Background and Overview

**DHIS** – District Health information System
**HISP** – Health Information Systems Program

*Global Open Source Software development & application*

*ICT for better health*

*ICT for development*
Health Information Systems
Program and DHIS 2

- HISP is a global network headed and initiated at the Department of Informatics, University of Oslo since 1994
- DHIS 2 open source software developed, customized and used for reporting, analysis and dissemination of health data
- Core funding from Norad
- Partners: WAHO, UNICEF, WHO (PAHO/CAREC, WPRO, AFRO)
- Used by projects funded by e.g. USAID, CDC, GIZ
- http://dhis2.org
HISP collaborative *Network of Action*

**Health Information Systems**
*Research, Implementation Development*
Use of information for action
Integration & Interoperability

**Open Source Software**
Sharing across the world
*DHIS2*; National HIS & Individual tracking

**Capacity Building**
Training, Education, Research
Training of health workers
Graduate courses, Masters, PhD

Network of Action
*eksempel West Africa: HIS Centre of excellence*
DHIS – District Health information System
HISP – Health Information Systems Program
University of Oslo; education, research & development

Background:

- HISP started 1994 in “New” pos apartheid South Africa
- Development DHIS 1 started 1997 & 2002 National Standard
- DHIS 1 & HISP to India from 2000
- DHIS 1 spread to many countries in Africa from 2000
- PhD program in Oslo, 30 students from Africa!
DHIS 2: Web & Fully Open Source

- Development of DHIS2 in Java started 2004
- First implementation Kerala –India 2006
- With HMN & Sierra Leone from 2007
  - develop DHIS to HMN + “African requirements”
- The Gambia from 2009; + more West African countries
- In India: implemented in many states
  - + Bangladesh & Sri Lanka
- GIS developed with WHO + More functionality
- 2010: Full Health Information Architecture:
  - SDMX-HD Interoperability Standard launched in Accra

2011+: Kenya, Ghana, + & Cloud based infrastructure
HOW it started: South Africa 1994 /95
– Problems & challenges:

• **Inequity** between blacks & whites, rural & urban, urban & “peri-urban”, former “homelands”, etc.

• **“Equity”** main target
  – But how to know whether targets are achieved?

• **Need standard data from across the country on**
  – Health status & Health services provision

• **Problem:** No coordinated data system – no standards
  • Fragmented information systems

• HISP key actor in developing the new unified Health Information System in South Africa
Apartheid legacy: a fragmented and top down health structure as reflected and ‘reproduced’ every day by the information systems
Information infrastructure - Installed base
Strategy: Information management at district level
- From fragmentation to integration;
Decentralisation: From central control to local empowerment

A) Pre-apartheid centralised, vertical and fragmented structure in Atlantis (simplified).
B) Decentralised integrated district model
As according to the ANC Health Plan
MINISTRY OF HEALTH AND SOCIAL WELFARE
ZANZIBAR
REPRODUCTIVE AND CHILD HEALTH SERVICES

Name of Health Facility: CH MASINGI
District: NORTH
Month: NTH
No. of Working Days: 26

Family Planning Services

<table>
<thead>
<tr>
<th>Method</th>
<th>No. of New Clients</th>
<th>No. of Continuing Users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15-24 yrs</td>
<td>≥ 24 yrs</td>
</tr>
<tr>
<td>Oral Pills</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Injection</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>IUD</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Navajolet</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tubal Ligation</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Condoms</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other Methods</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Pregnant Mothers Attendance

<table>
<thead>
<tr>
<th>No. of First Visits</th>
<th>Prime Gravida</th>
<th>Multi Gravida</th>
<th>No. of Mothers at Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 20 weeks</td>
<td>7</td>
<td>23</td>
<td>EPH Gestosis / Preeclampsia</td>
</tr>
<tr>
<td>After 20 weeks</td>
<td>2</td>
<td>0</td>
<td>Anemia</td>
</tr>
<tr>
<td>Total First Visits</td>
<td>9</td>
<td>23</td>
<td>Malaria</td>
</tr>
<tr>
<td>Re-attendance</td>
<td>5</td>
<td>23</td>
<td>Syphilis</td>
</tr>
<tr>
<td>IPT at 20 - 28 weeks</td>
<td>14</td>
<td>0</td>
<td>Pregnancy below 18 years</td>
</tr>
<tr>
<td>IPT at 30 - 36 weeks</td>
<td>14</td>
<td>0</td>
<td>Pregnancy above 35 years</td>
</tr>
</tbody>
</table>

Daily Delivery Services

<table>
<thead>
<tr>
<th>No. of Deliveries</th>
<th>Prime</th>
<th>Multi</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended by Skilled Personnel</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Attended by TBA</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

Infant / Maternal Deaths

No. of Maternal Deaths
No. of Children died: 1 - 28 days: 0, 1 - 11 Months: 0, 1 - 5 Years: 0

