Routine Health Information Systems: Concepts and Methods

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Outline of this presentation

• Routine Health Information Systems (RHIS) concepts
• PEPFAR (President’s Emergency Plan for AIDS Relief)
• Analytical Framework for Understanding RHIS Performance – The Prism Concept
• RHIS coordination and capacity building
• Analysis of RHIS data - Decision Support Systems
• Research Agenda
What do we mean by Routine HIS?

• Definition:
  – Ongoing data collection of health status, health interventions, and health resources
  – Examples: facility-based service statistics, vital events registration, community-based information systems

• Role:
  – **District level and below**: generate information in support of planning and management of quality health care services
  – **Integration** between individual care and community-based interventions and coordination with other sectors
  – **National level**: monitor performance and guide policy (MDGs)
Common Problems

• RHIS inadequate to provide needed information support
• Lots of (mostly irrelevant) data
• Data flow problems: under-reporting, missing reports and lack of feedback
• Lack of “information culture”
RHIS concepts

- Definitions
- RHIS system components
- RHIS and other data collection methods
- RHIS and the health system
HIS = MIS = HMIS = RHIS = ??

- « … a system that provides specific information support to the decision-making process at each level of an organization » (Hurtubise, 1984)
- How to deal with « Babelian » situation about the terms?
- HIS = the overall (national) health information covering all data collection methods (routine - non-routine)
- Routine HIS = often called Facility-based HIS = often called HMIS
- HMIS confuses people who think that disease surveillance is not part of HMIS.
- Just know what you are talking about.
The ultimate goal is not to gain information, but to improve action.
HIS: DATA COLLECTION METHODS

• ROUTINE DATA COLLECTION
  • Health unit based – Service Statistics
  • Community based
  • Civil registration and vital events
  • Sentinel reporting

• NON-ROUTINE DATA COLLECTION
  • Population or health unit-based surveys
  • Population census
  • Rapid assessment procedures (RAP)

• INFORMAL DATA COLLECTION
1. Surveillance
2. Surveys
   Surveillance Data
   Population-Based Surveys
   Health Facility Surveys

3. HMIS: Facility-based reporting
4. Program data: Non-facility based reporting
5. Targeted Evaluations

Surveys Database (Macro)
HIV Sero-database (BUCEN)

DATA WAREHOUSE
Results from HMIS/Program Reporting & Targeted Evaluations

National Database/CRIS+

Central PEPFAR Database
COP/Report
Commodities
Budget

USG/WHO/
Global Fund/
UNAIDS

Country-level

Web-based reports

HMIS and other EMERGENCY PLAN DATA SOURCES
Unfortunately...

Health information systems in most (developing) countries are woefully inadequate to provide the needed information support ...
Why Routine Health Information Systems?

• What is the role of routine health information systems at district level?
  – Evidence-based decision making
  – More effective and efficient planning and management
  – Enable health system performance
  – Contribute to improving health status
What is wrong with existing routine health information systems?

- Irrelevance and poor quality of the data collected
- Fragmentation into “program-oriented” information systems: duplication and waste
- Centralization of information management without feedback to lower levels
- Poor and inadequately used health information system infrastructure
As a result...

- Poor use of information by users at all levels: care providers as well as managers
- “Block” between individual care and public health information systems
- Reliance on more expensive survey data collection methods
Strategies to improve routine health information systems

- Propose technically sound HIS restructuring process
- Focus on district managed and population-based routine information systems
- Contribute to the state of the art (SOTA) on RHIS development: creation of RHINO in 2001
HIS Design

• Your assessment should have identified areas to work on.
• Sometimes a “top down” approach is not the best.
• Often you need to work up from the foundation.
• Overall design should incorporate the ‘ultimate’ build out and allow for incremental building.
• Priorities for IT investments
• Stakeholder involvement
MEASURE Evaluation: Focus on district RHIS

**District Population**

- **District Health Management Team**
- **Regional Health Mgmt Team**
- **Ministry of Health**
- **Universities**
- **Other Health Institutions**

**Routine Health Information System**

- **District Level**
- **Regional Level**
- **National Level**
- **Other Sectors:**
  - Environment
  - Civil Administr.
  - Transport
  - Education
Data collection

• Golden rules
  – Keep data collection instruments AS SIMPLE as possible
  – Involve users in the design
  – Standardize definitions and procedures and include them in a user’s manual
  – Develop an appropriate incentive structure for data use
  – Train care providers as data collectors and data users

• Paper-based versus computerized
• Facility-based versus patient-retained
Data aggregation

• Options:
  – (1) using individual data from clinical records; or
  – (2) using cumulative data from registers or tally sheets

• Purpose
  – reporting to higher level
  – periodic self-evaluation (e.g. monitor facility-based counseling and testing rates)
Data transmission

