ICTD Capstone Software Design for Underserved Populations

CSE 482B

COVID VACCINES, APRIL 5, 2021

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Schedule

Today

- Covid-19 vaccine background
- 10:40 - Meeting with Group 1: Vaccine Stock Tracker
- 11:00 - Meeting with Group 5: Vaccine Impact Modeling tool

Thursday

- 10:00 – Meeting with Group 2: Vaccine Passport
- 10:25 – Meeting with Group 3: Immunization Campaign Planning
- 10:50 – Meeting with Group 4: Notification / Registration Tool

Projects

1. Vaccine Stock Tracker
2. Vaccine Passport
3. Immunization Campaign Planning System
4. Notification / Registration tool
5. Vaccine Impact Modelling tool

Admin stuff

Weekly group turn ins through Canvas

- This week: Use cases. Progress report.

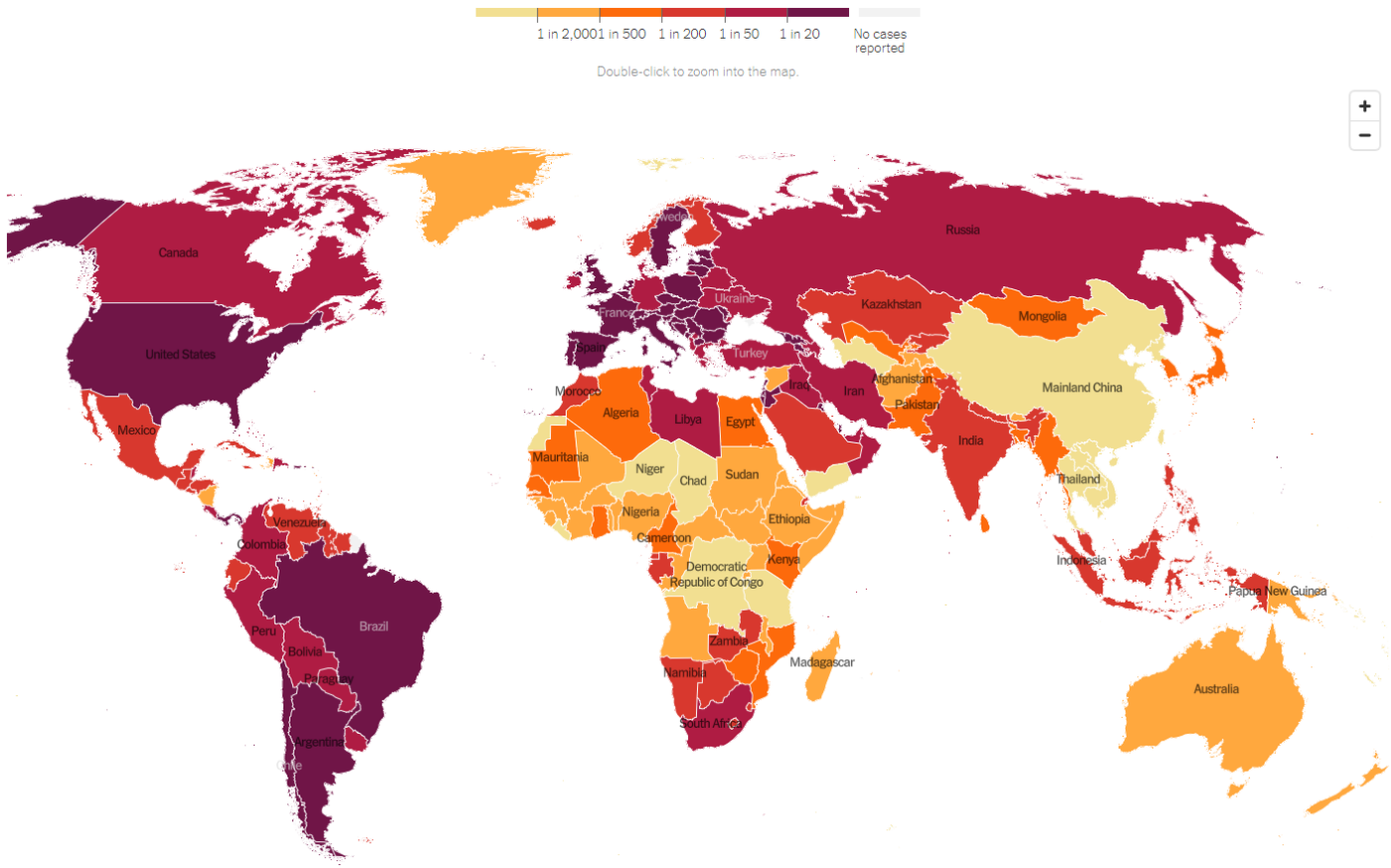
First presentation, Thursday April 15

- Project pitch
- Slides
- 15 minutes per group

Review slides from 4/1 for course mechanics

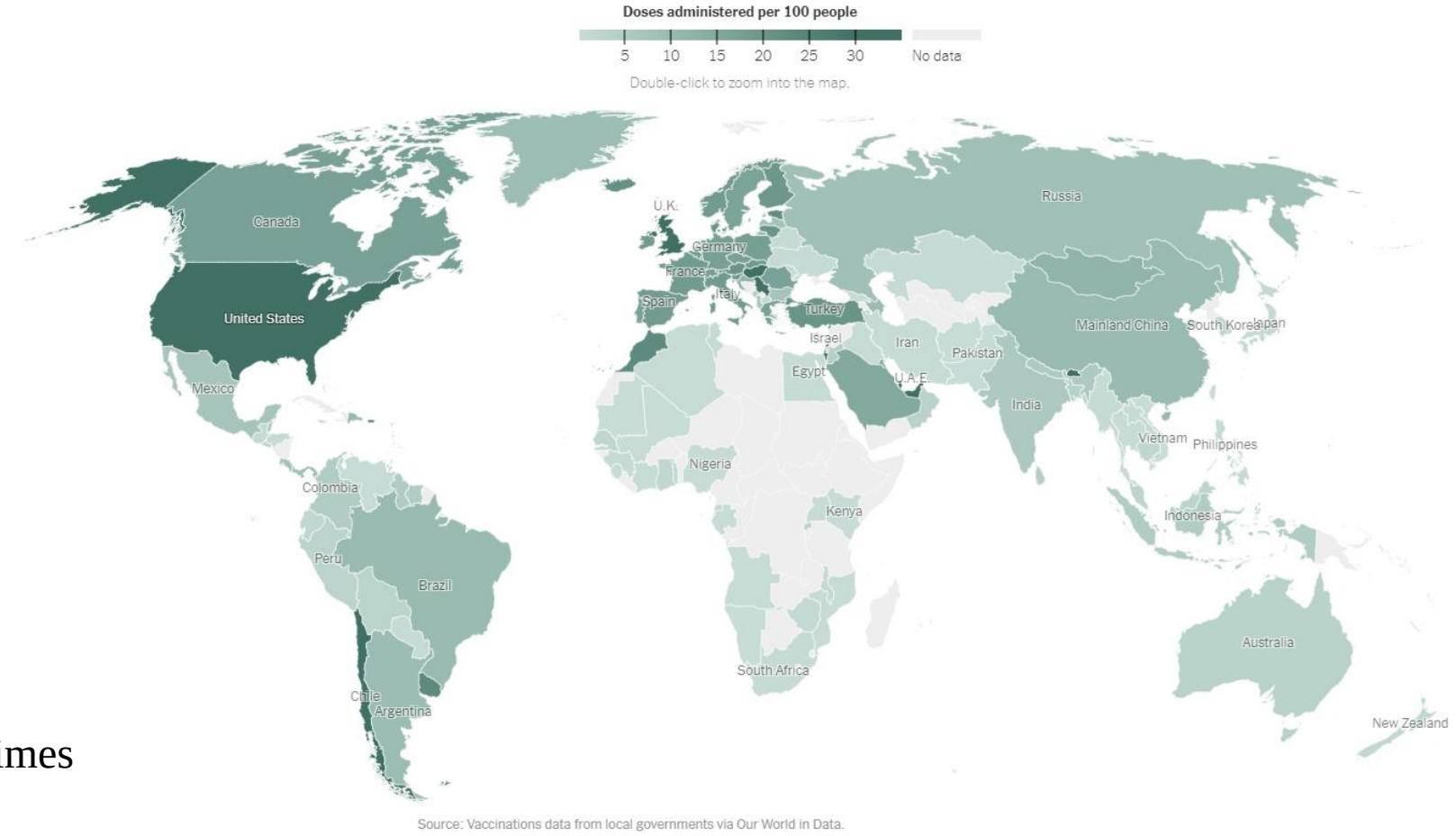
Goal of the course is for students to have a *successful experience, as a team, developing interesting software*

