Cold Chain Equipment Planning with CCEM

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PATH

My background

University of Washington, Computer Science and Engineering
- On faculty since 1986
- Professional interests
  - Computing for low resource environments
  - Educational technology
  - Software engineering
  - Algorithms
- On leave 2009-2011 with PATH

PATH HMIS Projects
- CCEM: Cold chain equipment manager
- FoneAstra: Temperature monitoring
- SmartConnect: Data communication
- Cell Phones for TB Case Screening in TZ
- Systems requirements for TB surveillance
- Mobile Midwife Project

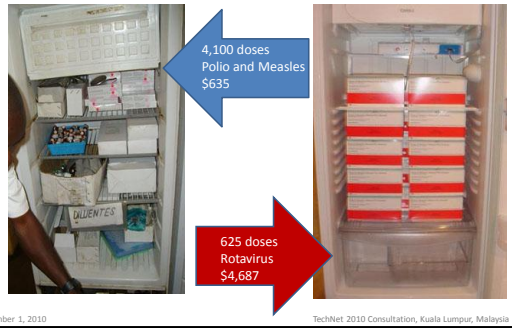
Outline

1. Problem Statement
2. CCEM Application
3. Project Status
4. Inventory-based Cold Chain Planning

CCEM Problem Statement

- Understand national cold chain capacity
  - Especially for introduction of new vaccines
  - Does the country have capacity
  - Develop a plan for meeting capacity needs
- Solution
  - Inventory of cold chain equipment
  - Analytics and modeling
  - Implementation: CCEM

Old vs. New Vaccines

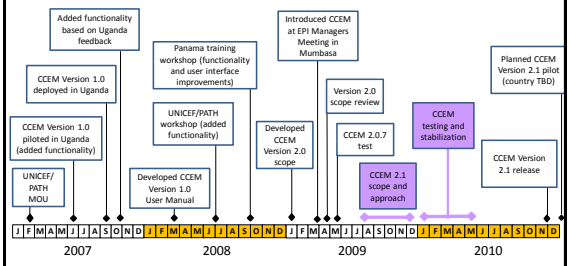


Cold Chain Inventory

CCEM History

- 2006. CCEM development starts at the TechNet Consultation in Mexico City with the idea that an equipment inventory and planning tool would support systematic management of the cold chain. *(Dr. Fernando Perez, MOH Peru)*
- 2007. In collaboration with Uganda EPI team, WHO/IST, and UNICEF/TACRO, CCEM is piloted.
- 2009. CCEM is migrated to MS Access 2007, with a new user interface and deploying software engineering principles.

CCEM roadmap

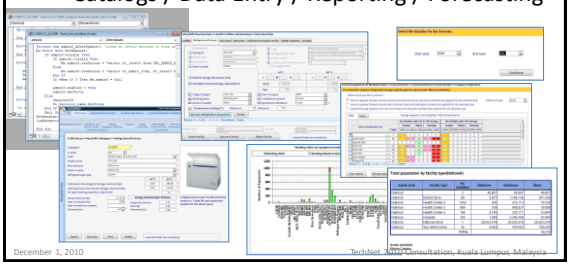


CCEM Vision

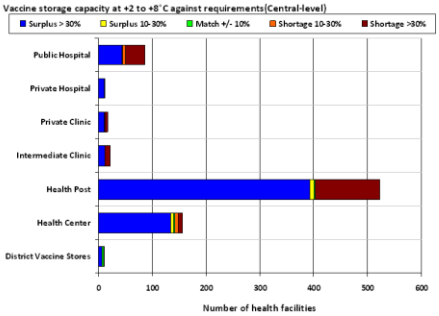
- Equipment Inventory + Analysis Tools
- Capture expertise of cold chain experts in software
- Provide basic tool for analyzing a nation's cold chain
- Enable countries to do their own cold chain analysis and equipment planning
- Model:
  - Cold chain inventory and capacity
  - Inventory changes
  - Cold chain and supply chain policy changes

CCEM Application

- Visual Basic / Microsoft Access Application
- Catalogs / Data Entry / Reporting / Forecasting

