

Computing and Global Health

Lecture 4

Medical Record Systems

Winter 2015

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Today's topics

- Paper to Digital, Nicki Dell
- Readings and assignments
- Medical Records in the US
- Global context
- Open MRS
- iSante
- General discussion

Readings and Assignments

- Homework 3
 - Fahad!
- Readings
 - Implementing electronic medical record systems in developing countries
 - Clinical decision support challenges
 - Open MSR

Date	Topic
Jan 7, 2015	Overview
Jan 14, 2015	Surveillance
Jan 21, 2015	Tracking
Jan 28, 2015	Medical records
Feb 4, 2015	Logistics
Feb 11, 2015	Patient support
Feb 18, 2015	Treatment support
Feb 25, 2015	Health worker support
Mar 4, 2015	Behavior change
Mar 11, 2015	Finance



Assignment 4

- Ins... standalone instance of... MRS
from [http://www.ada/](#)
- Conf... lam
Por... at Hogwarts Infirmary

Write a review of the 2005 “Implementing electronic medical record systems in developing countries” paper by Hamish Fraser et al. Assess how well this paper has withstood the test of time. How much of the paper is still relevant in 2015?

Expected length: one or two pages.

Medical Records in the US

- Hospitals / Clinics slow to adopt
 - 2008 use, about 20%
 - IT Spending in Healthcare is low (2%)
- Growing mandates for use
 - Medicare fines
 - HITECH incentives
- Debates on cost savings
- Issues about security and privacy

9 Reasons Doctors Hate EMRs

1. **Time-Consuming Data Entry**
2. **User Interfaces That Do Not Match Clinical Workflow**
3. **Interference with Face-to-Face Care**
4. **Insufficient Health Information Exchange**
5. **Information Overload**
6. **Mismatch Between Meaningful-Use Criteria and Clinical Practice**
7. **EHRs Threaten Practice Finances**
8. **EHRs Require Physicians to Perform Lower-Skilled Work**
9. **Template-Based Notes Degrade the Quality of Clinical Documentation**

TOP POST
513,019 VIEWS



31 Ways To Make Your Flight Attendant Hate You

JUST 26 REASONS PEOPLE HATE THE NEW ENGLAND PATRIOTS

10 reasons everybody hates the New England Patriots

EMR Summary

- Some clear advantages
 - Information available to health care providers
 - Simplification of some actions
 - Possibility of a patient sharing information across providers
- However
 - Disruptive to care process
 - Mismatch of benefits
 - Component of larger change to health care system

Benefits of Electronic Medical Records

- Ease of locating
- Legibility
- Validity checks
- Data extraction for research
- Link to external information relevant to health status (e.g., documents on drug interactions)
- Data available to multiple users
- Safe backup

Box 1 Benefits of EMR systems

- Improvement in legibility of clinical notes¹³
- Decision support for drug ordering, including allergy warnings and drug incompatibilities²⁴
- Reminders to prescribe drugs and administer vaccines^{24,25}
- Warnings for abnormal laboratory results²⁵
- Support for programme monitoring, including reporting outcomes, budgets and supplies^{26,27}
- Support for clinical research
- Management of chronic diseases such as diabetes, hypertension and heart failure^{2,28}

Key considerations for EMRs

Usability and Use in
Clinic Workflow

Improvement of patient
care and health system
operation

Implication on
organizational structure

Technology:
robustness, accuracy,
security, privacy

Medical Record Systems in Developing World

- Healthcare setting
 - Private urban hospitals
 - Public hospitals and clinics
- Different approach to treatment
 - Services by lower skilled workers: Nurses, CHWs
 - Very fast evaluation / treatment by physician

Country	Pop/Doc
Cuba	170
Russia	230
Iceland	280
Germany	300
USA	390
Japan	500
Brazil	900
Pakistan	1400
Zimbabwe	6300
DRC	9100
Uganda	12500
Niger	25000
Ethiopia	33500
Tanzania	50000

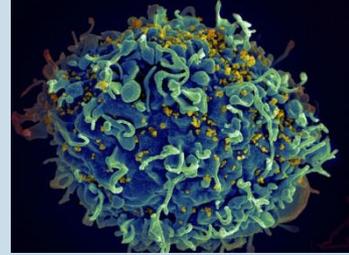
Driving case, infectious disease

- HIV and MDR TB
- Conditions requiring multiple rounds of treatment
 - Case history and test results
- Donor funding
 - Commitment to treating disease
 - Introduction of focused treatment and direct support for doctors
 - Developed country management of treatment programs