- **Within the individual health care system**
  - To promote continuity of care (between care services and lab; between first level and referral level)

- **From health units to system management level**
  - Periodic reporting respecting existing channels (facility --> district --> regional --> national)
  - Appropriate use of newer communication technologies (Internet, e-mail, PDAs, smart cards, etc.)
Data processing and analysis

- Increasingly with use of computer technology
- Development of customized applications for data processing and analysis
- Emergency Plan: opportunity to build capacity in data processing/analysis at district level
Five principles to improve use of information

• Active participation in system design leads to ownership/relevance of information
• Production of quality and timely data
• Performance-based management systems
• Communication between data and action people
• Data presentation and communication customized for users at all levels
Successful HIS reform requires:

- Preliminary stakeholders analysis
- High level leadership: find a “saint”
- Broad consensus-building of users in the design stage
- Useful information products early in the process
Proposed methods and tools

• Direct HIS reform efforts towards development of district level managed integrated RHIS

• Develop comprehensive RHIS strategic planning tool (including stakeholders analysis; behavioral/systemic/technical assessment)

• Develop web-based decision support systems and data warehouses

• Develop longitudinal medical record systems for HIV/AIDS (both paper-based/computerized)

• Pilot test newer ICT tools: PDAs, cell phones, smart cards, GPS/GIS
A Sample of MEASURE Evaluation RHIS Activities

(Monitoring and Evaluation to Assess and Use Results)

• Technical assistance to countries: RHIS strengthening (e.g. Morocco, Eritrea, Haiti, Nigeria, Ivory Coast, Kenya)

• RHINO: birth and early development
  – Potomac, South Africa, Thailand workshops
  – Listserv (rhino@lists.jsi.com): advocacy and communication
  – RHINO Website (http://www.rhinonet.org)

• PEPFAR (President’s Emergency Plan for AIDS Relief:
  – Managing MIS subgroup
  – Country assessments
  – Coordination and consensus building
  – Technical assistance to countries
  – System strengthening
Lessons learned

• Need for quality and timely information is the highest at district level and below
• Availability of quality information is not a sufficient condition to use it for action
• Immense need for in-country capacity building, again district level and below
• PEPFAR: shift to ART calls for patient/client management tool development
PEPFAR
(President’s Emergency Plan for AIDS Relief)

• A multi-agency $15 billion U.S. initiative to provide HIV care, treatment, and prevention services to HIV affected populations in the developing world
• Two, Seven, Ten Goals: Treat 2 million infected people with anti-retroviral therapy, prevent 7 million new infections, and care for 10 million people infected by HIV or affected by it.
• HMIS committee – draws expertise from USAID, CDC, HRSA, Census Bureau, DoD, and Peace Corps
  – Includes technical expertise from private partners
  – Works closely with counterparts at WHO and UNAIDS
PEPFAR
Strategic Information Key Components

• HIV/AIDS surveillance
• Population-based bio-behavioral surveys and facility surveys
• Health Management Information Systems for facility-based reporting
• Program-level monitoring and reporting (non-facility based)
• Targeted evaluation studies
Place of facility-based HIS in Emergency Plan

• The facility-based health information system (RHIS) is one of main sources of information for M&E of the Emergency Plan
• Facility-based HIS in most recipient countries are weak and their strengthening is a key strategy for M&E of the Emergency Plan
• Strengthening of HIS is not a quick fix: it needs a broad system approach to be successful.
• The same is obviously true for the introduction of Information Communication Technology (ICT)
Examples of Information Systems Supporting HIV Programs

- Pharmacy management
- Laboratory management
- Logistics/supply chain management
- Program monitoring (OVC, palliative care)
- Facility-based patients systems (e.g., ART)
- Vital statistics registries
- Facility-based surveys (e.g., ANC clinics)
- Population-based surveys
- National notifiable disease reporting systems
Emergency Plan: HIS design and implementation challenges (1)

• How to provide immediate assistance to focus countries in order to report core indicators?
• How to strike a balance between short-term results and long-term objectives of capacity-building?
• How to link the Emergency Plan supported MIS to the National HIS?
• How to address the country-specific context of facility-based information systems?
Emergency Plan: HIS design and implementation challenges (2)

- How to address the lack of HIS human resource capacity?
- How to ensure the production of quality data by the HIS?
- How to ensure confidentiality of HIV/AIDS information?
- How to address the complexity of multiple-source funding?
Rationale for integration of HIV/AIDS information in existing (facility-based) RHIS

• Integration with other individual health interventions
  – prenatal/postnatal and obstetrical care
  – STI, tuberculosis
• Integration with other sectors and communities
  – school health, orphan care, home care etc.
• Cost-effectiveness
  – avoid duplication in data collection and continuity of care
Role of facility-based RHIS in the Emergency Plan

