Software and Global Health: Information systems for the vaccine cold chain

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Vaccine Cold Chain Structure

Vaccine Manufacturers

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Primary vaccine store</th>
<th>Intermediate vaccine store</th>
<th>Health centre</th>
<th>Health post</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPV</td>
<td>-15°C to -25°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCG</td>
<td>2°C to +8°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles, MMR, MNIR</td>
<td>2°C to +8°C (2°C to 8°C also possible)</td>
<td>+2°C to +8°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YF</td>
<td>2°C to +8°C</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Hib freeze-dried</td>
<td>2°C to +8°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meningococcal A&amp;C</td>
<td>2°C to +8°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HepB</td>
<td>+2°C to +8°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPV</td>
<td>+2°C to +8°C</td>
<td>+2°C to +8°C Never Freeze</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DT, DTP, DTP Hep B</td>
<td></td>
<td>+2°C to +8°C Never Freeze</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hib liquid</td>
<td></td>
<td>+2°C to +8°C Never Freeze</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Td</td>
<td>+2°C to +8°C</td>
<td>+2°C to +8°C Never Freeze</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TT</td>
<td>+2°C to +8°C</td>
<td>+2°C to +8°C Never Freeze</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cold Chain
Cold Chain
Cold chain equipment software
Old vs. New Vaccines

- **4,100 doses**
  - Polio and Measles
  - $635
- **625 doses**
  - Rotavirus
  - $4687
Cold chain inventory

- What is the status of a country’s cold chain?
- How many refrigerators?
- What types are they?
- How old?
- Are they working?
- Are they big enough for the required vaccines?
- Where are they?

Country A: 5306 facilities, 4946 refrigerators
Country B: 827 facilities, 1426 refrigerators
Country C: 2846 facilities, 3153 refrigerators
Country D: 1605 facilities, 3080 refrigerators
Inventory Based Cold Chain Capacity Analysis

Cold Chain Planning Tool (CCEM)

- Health facility list
- Demographic data
- Refrigerator inventory
- Vaccine schedule
- Capacity analysis
- Reports
- Equipment requirement list
Cold Chain Equipment Manager (CCEM) Software
Reports

![Diagram of Electrical Availability (Country C)](image1)

![Diagram of Electrical Availability (Country B)](image2)

![Map of Locations with Health Centre Information](image3)

Nkasa Health Centre
- Facility type: Health centre - MoH
- Electricity level: Under 8 hours/day
- Kerosene: Not Available
- Gas: Not Available
- Stock-outs: No
- Base Surplus: Over 30% surplus
- Population: 17742
- Fridges: MK304, V170 EK
CCEI Data Standards

• Goal: Agree on standards to allow tools to interoperate
• Wide range of tools available
• Data integration problem is central
• Need for multiple software tools
HISP / DHIS2

- **HISP**: International effort with hubs in Norway, India, Vietnam, South Africa
- **DHIS2**: Health indicator reporting software
  - Web based, to data base back end
- **Wide scale deployment**
  - Roughly thirty countries, including nationwide use in some countries
  - State reporting in roughly half the states of India
- [http://www.hispindia.org/](http://www.hispindia.org/)
- [http://dhis2.org/](http://dhis2.org/)
Incorporating CCEM into DHIS2

• Much better architecture
• Add to existing system, as opposed to introducing a new system
• Implementation of inventory component and reports by HISP India
• Working prototypes available
Unifying cold chain inventory tools

- Wide range of cold chain inventory tools are used
- Is it possible to bridge between the tools
  - Deal with the reality of Health Information System software
  - Support migration to contemporary software tools
- General approach
  - Cold chain inventory model with conversion/visualization tool
- One button import/export
ODK Tables

• Cold chain data sets natural match for tables
• Use cases for ODK Tables
  • Inventory construction
  • Facility visits
• Benin data set implemented in Tables
Temperature monitoring

- Real time reporting of vaccine refrigerator temperatures
- Key for sustainable use of temperature monitoring system is a back end that is linked to a national system
(Simple) Health System Modeling

- CCEM relies on very simple models
  - Storage requirement = doses \times \text{volume per dose}
- The challenge for application like CCEM is to make the modeling easy to use.
- Simulation based games solve the same interface problems that come up in CCEM.
  - Assignment of assets to locations on a map
  - Setting conditions over regions
  - Ease of use / learnability essential
Reminders and Alerts
Countries