Global impact of Covid



New York Times

Global Covid-19 Vaccination

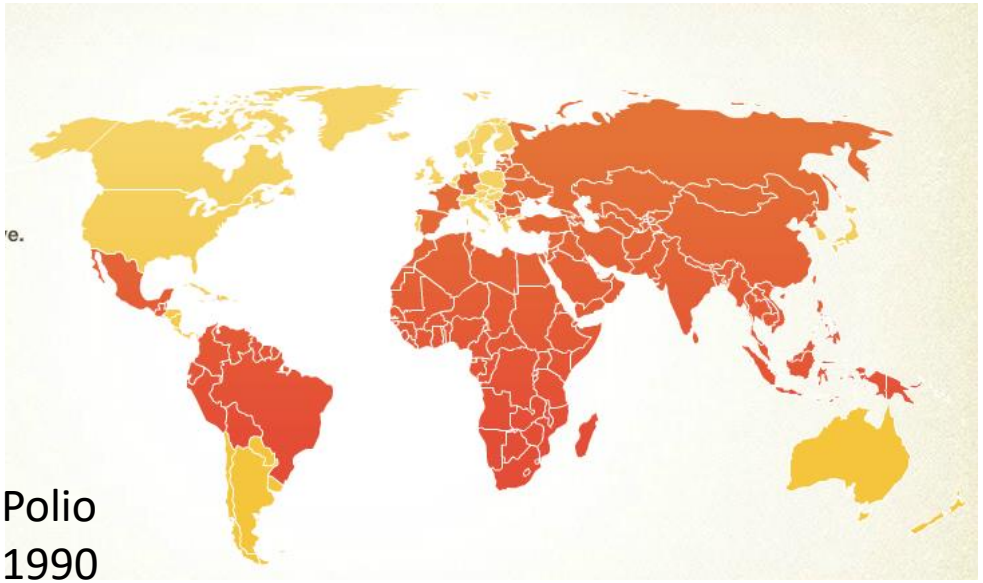


New York Times

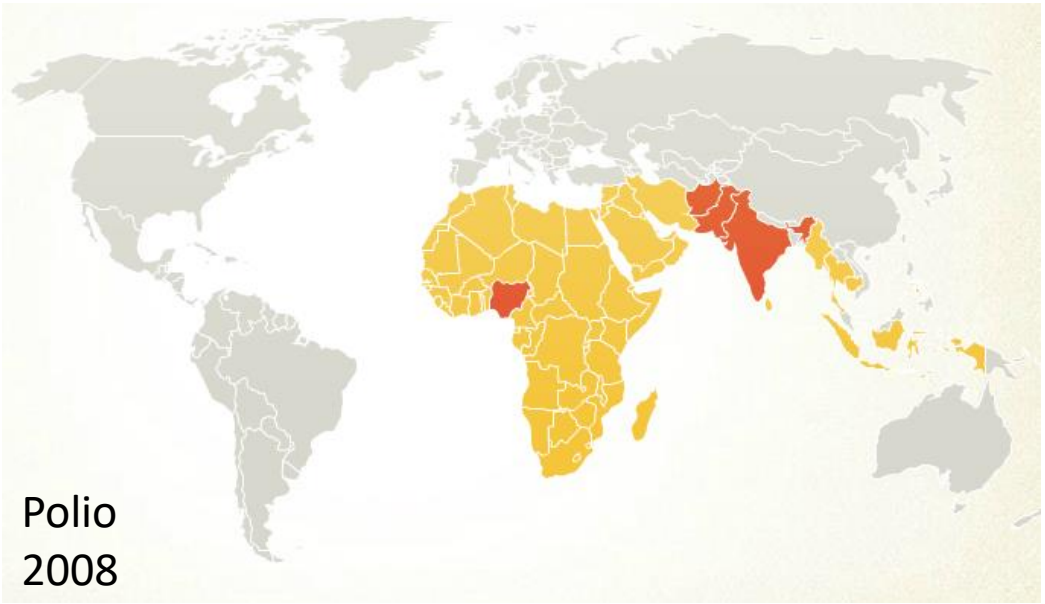
Immunization is one of the world's most effective health interventions

- Wide coverage of basic vaccines
  - Diphtheria, Pertussis, Tetanus: 77% in poorest countries
  - Tremendous reduction in deaths
  - Some diseases close to elimination

Polio (2018), 3 endemic countries, 29 cases of wild polio



Polio
1990



Polio
2008

How do vaccines work

Antibodies – body “learns” how to defend itself from diseases

Vaccination history from small pox

Weak version of the disease leads to immunity

Gradual evolution in technique

- Low grade exposure
- Weakened version of the disease
- Dead version of the disease
- Genetically engineered to target aspects of the disease
- mRNA vaccines

Covid Vaccines

13 Authorized/approved vaccines (As of April 1, 2021), about 50 in development

mRNA
- Pfizer
- Moderna

Viral vector
- AstraZeneca
- Sputnik (Russia)
- Johnson and Johnson

Inactivated
- Beijing Institute of Biological Products
- Sinopharm
- Covaxin (India)

Vaccine development and approval

Vaccine development is a well understood process

Usually, vaccine development is very slow and requires multiple types of approval

Standard trial regime: Phase 1, Phase 2, Phase 3

Lots of things are evaluated in release of a new vaccine, or new formulation of a vaccine