History of HIV and treatment

- c. 1910 Emergence of HIV in Congo
- 1960 Earliest documented cases
- 1980 AIDS cases identified in US
- 1984 HIV identified
- 1986 C. Everett Koop releases surgeon generals report
- 1987 AZT approved by FDA
- 1988 First world AIDS Day

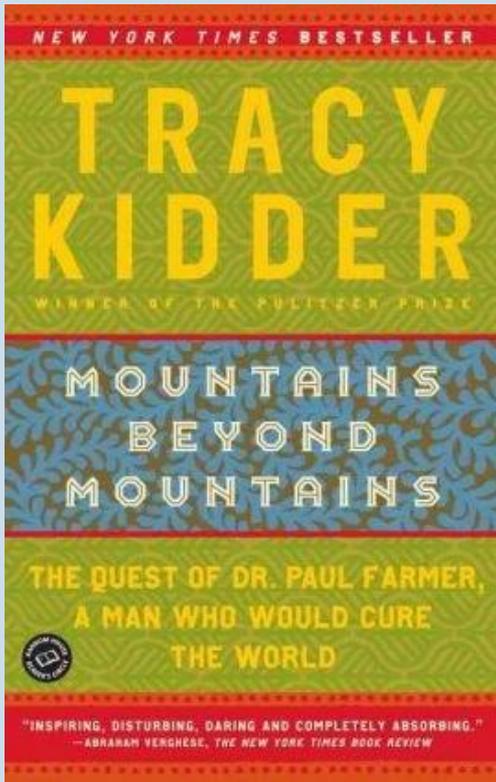


History of HIV and Treatment

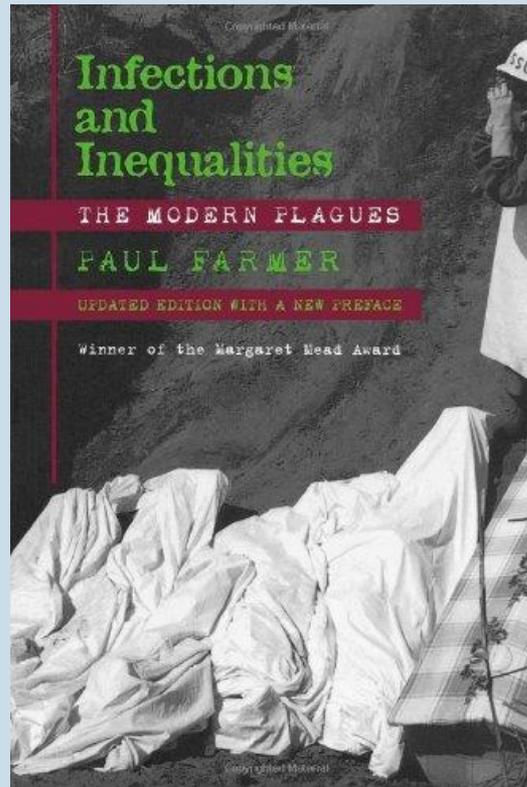
- 1997 HAART Therapy becomes standard in US
- 2000 Millennium Development Goals targets end of HIV transmission in 15 years
- 2001 Indian generic drug manufacture starts development of HIV drugs (\$350 per year, vs. \$10,500 for branded)
- 2002 Global fund established, FDA develops framework to allow poor countries to produce HIV drugs
- 2002 ART started in developing countries
- 2005 George W. Bush announces PEPFAR, \$15 Billion over five years
- 2008 PEPFAR reauthorized
- 2010 Greatly expanded use of ARVs in developing countries



