MDR-TB

Information Systems:
Solutions to Enhance Laboratory Capacity in evaluation of New Diagnostics and Therapies

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Content

• Information as an intervention
• Information supply chain concept
• A systems approach to ICT capacity building
• Technology adoption: impact on strategy and tactics
• Information systems types
• Information system attributes
• Recommendations

ICT = information, communication, and technology
Information is an Intervention
Some Examples

• It drives the right therapeutic to the right patient
  – It prevents emergence of drug resistant strains
  – It treats patients more cost effectively

• It improves operations
  – It prevents nosocomial spread by tracking infection control risks
  – It improves contact tracing and follow up
  – It ensures SLD are available for DRTB patients

Given the cost of disease spread, years of treatment, impact on productivity, and overall morbidity and mortality, investment in the information supply is very cost effective.
The DRTB Information Supply Chain....

A Comprehensive Logistics-Based Approach to Data and Information Provisioning for MDRTB

A country-specific phased approach to speed data to critical decision points in the second line drug supply chain
The DEOC and Incident Management Structure Develop and Operate Supply Chains

During a response, there are at least three critical supply chains that support a successful public health response.

- Human Resources
- Products/Hard Goods
- Program Coordination

Information and technology products and services HAVE NOT BEEN provisioned in a systematic and coordinated fashion. eRISC was established to fill this gap and provide coordination and integration of all technology products and services across CDC.

DEOC = Director’s Emergency Operations Center
Health Access, Outcomes, and Cost are Compromised

Data and Information are not Available throughout the Healthcare System
Poor integration with more sophisticated hospitals at the national and or regional level

No standardized patient management process

Patient recording keeping is highly variable and not portable

At the CHPS centers at community level, a small health point is located in one village, covering several (5-10) villages, with a Community Health Officer (best case scenario), a professional nurse, an auxiliary nurse, midwives and a couple of volunteers (CHV). MOH is often divorced from activities here.

At the sub-district level, there is a lack of available medical personnel – volunteers (aka Local Doctors) often serve as medical personnel – they often give wrong advice since they are not qualified.

Most villages are scattered widely and in most cases, without health facilities. They have volunteers who work under the supervision of a community health officer.

The lack of transportation and the model of minimum vehicle mix for the different health levels is not in place. Introduction of 2 way radios mitigated some of the communication issues but the main problem of inequitable access to healthcare is still rife in these areas due to lack of information flow.

70% of the poor population is citing costs as one key reason for non-use of medical service. This is even with the implementation of the NHIS.

More than 50% of people in rural areas do not seek medical care
System Evaluation

Identify Critical Information Points

• Technology adoption can be time and resource intensive
• DRTB incidence/prevalence continues to climb so time is critical
• Must identify the ‘critical information points’ to optimize impact on SLD supply chain
• Design information solutions to achieve impact as quickly as possible and then mature solutions: two phased approach if needed
A Public Health Information Supply Chain

Usually, at best, a vague idea in a person’s mind

Information supply chains must be engineered.

A disciplined approach to data and information provisioning will enable measurement of data/information quality and impact.

Measurement will enable performance improvement.

A subset of data and information flow for Pandemic Influenza
The Supply Chain Components

- **Information Products** – Questions that drive decision making
  - The ability to enumerate information requirements is critical event preparedness and response. By definition, all supply chains must have a clear idea of the product(s) that it must produce
  - Information products support the CDC business functions critical for emergency response
- **Source of raw materials** – Data systems
  - Data systems that provide the data for information products
- **Human resources** – Staffing
  - Staffing that build and operate the systems as well as create the information products
- **Standard operating procedures** -- A logistics-based approach
  - Processes that manage the data to produce information
  - Includes all aspects of managing the supply chain including staffing, hardware, software, data integration, data analysis, report generation, continuity of operations, etc
Integrated national eHealth architecture in Rwanda, (partial view)

- **Supply chain systems**
  - **Camerwa**

- **Pharmacy system**

- **National reporting system**
  - **TRACNet**

- **National registries**
  - e.g. patients, providers

- **EMR System**
  - **OpenMRS**

- **Mobile health systems**
  - **SANA, ODK, OpenXdata**

- **Laboratory System**

- **Radiology / telemedicine system**

- **SDMX-HD**

- **HL7**

- **Dicom**

- **Registration and insurance**
PIH-EMR Data

- Smears
- Cultures
- Drug sensitivity (DST)
- Biochem.
- Hematology
- Drug regimens
- Pharmacy
- Registration form
- History/exam
- Previous Rx
- Previous Dx
- Contacts
- Follow up
- Chest X-ray

PIH-EMR: Electronic Medical Record

View Patients
- Search for a patient:
- List All Patients:
  - Peruvian patients
  - Haitian patients
  - Rwandan patients

Data Entry
- Search for a patient:
- Create a new patient
- New patient

Data Administration
- Merge patients:
- Find DST or Bacteriology:
- Search

*PIH-EMR Data Diagram with various medical data points and a computer interface.*
### Analysis of monthly drug requirements

<table>
<thead>
<tr>
<th>Medication</th>
<th>Form of drug</th>
<th>Total quantity required</th>
<th>Estimate for all patients</th>
<th>Price per unit</th>
<th>Total cost for this drug</th>
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Predicting MDR TB drug needs

Patient recruitment 1996-2005

Length of time in treatment

Darius Jazayeri, 2005
Quantification for MDR TB drugs

- Recruitment rate
- Time in treatment
- Proportion of patients on each drug

%age predicted/prescribed for 13 drugs

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<th>Year</th>
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<td>3.4%</td>
<td>10.9%</td>
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</table>