- Production of data on quality and continuity of patient care (ART - PMTCT)
- Production of data on laboratory results
- Production of data on resources: human resources, drugs, equipment, costs
- Facilitating integration of HIV/AIDS interventions with other interventions: TB, MCH, orphan care, etc.
It’s More than Forms, Software

• Need to provide a complete solution
  – Forms
  – Software
  – Documentation
  – Training
  – Support
  – Evaluation
  – Continuous Improvements
Competing Needs / Tensions

No absolute “best” approach
Tensions

Short Term vertical solutions

Simpler, faster, more immediate impact

Long-term building of the HIS

More complex, longer term investment

- Both approaches must support the national system.
  - We do not help ourselves by assuming our need for quality, timely data supercedes other in-country needs.
Tensions

Custom forms

More effective operations

National forms

Faster roll-out, allows more comparability

- DOTS (TB treatment) as an example?
- Less discussion has been around paper innovations, but perhaps more is needed in the future.
Tensions

Custom software built from scratch

More effective operations

Standardized solutions

Faster roll-out, efficiencies in development, operations and support

- Investigating existing solutions takes time; programmers want to program
- Need to find the middle ground with solutions that can be locally customized but centrally supported
Tensions

Emergency Implementation

Damn the torpedoes (and the cost)

Don’t implement solutions that require expensive technology and HR

Sustainable Solutions

• Deal with the emergency and then work on sustainability?

• Nearing end of second of five years on the Emergency Plan
Introducing an Analytical Framework for Understanding Performance of Routine Health Information Systems in Developing Countries
PRISM Framework for Understanding Health Information System (HIS) Performance

**Inputs**
- HIS assessment, HIS strategies, HIS interventions

**Organizational/ Environmental Determinants**
- Information culture, structure, roles & responsibilities, resources

**Desired Outcomes**
- HIS performance
  - Good quality information
  - Appropriate use of information

**Improved Health System Performance**

**Improved Health Outcomes**

**Technological Determinants**
- Data quality, system design, IT

**Behavioral Determinants**
- Knowledge, skills, attitudes, values, motivation

**Desired Outcomes**
- HIS performance
- Good quality information
- Appropriate use of information

**Improved Health System Performance**

**Improved Health Outcomes**
What is good HIS performance?

- Production of **good quality** data

- **Continued use** of health data for improving health system operations and health status.
What influences quality and use?

- Standard indicators
- Data collection forms
- Appropriate IT
- Data presentation
- Trained people

Technical factors
What influences quality and use?

- Resources
- Structure of the health system
- Roles, and responsibilities
- Organizational culture

System and environment factors
What influences quality and use?

- Motivation
- Attitudes and values
- Confidence
- Sense of responsibility

Behavioral factors
Applying the analytic framework

- Needs assessment: change the way we analyze problems and see opportunities
- Strategies and interventions: attacking the three sets of determinants
- Expanded partnerships to better address demand-use continuum: health, planning, financing ministries, NGOs, private sector
- Capacity building for sustained HIS performance
- TA: involving a broader range of professionals including OD and behavioral sciences.
Strategic approach:
The Data Demand - Use Continuum

Source: MEASURE Evaluation/USAID
RHIS Coordination

• RHINO (Routine Health Information NetwOrk):
  – building a sustainable network of RHIS professionals
  – Workshops, Presentations, Listserve, On-line Forums, RHINO Register and Bibliography

http://www.rhinonet.org
Health Metrics Network

- Establish national coordinating mechanism - MOH, Bureau of Statistics, research & academic bodies, disease-specific programmes
- Select essential indicators and develop integrated database – Data warehouse
- Develop national health information system plan; better planning and coordination of household surveys
- Develop health information system components; sample registration that includes causes of death; avoid less cost-effective methods such as maternal mortality surveys
- Enhance synthesis and use of data for decision-making (linking inputs and outcomes) by combining data from all sources and linking to budgets and expenditure.
- Support Health Statistics Resource Centre (software library, PDF electronic library).
Capacity building

- Routine Health Information System course on district RHIS design and implementation (South Africa, 2005, Mexico, 2006)
- Adding HIS module to the existing M&E curriculum with focus on use of information
- Provide TA on RHIS strengthening in selected countries, particularly in PEPFAR countries
Analysis of RHIS data

• Summary tables
• Listing reports
• Time trend graphs
• Regional comparisons graphs
• Geographic Information Systems (GIS)
• Pivot tables - OLAP (online analytic processing)
• Data mining
• Data Warehousing
• Decision Support Systems
What is a Decision Support System (DSS)?

- A computerized application allowing health managers to visualize health indicators and data elements collected by the Routine Health Information System in graphical and geographical presentations.
- Based on the principle that COMPARISON is one of the most powerful analytical methods:
  - spatial: by health facility, district, province etc.
  - time: trends by week, month, year, etc.
  - indicators: between inputs and outputs
  - benchmark: expected versus achieved
Why a Decision Support System (DSS)?