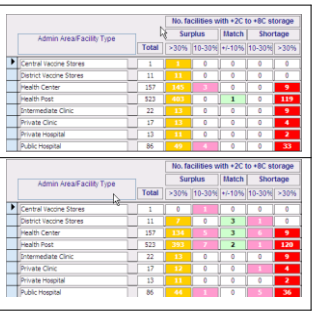


Scenario 1 - Cold chain capacity analysis



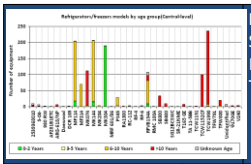
Scenario 2 - PCV7 introduction

Before PCV7



After PCV7

Scenario 3 - Equipment removal



Inventory report: Significant numbers of MK074, TCW1152CF, and TCW1990 are >10 years old

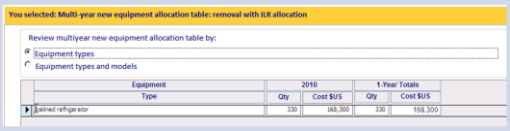
Forecast report: Impact of removal of MK074, TCW1152CF and TCW1990 on capacity

Admin Area/Facility Type	Total	No. facilities with +2C to +8C storage: Surplus >30%	Surplus 10-30%	Match +/-10%	Shortage 10-30%	Shortage >30%
Central Vaccine Stores	1	1	0	0	0	0
District Vaccine Stores	11	6	1	2	1	1
Health Center	157	126	5	2	1	23
Health Post	523	238	0	0	0	285
Intermediate Clinic	22	8	0	0	0	14
Private Clinic	17	5	0	0	0	12
Private Hospital	13	4	0	0	0	9
Public Hospital	86	23	1	0	0	62

Scenario 4 -Equipment allocation

CCEM will allocate equipment to meet capacity shortages using user-set equipment preferences, evaluating energy availability, climate zones, and identification of the least cost (capital) option.

If a single ILR model is selected for allocation to meet capacity needs for all facilities below the District Vaccine Store, CCEM generates the following results:



However, for 144 facilities with electricity <8 hours per day, an ILR is not an option....

Scenario 5 -Multiyear forecast and planning

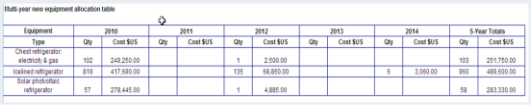
CCEM generates equipment requirements to meet capacity shortages in multiyear plans

1. CCEM user requests cold chain capacity impact analysis of removing TCW 2000, TCW1152CF, and MK 074 over 10 years old in Year 1 of a 5 year plan.

2. CCEM user requests capacity impact analysis of adding PCV7 vaccine in Year 3 and Year 4, then adding rotavirus vaccine in Year 5 of this 5 year plan.

3. CCEM user requests multiyear equipment budget report associated with the automated allocation of equipment for all facilities below the District Vaccine Store needing additional cold chain capacity in each year of the 5 year plan. User selects a specific ILR model, EG refrigerator model, and solar refrigerator model for CCEM to evaluate for suitability.

Results:



Where CCEM is today

- CCEM 2 and Supporting Materials available online at www.path.org and www.technet21.org
- Ongoing collaboration with Kenya EPI team to pilot CCEM 2 for cold chain inventory and planning
- Regional technical workshop under discussion with the WHO regional team for ESAR

CCEM Core Data Elements

1. Administrative hierarchy
   - Country, Province, Region, District, Subdistrict
2. Facilities and vaccine stores
   - Facility info
   - Demographics: Population, Live births
3. Refrigerator Inventory

Software Development Challenges

- Challenges and experiences from developing CCEM are not unique
- Lessons from CCEM
  - Developing software is hard!
  - Software engineering tools helped
    - Issue tracking
    - Configuration management
    - Test cases
  - Absolutely critical to have strong public health input and domain knowledge
  - Important to figure out how to bridge between public health and computing technology

Wishlist for the future

- Robust database for inventory
- Multiple mechanisms for updates
- Core inventory / geographic info with country customization
- Geographic information system
- Web accessible (with access control)
- Extensible analytics and visualization



Acknowledgements

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