- Efficacy, side effects, dosage, stability
- All this takes a long, long time

However, in an emergency, things move faster, such as the Ebola vaccine
- All approved Covid vaccines have been approved under emergency use provisions

Companies had been working on vaccines for other SARS type viruses
- So when Covid happened, lots of the work had been one

Lots of uncertainty about how well vaccines and vaccine programs actually work

Global Development

Global organizations set policy

World Health Organization

unicef

GAVI
THE GLOBAL ALLIANCE FOR VACCINES & IMMUNIZATION

Donors

USAID
FROM THE AMERICAN PEOPLE

DFID Department for International Development

BILL & MELINDA GATES foundation

Country ministries

MINISTRY OF HEALTH
REPUBLIC OF GHANA

MAIL

Global Organizations

UNICEF
- Support for immunization programs

WHO
- Support for health programs
- Global health governance

GAVI
- Global vaccine alliance
- Financial support for vaccines in low and middle income countries

DONORS
- Supply the money and influence programs

NGOs
- Global implementation

Funding Covid Vaccines

Covid vaccine cost between $8 and $30 per dose

- 10 dose vials
- Most vaccines require two doses

Rich countries pre-ordered vast supplies of vaccines

Poor countries lack resources to buy adequate supplies and immunization has generally been supported globally

