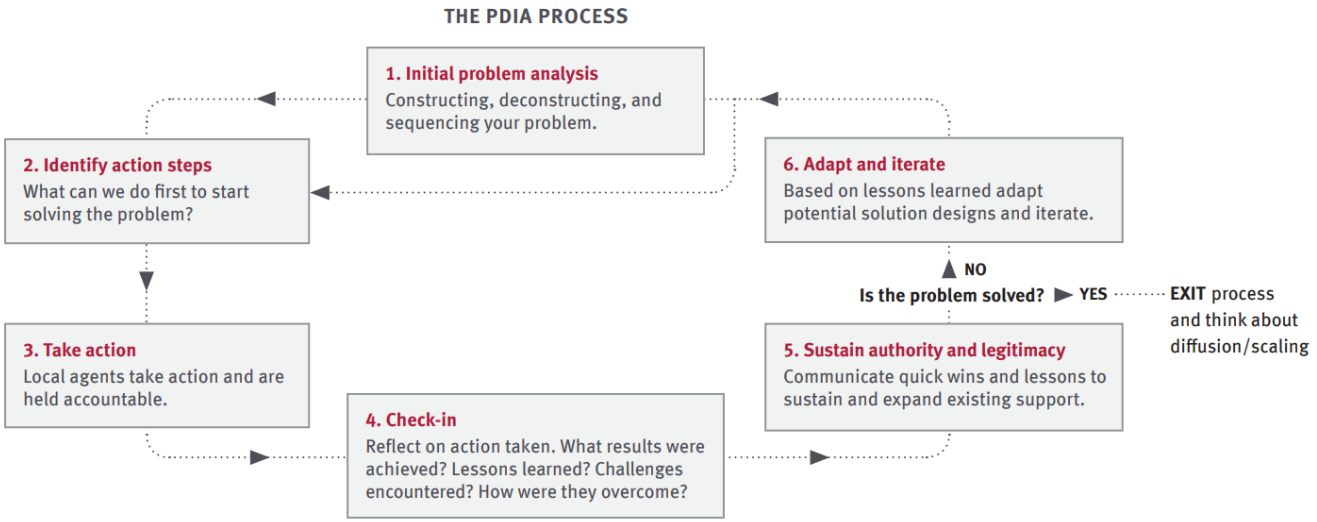
Design Objective – v3

Increase access* to diagnostics, cost-effectively

*Access: Tests can be ordered, Samples collected, tested, and correct results can be returned in a timely manner

Complex problem - How do we tackle this?

- We do have tools to improve complex socio-technical systems
- Problem-Driven Iterative Adaptation (PDIA)* – Andrews, Pritchett, Woolcock, Building State Capability – Harvard Kennedy School



*Analagous frameworks: OODA loop (Boyd), PDCA loop (Deming)

- Have a living decision model that guides you directionally, is continuously challenged and keeps increasing in fidelity

Countries with whom we are actively working on this path

Small proofs-of-concept

- Lesotho
- India

Design workshops to spark thinking, identify opportunities:

- Nigeria
- eSwatini
- Zimbabwe

Full-country design exercises

- Kenya
- The Philippines
- Tanzania

...MORE COMING!

THANK YOU!