(two 6 month estimates are combined for each year).
Core variables for SLD Supply Chain support

- Demographics
- Program enrollment date
- Start date for drugs
- Drug regimen - including individual drugs and doses
- Treatment status
- Treatment outcome
- Outcome date

More clinical variables
- Smear and culture results
- DST results
- Other lab data (hematol, biochem)
- Previous medications
- Adverse events
- Socio economic factors
OpenMRS: a modular, open source, EMR platform

- **Collaborative** project of PIH, the Regenstrief Institute, Indiana and South African MRC
- Uses **concept dictionary** for data storage
- **Modular design** simplifies adding new functions and linking to other systems
- Supports **multiple languages** and **multiple data standards**
- Released with **open source** license (April 2007)
- Core of **paid programmers**, growing **community support**
- **Main site**: [www.openmrs.org](http://www.openmrs.org)
Disease-specific EMR (MDR-TB)

Find Patient(s)

Find Patient(s) mukherjee
1 to 1 of 1
Identifier First Middle Last Age Gender Birthdate Health Center
1 44006563-G Joia Test Mukherjee 28 F ~ 01/01/1981 Mulindi

Create Patient

To create a new person, enter the person's name and other information below. It is good practice to first verify that this person is not already in the database using the search box above.

Name
Birthdate (Format mm/dd/yyyy)
Gender ○ Male ○ Female

Create Person

View All MDR-TB Reports

- WHO Form 05 Quarterly (2008 version)
- WHO Form 06 6-month (2008 version)
- WHO Form 07 Annual (2008 version)
- WHO Form 07 Quarterly Report (2006 version)
- WHO Form 08 6-month report (2006 version)
- WHO Form 09 Annual Report (2006 version)

View Drug Requirements

- drug requirements for next month
- number of patients taking each drug

Demonstration data only
# MDR-TB treatment history

**flowsheet**

**Demonstration data only**

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**Charles Virunga**

- **Age**: 35 yrs (≈01-Jan-1975)
- **Health Center**: Cange
- **BMI**: 24.7 (Weight: 67.5 kg, Height: 165.0 cm)
- **Regimen**: Ethionamide (Eto), Ciprofloxacin (Cfx), Pyrazinamide (Z), Cycloserine (Cs), P-aminosalicylic acid (PAS), Capreomycin (Cm), Moxifloxacin (Mfx)
- **Last encounter**: Specimen Collection @ Cange | 19-Aug-2010 | Louise Allen
- **MDR-TB program start date**: 05-Apr-2007
- **Treatment start date**: 05-Apr-2007
- **Culture Status**: Unconverted

## Patient Overview

- **Patient Enrollment Date**: 05/04/2007

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### Patient Information Table

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<th>E</th>
<th>S</th>
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**Find Patient(s)**
OpenMRS-Google Maps–Mobile Health Integration

Karachi, Pakistan

Credit: Owais Ahmed, Aamir Khan
OpenBoxes
Shipment tracking and inventory management system

Credit: Justin Miranda, PIH        Funding: Rockefeller Foundation
Supply Chain Interoperability

International supplier

National Warehouse

District Warehouse

Health Facility pharmacy

Health Facility EMR
Supply Chain Interoperability

International supplier

National Warehouse

District Warehouse

Health Facility pharmacy

Health Facility EMR
Recommendations

• Systems approach to requirements development to produce needs-specific information supply chain and phased maturation

• Phased solution design to provide SLD supply chain data
  – Simple systems with targeted features and impact
  – More robust and complex information systems

• Development and tracking of measurable performance metrics
  – Information supply chain
  – SLD supply chain

• Improved standardized coding for SLD and associated bar coding capability to support tracking activities, e.g.
  – Name, batch number, expiration date, authentication ID

• Standardized reporting elements for drug stocks and status
Recommendations

• ICT planning and implementations that support the health priorities for a country by leveraging common strategies and approach
  – Healthcare services and public health activities across multiple diseases
  – Drug and supply chains for multiple diseases
• Development and tracking of measurable performance metrics
  – Information supply chain
  – SLD supply chain
• Critical need for DRTB ‘operations’ systems to track all associated DRTB program information supply chain activities such as clinical care, epidemiological activities, infection control programs, SLD supply chains, etc.
To Stop the Spread of TB Globally

To stop the spread of TB globally, the world needs:

• **Better TB diagnostics** — that are rapid, practical and accurate in resource-poor settings — are critical to ensuring that people receive proper and timely treatment.

• **New TB drugs** — that will shorten treatment, be effective against susceptible and resistant strains, be compatible with antiretroviral therapies used for HIV/AIDS and that will improve treatment of latent infection — will dramatically improve TB treatment and control.

• **A new vaccine** — that is both effective and safe for children, adolescents and adults, including people infected with HIV — will decrease TB incidence overall and, along with an effective drug therapy, could eventually control the disease.

http://www.finddiagnostics.org/programs/tb

And......efficient sustainable information supply chains
Linking Public Health Functions to Information and Data Flow

• Document the public health functions, information required, and work flow needed to prepare and respond to DRTB control
• Document through enterprise architecture process the information exchange required to support PH functions and work flow
• Document the system and data flow associated with the information exchange discovered by enterprise architecture

*This critical process presents difficult challenges as a consequence of the need to translate public health practice into technical architectures.
Thank You

Dale Nordenberg, MD
Novasano Health and Science