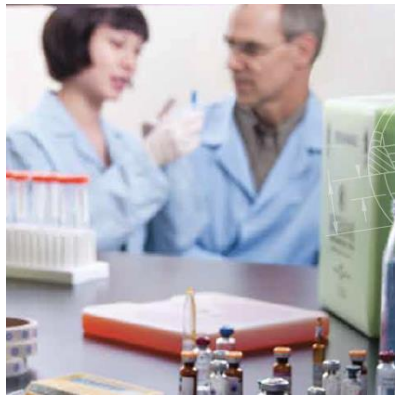
- Strong moral argument for global immunization
- And the pandemic will only be controlled with global immunization

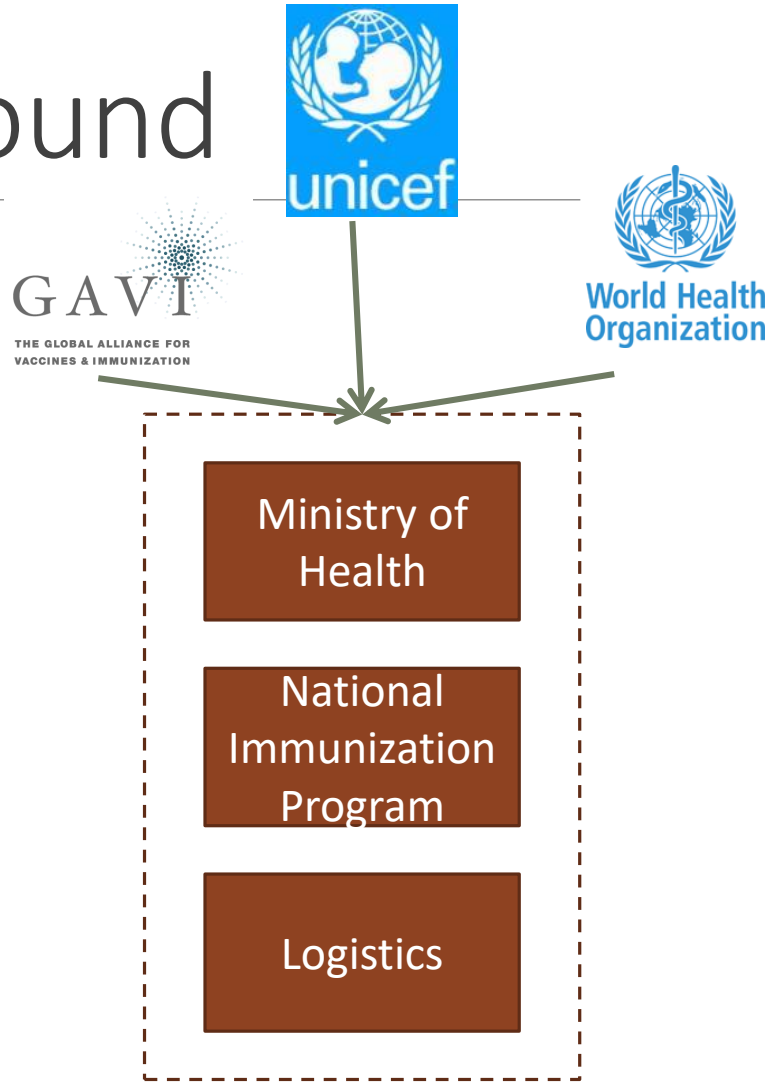
Covax is the funding organization set up by Gavi for supporting Covid vaccines