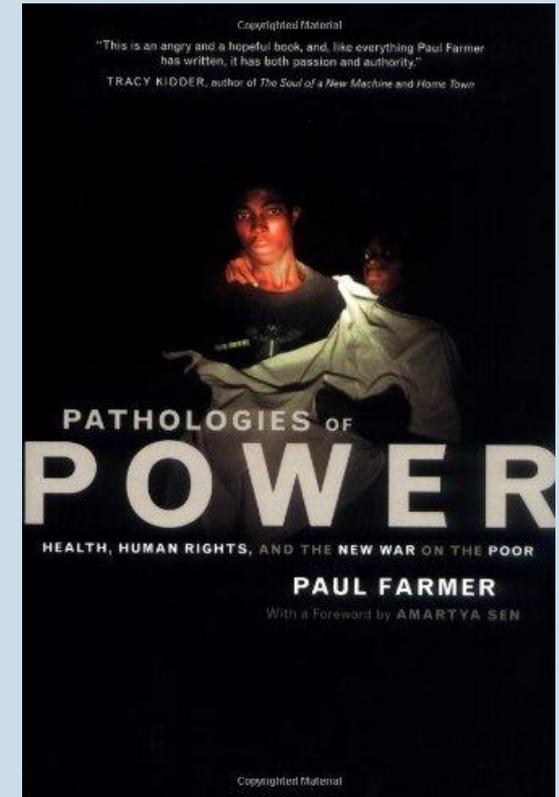
Paul Farmer



1/28/2015



University of Washington, Winter 2015



15

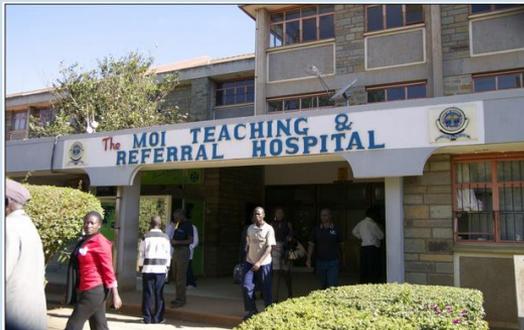
Partners in Health

- Founded by Paul Farmer
- Initial project, Zanmi Lasante (1987) in Haiti
 - Expanded to serve central plateau of Haiti, catchment population 1.2 million, employs 4,000 people
- Socios En Salud, Lima, Peru (1997)
 - Community health programs
 - Large scale TB study
- Other countries
 - Burundi, Malawi, Russia, Rwanda
 - Often a focus on HIV or TB
 - Multiple health facilities, large scale training, ties with MOH



AMPATH

- Academic Model Providing Access To Healthcare
- Moi University and teaching hospital
 - Partnership with a consortium of US universities led by Indiana University
- Manage health care in hospital/clinics across western Kenya





OpenMRS History



- Motivated by AMPATH model of using data in treatment
- (2004) Modeled after US system (Regenstrief)
- Connection with PIH
- Started with the data model
- Name selected with no reference to Open Source
- Launch February 2006 in Kenya
- Expanded with real software developers and Google Summer of Code



OpenMSR Development



- Philosophy of Participatory Design
 - Ask the doctors what they need
- 2008 – Rwanda rolls out OpenMRS with local capacity
- Formal non-profit organization
- A small number of software developers manage and implement key modules



OpenMRS Design

OpenMRS Find Patient Record interface showing a search bar and a table of patient records.

Identifier	Name	Gender	Age	Birthdate
1003A5 <small>(Recent)</small>	Harry Potter	M	24	01-Jun-1990
10014L <small>(Recent)</small>	Richard Robinson	M	65	19-Oct-1949

Showing 1 to 2 of 2 entries

OpenMRS Register a patient form with fields for Name, Gender, Birthdate, and Contact info.

What's the patient's birth date?
 Required
 Day: [] Month: [] Year: []
 Or
 Estimated Years: [] Estimated Months: []

OpenMRS patient profile for Hall, Paul (Male, 34 years old, born 13 Mar 1980). Patient ID: 10028A.

DIAGNOSIS

- Urinary incontinence
- Mental status change
- Cholera due to Vibrio Cholerae
- Rabies
- Electrolyte or Fluid Disorder
- Kwashiorkor
- ANEMIA, IRON DEFICIENCY
- Perineal laceration during delivery
- Cough

VISITS

- 25 Aug 2014: Outpatient
- 07 Mar 2014: Outpatient
- 22 Dec 2013: Outpatient
- 10 Sep 2013: Outpatient
- 29 Jun 2013 - 30 Jun 2013: Inpatient

VITALS

Last Vitals: 25 Aug 2014 09:25 PM

- Height (cm): 169cm
- Weight (kg): 211kg
- (Calculated) BMI: 73.9
- Temperature (C): 25°C
- Pulse: 115/min
- Respiratory rate: 56/min
- Blood Pressure: 180 / 139
- Blood oxygen saturation: 85%