- To allow health managers with limited data analysis skills to better interpret aggregate information from the RHIS
- To enable health managers to more rapidly and efficiently prepare their data for analysis and use for decision making
- Well suited for health managers at national, regional, district levels and below
Decision-Support System

- Data Source
- SQL
- OLAP
- Visualization
- Statistics
- Data Mining
- Models
- Reports, charts, and graphs

User

Retrospective

Descriptive/Prospective
Results: Producing quality data in Morocco

• **Intervention**: Restructuring MCH/FP facility-based information system

• Before RHIS scaling-up, the only contraceptive prevalence rates available to the MOH were national estimates from DHS, every 5 years

• After scaling-up, calculations from RHIS data provided the needed annual district and national level CPR estimates
Tx d'utilisation contraceptive par Province
Région Souss-Massa-Draa

Année 2002
Results: Improved use of info for decision making in Niger

- **Intervention**: Restructure infectious diseases reporting system
- Before scaling-up, meningitis vaccines and drugs were distributed equally among the districts
- After scaling-up, vaccines and drug were distributed in proportion to the meningitis attack rate by district
- Improved presentation of outbreak distribution was used by MOH to convince donors to supply needed vaccines (4.5 million doses)
The Meningitis Belt in Sub-Saharan Africa

Source: United Nations Country Team in Ethiopia (UNCT)
Weekly Meningitis Incident Cases, 1986 to 1996

Data Source: DSNIS/SG/MSP. Image Source: USAID.
Weekly Meningitis Incident Cases, November 1994 to July 1995

Mass Vaccination

Data Source: DSNIS/SG/MSP. Image Source: USAID.
Taux de Meningite par 100000 Habitants: Semaine 17, 1995
République du Niger

Source DSNIS/SG/MSP

Data Source: DSNIS/SG/MSP. Image Source: USAID.
Results: Improved use of info for decision making in Eritrea

- **Intervention**: general restructuring of the facility-based RHIS
- Before scaling-up to improved RHIS, vaccine stock outs went unreported
- After scaling-up, vaccine stock outs could be monitored monthly, and the relationship between stock outs and children vaccinated could be tracked
- Evidence of elevated stock out percentage alerted MOH to request additional vaccines from donors
BCG Stock-outs: Effect on Children Vaccinated

Eritrea: All Zones
2002 - 2003
Some Examples of Decision Support Systems (DSS)

• Niger 1995
  – DOS-based dBASE with Clipper and dGE Graphics enhancements

  – Microsoft Access based with Active-X Object development tools (Graphics Server and Map Objects LT)

• Future Systems
  – Web-based, with Visual Studio.NET and Graphics Server.NET
  – Web-based with Open Source solutions (PHP)
Some results of Decision Support Systems (DSS)

– Widely appreciated by district health managers as a planning and programming tool for health activities in their districts.
– The district managers have “ownership” of the data, and have higher motivation to insure the data is of good quality.
– More emphasis is needed on the development of an “information culture”, in which there is more motivation and incentives for managers to use data for decision-making (use of info workshops)
Future Directions for RHIS

- Development of Web-based systems across multiple platforms (Windows/Linux…, .NET/Open Source…)
- Use of Mobile Computers/PDA’s/Cell phones
- Use of Data Warehousing and Data Mining techniques
- Use of Data Visualization and Business Intelligence techniques
- Use of Database synchronization techniques
- Development of Patient-based systems
- Development of User Defined, Customizable Systems
Proposed Research Agenda (1)

• How can we measure the impact of integrated district RHIS on health system performance and health outcomes?
• What should be integrated and what not, and at what level?
• Develop a “generic” list of district level indicators as well as guidelines on how to develop such a list
• Research on validity and reliability of RHIS - going beyond technical aspects - looking at behavioral aspects around use of information
Proposed Research Agenda (2)

- How to better link routine service statistics to non-routine data collection
- What is the relationship between information presentation and use?
- How to involve communities in managing RHIS?
- Role of GIS technology in spatial analysis and health system planning
Websites

• MEASURE Evaluation Website:
  http://www.cpc.unc.edu/measure

• Middle Earth MOH Demo:
  http://snisnet.net/DSSDemoInstallFiles.zip

Kenya HIV/AIDS PEPFAR Program Monitoring Website:
  http://snisnet.net/KePMS.php

• Biostatistics and Epidemiology Website:
  http://www.jsi.com/measure/biostat.htm

• RHINONet:
  http://rhinonet.org

• Health Metrics Network:
  http://www.who.int/healthmetrics/

• DHS Stat Mapper:
  http://statmapper.mapsherpa.com/