Postnatal Services

No. of Mothers attending Postnatal care: 7th Day: 6, 14th Day: 2, 28th Day: 1, 42nd day: 0

Growth Assessment / Nutritional Status for Children under 5 years

<table>
<thead>
<tr>
<th>Age (Month)</th>
<th>Total Attendance (Male)</th>
<th>Total Attendance (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>Greco</td>
<td>Grey</td>
</tr>
<tr>
<td>0 - 11</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>12 - 23</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>24 - 35</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>36 - 46</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>14</td>
</tr>
</tbody>
</table>

Name of Service Provider: K Macrane
Designation: PHN
Signature: [Signature]
Date: 3/1/07
Record of patients seen
Summary of key information
Data analysis and use

Data entry into database

1.1 Number of Anaesthesia Cases per Month

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>Feb</td>
<td>425</td>
</tr>
<tr>
<td></td>
<td>Mar</td>
<td>386</td>
</tr>
<tr>
<td></td>
<td>Apr</td>
<td>434</td>
</tr>
<tr>
<td></td>
<td>May</td>
<td>471</td>
</tr>
<tr>
<td></td>
<td>Jun</td>
<td>461</td>
</tr>
<tr>
<td></td>
<td>Jul</td>
<td>426</td>
</tr>
<tr>
<td></td>
<td>Aug</td>
<td>459</td>
</tr>
<tr>
<td></td>
<td>Sep</td>
<td>451</td>
</tr>
<tr>
<td></td>
<td>Oct</td>
<td>456</td>
</tr>
<tr>
<td></td>
<td>Nov</td>
<td>452</td>
</tr>
<tr>
<td></td>
<td>Dec</td>
<td>426</td>
</tr>
<tr>
<td>2005</td>
<td>Jan</td>
<td>431</td>
</tr>
<tr>
<td></td>
<td>Feb</td>
<td>481</td>
</tr>
<tr>
<td></td>
<td>Mar</td>
<td>434</td>
</tr>
<tr>
<td></td>
<td>Apr</td>
<td>412</td>
</tr>
<tr>
<td></td>
<td>May</td>
<td>459</td>
</tr>
</tbody>
</table>

Total

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>4,445</td>
</tr>
<tr>
<td>2005</td>
<td>1,169</td>
</tr>
<tr>
<td>Grand Total</td>
<td>5,614</td>
</tr>
</tbody>
</table>

Graph showing monthly cases from January 2004 to May 2005.
NGOs (Non-gov. Organisations)

Clinics

DISTRICT INFORMATION SYSTEM & DATABASE

DISTRICT HEALTH MNG. TEAM

Health Committees

Local Government

Health & Welfare Forum

Unions

Special Interest Groups

Community Structures

COMMUNITY

Government

DISTRICT

Vertical Health Programs

Nutrition

TB

STD/ AIDS

Family planning

School Health

Referrals

Dental Services

Maternity/ Midwife units

GOVERNMENT

Health Services

Environmental Health

Psychiatric services

Day hospitals

Circumcision Surgeons

Private Sector

NGOs (Non-gov. Organisations)

Information from other sources, e.g. Birth / death registers; TB register, census data, socio-economic data

Information from other sources, e.g. Birth / death registers; TB register, census data, socio-economic data
Example: HMN architecture - National data warehouse
Data warehouse

- Data mart
- Meta data
- Visualising tools

DHIS 2

Web Portal

Dashboard

Graphs

Maps

Data capture from paper forms

Data from Mobile devises

Extract Transform Load

Getting data in - Data warehousing

Getting data out - Decision support systems

LMIS

HR

EMR

Mobile

Dashboards

Annual measles coverage %

Measles under 1 year coverage by district 2006

(Measles doses given to children < 1 year / total population < 1 year)

74.7  81.3  79.0  80.7  89.5  94.4  80.0  79.9  93.6  93.8

Data from

Mobile devises

Web Portal

Dashboard

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Maps

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Data warehouse

- Data mart
- Meta data
- Visualising tools
Output tailored to the range of devices and infrastructures

- SMS
- Lightweight Browser
- Android app or browser
- Tablet
- PC/laptop
Different levels of the health system – different needs for information

<table>
<thead>
<tr>
<th>Level of health system</th>
<th>Quantity of data</th>
<th>Data granularity</th>
<th>Information needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global/Region</td>
<td>Less data</td>
<td></td>
<td>Summary indicators General, e.g. MDG</td>
</tr>
<tr>
<td>Countries/Health Programs</td>
<td></td>
<td>Less data</td>
<td>Indicators National /program</td>
</tr>
<tr>
<td>District</td>
<td></td>
<td>More data</td>
<td>Indicators district management</td>
</tr>
<tr>
<td>Facility</td>
<td></td>
<td></td>
<td>Facility management</td>
</tr>
<tr>
<td>Patient</td>
<td></td>
<td></td>
<td>Patient records, tracking &amp; care</td>
</tr>
</tbody>
</table>
Hierarchy of data standards:

- Balancing national need for **standards** with local need for **flexibility** to include additional indicators
- All levels have freedom to define their own standards as long as they adhere to the standards of the level above (core data set)
Main components of a HIS (also the DHIS metadata model)

- The organisational hierarchy

  - service-delivery and administrative organisational units organised in a hierarchy of typically 4-6 levels and following administrative areas (country, province, district/municipality, sub-district)
DHIS metadata model cont.