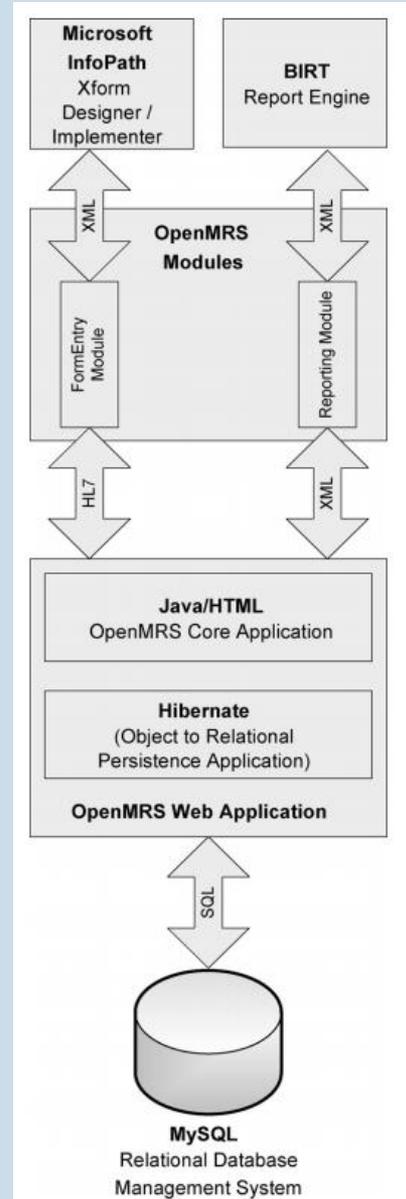
OpenMRS Active Visits table showing a list of visits for patient 10014L.

Patient ID	Name	Check-In	Last Seen
OpenMRS ID: 10014L	Richard Robinson		Discharge Inpatient Ward @ 25 Jan 2015, 15:45:27

Showing 1 to 1 of 1 entries

OpenMRS Visits history for a patient, showing a list of visits with details like date, time, and user.

- 25 Jan 2015 active time 03:38 PM
- Gonorrhea
- 22 Jun 2014 - 22 Jun 2014
- Bacterial Infection
- 11 Jun 2014 - 11 Jun 2014
- Retained placenta or membranes, without Hemorrhage
- 25 Mar 2014 - 25 Mar 2014
- VARICELLA
- 21 Feb 2014 - 24 Feb 2014
- Phlebitis and thrombophlebitis
- 19 Oct 2013 - 19 Oct 2013
- Nutritional Marasmus
- 10 Sep 2013 - 10 Sep 2013
- Musculoskeletal pain
- 06 Aug 2013 - 09 Aug 2013
- Hypertensive heart disease
- 26 Feb 2013 - 26 Feb 2013
- Infection by Strongyloides
- 07 Feb 2013 - 07 Feb 2013
- Decubitus Ulcer



Concepts in OpenMRS

Find Concept(s)

Find a concept by typing in its name or Id:

- Diarrhea
- Diabetes Mellitus
- DIASTOLIC BLOOD PRESSURE
- diarrhoea ⇒ Diarrhea
- DIARRHEA, CHRONIC
- DIAGNOSIS LIST
- Diagnosis date
- Diagnosis order
- Diagnosis certainty
- Diabetes Mellitus, Type II

Showing 1 to 10 of 35 entries

Show entries

Manage Concept Sources

[Add New Concept Source](#)

Current Concept Sources

Name	HL7 Code	Description
<input type="checkbox"/> SNOMED_CT	SCT	SNOMED Preferred mapping
<input type="checkbox"/> SNOMED_NP		Non-preferred SNOMED CT mappings
<input type="checkbox"/> ICD-10-WHO		ICD-10 WHO Version
<input type="checkbox"/> RxNORM		RxNORM CUI
<input type="checkbox"/> LOINC		LOINC code
<input type="checkbox"/> PH		Equivalent concept ID in Master Partners-in-Health Concept dictionary
<input type="checkbox"/> PH_Malawi		Partners In Health Malawi concept dictionary
<input type="checkbox"/> AMPATH		AMPATH concept dictionary
<input type="checkbox"/> SNOMED_MVP		MVP Namespace Identifier extensions to SNOMED CT
<input type="checkbox"/> org.openmrs.module.mdrtb		The required concepts for the MDR-TB module
<input type="checkbox"/> HL7 2.x Route of Administration HL70162		Members of value set from HL7 for routes of administration
<input type="checkbox"/> 3BT		Belgian Bilingual Bi-encoded Thesaurus (3BT)
<input type="checkbox"/> ICPC2		International Classification of Primary Care version 2 from WONCA.
<input type="checkbox"/> CIEL		Columbia International eHealth Laboratory concept ID
<input type="checkbox"/> org.openmrs.module.emrapl		Reference application module
<input type="checkbox"/> IMO_ProblemIT		Intelligent Medical Objects, Inc. problem/disease/finding datasource
<input type="checkbox"/> IMO_ProcedureIT		Intelligent Medical Objects, Inc. procedure/test datasource
<input type="checkbox"/> NDF-RT_NUI		Unique numeric indicator from NDF-RT drug information database

Viewing Concept: Malaria, confirmed

[Previous](#) | [Edit](#) | [Stats](#) | [Next](#) | [New](#)

Id 160148
UUID 160148AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
Locale [English](#) | [Spanish](#) | [French](#) | [Italian](#) | [Portuguese](#)
Fully Specified Name Malaria, confirmed
Synonyms
Search Terms
Short Name
Description
Class Diagnosis
Datatype N/A

Mappings

Relationship	Source	Code	Name
SAME-AS	CIEL	160148	
SAME-AS	PIH	7127	
NARROWER-THAN	SNOMED NP	61462000	
SAME-AS	IMO ProblemIT	1527785	
NARROWER-THAN	SNOMED NP	2931005	
NARROWER-THAN	ICD-10-WHO	B53.8	

Version
Created By Super User - 08 June 2011 16:46:19 PDT
Changed By Super User - 25 April 2013 12:05:06 PDT

Contained in Sets [General and unspecified diagnoses](#)

Resources [Similar Concepts](#)

Inclusion of medical ontologies and concept sources

Basic requirements

- Capture information about encounter
 - Vital signs
 - Test results
 - Observations and notes tied to medical terminology
- Link together encounters by individual

Challenges with OpenMRS

- Customization needed for different deployments
 - Local instances with programmer support
- PC and networking infrastructure
- Delayed data entry
- Data quality
- Inconsistent level of use
- Patient identity
 - Identities across different facilities or registrations

Mobile devices



- Should one build a mobile device interface to a medical records system?
- Use cases
 - Patient management (e.g., registration)
 - Data entry for clinical notes or cases
 - Access to test results and previous case data
 - Medication ordering
 - Clinical alerts
- Argument in favor
 - Mobile devices will have greater availability than computers
 - Technical challenge: Android application to provide more robust synchronization
- Other issues
 - Security and privacy
 - UI for small form factor

AMPATH deployment of mobile phones and OpenMRS

- Use case: Clinical Decision Support Systems

- Data available to clinician
- Reminders of actions to perform

- AMPATH

- Paper summaries
- Challenges: making summaries available, timeliness of summaries, printing summaries

- Solution

- Application built on top of ODK for access to OpenMRS

Testarius Paul Kungu 014021634-2

Male 35 Years 10 Months 11(11/11/11)
 HIV STATUS: EXPOSURE TO HIV (SAI-0006)

First Encounter: 11/05/2011 Highest WHO Stage: 6 Months HIV Rx Adherence: 100%

Problem List **Immunization** **Recent ARV's & CD Counts**

1. MALARIA (resolved - 1 year) 2. DPT (1/10) 1. TRIMETHOPRIM AND SULFAMETHOXAZOLE
 2. MUCICELA TEST (resolved)

ARV Side Effects
 NONE

Maternal pMTCT, Med / Period / Doses Given / Rx Length

1. ISOSUAPRINE / POSTPARTUM ANTIPARTUM ANTIPARTUM (Unknown Dose) / 44.0 Weeks
 2. LAMIVUDINE / POSTPARTUM ANTIPARTUM ANTIPARTUM (Unknown Dose) / 44.0 Weeks
 3. ZIDOVUDINE / POSTPARTUM ANTIPARTUM ANTIPARTUM (Unknown Dose) / 44.0 Weeks

Flowchart (Initial + Last Four Values)

WT (KG)	HT (CM)	CD4	VRAL.LD	HGB	SOFT	DNA PCR	ELISA	CREAT
55.0	150.0	200.0						
60.0	160.0	200.0						
60.0	160.0	200.0						
60.0	160.0	200.0						

Last 2 Check X-Rays (check chart or needed for ready order in 14-Feb-2012)
 No check entry includes available.