✓ Collection forms, data elements, indicators and reports

✓ Data is collected/imported in data sets; typically in data entry forms that are typically grid-based

✓ “Atomic variables” => Flexibility. Each value captured in the form is linked to a data element which describes the phenomena captured, e.g. “Number of BCG vaccines given”, and referencing the organisation unit (e.g. a clinic) and the period (Sep 2008) the specific form is valid for. +

✓ Any other relevant data, e.g. Population census, data on number of beds, doctors, nurses etc.

✓ Data captured from paper forms – in health facility or at district level
BEFORE: data exported to higher levels on memory sticks
NOW: direct on national server
DHIS metadata model cont.

✓ Data elements and indicators

✓ Combining & analysing any data in formulas. For better comparative analysis indicators can be defined as formulas combining data elements, e.g.

BCG Coverage < 1 year =
100% x BCG vaccines given < 1 year / Population < 1 year

✓ Data elements and indicators can be grouped across many dimensions
✓ and the values are visualised in various output formats (tables, charts, maps).
Global distributed participatory development of DHIS 2 – SW end-user application which is used differently in each participating context. Is it possible?

- **India Use Context:** 30 states, each a country
  - Branching. Risk of forking Example India

- **Continuous DHIS 2 development:** common core, different local applications
Sierra Leone 2008-09: No National Internet
- aggregate data from all programs & services (horizontal integration)

Health facilities and hospitals reporting aggregate paper forms to HIS office at district

Data and tools available to all staff

Integrated data entry

Integrated data management

Other districts reporting to national

Information use

Feedback

Harmonised paper forms

HF1  HF2  HF3  .....  HFn
Mobile subscribers per 100 persons

Source: World Bank
Total bandwidth of communication cables to Africa

Source: AFRINIC
Cloud infrastructure - Africa since 2011, e.g. Kenya, Ghana

Online data use; web pivot reports, charts, maps

Online Data capture

Mobile Data Use

Mobile Data Capture

Online / / Offline

Offline data use application

Datamart
- pivot tables
Archive
- reports,
- Charts, maps

Online / / Offline

Browser

Offline Data Capture

BCG: 12
PENTA1: 10
PENTA2: 7
PENTA3: 11

Offline data use application

Datamart
- pivot tables
Archive
- reports,
- Charts, maps
Online central server vs Offline stand-alone HIS
Integrated health information architecture: Data warehouse
- integrating sub-systems, services, programs

- Services de prévention: Vaccination, Mère & enfants, etc.
- RH
- Logistique & médicament
- Rapportage Mobile
- Integration de technologies, données & grammes de santé
- Utilisateurs de données traitées et intégrées
- Utilisateurs de données primaires & fournisseur de données
- SIG
- Transfert électronique
- Interopérabilité: Saisie à partir du papier
- Rapport papier:
- Maladie spécifiques: TB, VIH/SIDA, Décl. Obligat, etc.
- iHRIS gestion RH
- Dossier patients
- Analyse de données
- Utilisateurs de données primaires & fournisseur
- De données
SDMX-HD: Statistical Data & Metadata Exchange for the Health Domain

SDMX-HD: Metadata “order” from DHIS to OpenMRS, e.g.: #deliveries @health centre X for month of May

DHIS: Data warehouse Statistical data

DHIS is calculating the indicator: Deliveries per midwife

SDMX-HD: Metadata “order” from DHIS to iHRIS, e.g.: #midwives @health centre X for month of May

OpenMRS: Medical records

SDMX-HD: Piloted in Sierra Leone and launched in Accra

iHRIS: Human Resource records
Number of clients per clinical worker per day, by district, 2008 and 2009

Integrated Human Resource and Health service data - made possible by systems integration & interoperability
India: Integrated architecture (design) of interoperable systems

An integrative “umbrella” across programs, sub-systems & infrastructures (paper, computers, Internet, mobile telephones)

Replicated at each
Administrative
Level:
National
State/Province
District

Data warehouse

Reports, GIS, Pivot, graphs, etc,

Import Electronic data

Export electronic summary data

Human Resource records

Medical Records

DHIS2

DHIS2/ NBIT

Household Tracking

Monthly summary reports

Data from / to Mobile telephones

Data capture from paper reports

OpenMRS / DHIS2 tracker

Register pregnant women & children for immunization

iHRIS