Reminders: (Write number next to each reminder)
 1. Please order HIV ELISA. Pt > 18 mo old with no valid ELISA result. (____)
 2. Consider starting ARV Meds. Pt > 5 yrs with positive DNA PCR AND CD4 Count < 350 (____)

014021634-2

Enter patient name

Recent OI Meds with Start Date

+ Add Missing OI Drug

Pilvas Chesogon Matey
 886EG-1
 RIFAMPICIN ISONIAZID
 PYRAZINAMIDE AND
 ETHAMBUTOL
 Unknown Date

Bivon Chesimba Okoko
 505KT-2
 Weight (KG)
 63.0 59.0 59.0
 26 May 04 Apr 03 Apr
 2006 2006 2006

Mandago Khikosa
 Makame
 126CH-2
 Hemoglobin (HGB)
 CD4
 ORD
 26 May
 2006

Michelle Awor
 Nyambwegi
 67EG-8

Alex Kuto Chobong
 673MO-7

Paperwork

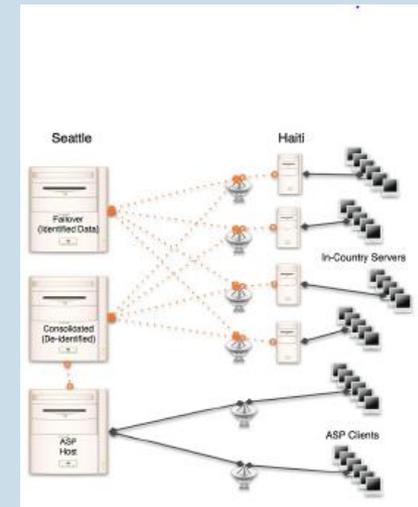
- How does use of paper relate to EMR
 - Completely parallel
 - Data written on paper, then entered in EMR
 - Data entered directly in EMR
- Level of use of EMR often varies substantially
 - Inside a facility
 - Between different facility inside a single system
 - Over time

Use cases

- How is the MRS really used?
- Collection of data for external reporting
- Collection of data for process improvement
- Providing information to clinician during patient care
- Providing decision support for clinician
- Interface with services

iSante MRS

- UW Clinical Research Group / I-Tech
 - CDC Funded project for EMR in Haiti
 - Started 2005
 - Windows IIS application
 - Roughly 70 clinics in Haiti
 - Local implementations, with daily backup of all data to a central server



While we subscribe to the widely held opinion that participatory design is almost essential to the successful adoption of an IT intervention, the initial requirements for the project were driven by PEPFAR programmatic needs. S. Wagner et al. [2009]

iSante



- Key implementation issues:
 - Infrastructure
 - Distance between implementers and deployment
 - Process of continuous development
- Focus of the tool is data entry and report generation
 - Progress when data entry done at patient visit time (as opposed to batch entry later)
 - Many monthly reports were still tabulated by hand
 - Uses to improve care: generate lists of missed appointments and people late for medication
- Patient privacy
 - Records restricted to individual clinics
 - Complications when people moved

Soins de santé primaire--consultation
Date de visite: 03/05/13 JJ/MM/AA

INFORMATIONS GÉNÉRALES

SIGNES VITAUX/ANTHROPOMETRIE

Pds 1000 kg lb TA 120 / 80

Temp 99 Le poids devrait être entre 0 et 500!

Nom et Prénom du Prestataire : Dr. Jones

MOTIFS DE CONSULTATION

EXAMEN PHYSIQUE

IMPRESSIONS CLINIQUES/DIAGNOSTIQUES

TUBERCULOSE

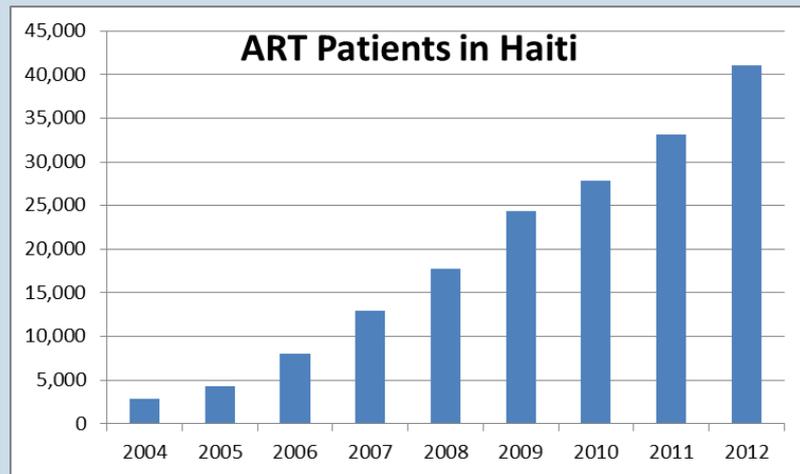
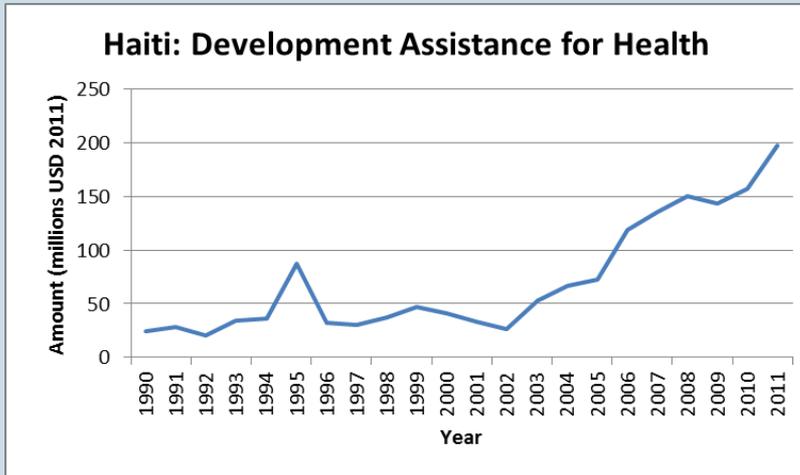
SURVEILLANCE DU TRAITEMENT (TB)

RESULTAT DU TRAITEMENT (TB)

CONDUITE A TENIR

MOTIF PLAN

Haiti Context



- Expansion of development assistance for health since 1990
- Scale-up of HIV antiretroviral therapy (ART)
- Scale up of electronic health information systems

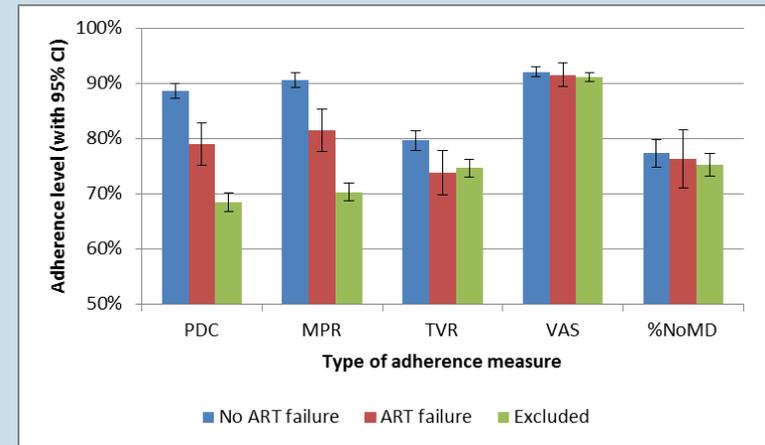


ART Adherence

- Relationship between HIV antiretroviral therapy (ART) adherence and HIV viral suppression is well-established
- Second-line ART regimens are expensive and not widely available
- No perfect measures of ART adherence
 - Self reported adherence
 - Pharmacy data (considered accurate in iSante)

I-Tech Study

- Compare pharmacy and self-report measures of adherence
 - Adherence measured by CD4 count
- Result
 - Pharmacy data a far stronger predictor
- Use
 - High risk patients can be given extra counseling



PDC, MPR: Pharmacy data
VAS, NoMD: Self-report



Medical Record Systems – Random thoughts and questions

- Is the developing world MRS problem the same as the developed world MRS problem?
- Is the key problem just keeping networked PCs up and running in a facility with poor infrastructure and limited IT support?
- What is the level of technical support necessary to run OpenMRS in a network of health facilities?
- Will OpenMRS be around in 10 years?
- How to do Medical Record Systems tie into the agendas of different ICT and Global Health organizations?