Immunization Domain Background

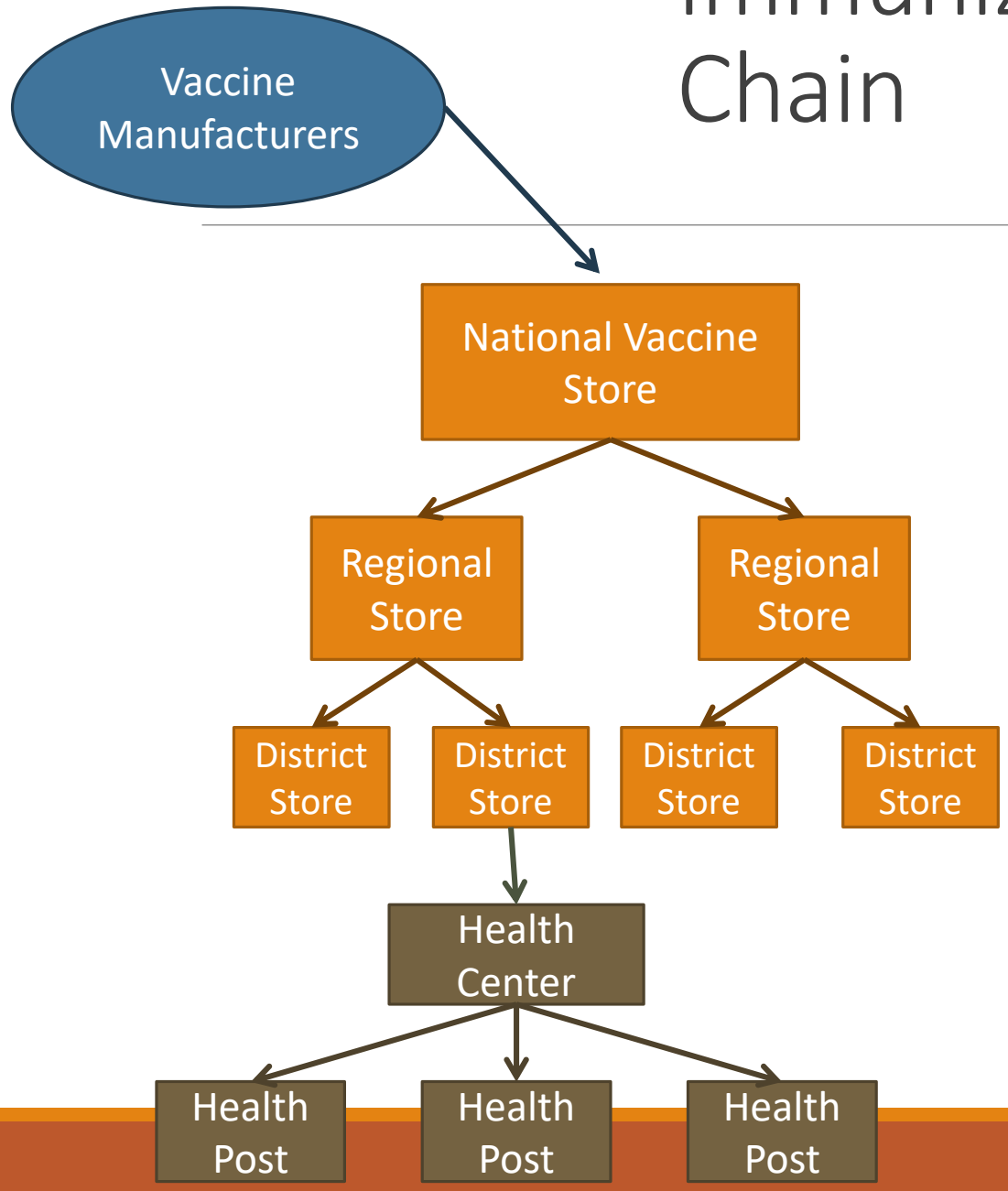
Vaccines are the same around the world

For many countries – immunization is managed and funded globally





Immunization Cold Chain



Immunization Cold Chain Challenges

Ensure that all countries have high quality vaccine cold chains

- Working equipment at all points in vaccine supply chain
- Sufficient capacity for vaccines

Refrigerators need power

- Grid power, Solar power, Gas, Kerosene
- Many areas suffer from regular power outages
- Desire to replace Kerosene / Gas equipment with Solar

Equipment upgrades

- Identify needs and determine order size
- Remove obsolete equipment
- Ensure proper installation
- Establish repair infrastructure
- Monitoring of equipment condition

Cold Chain Equipment Inventories

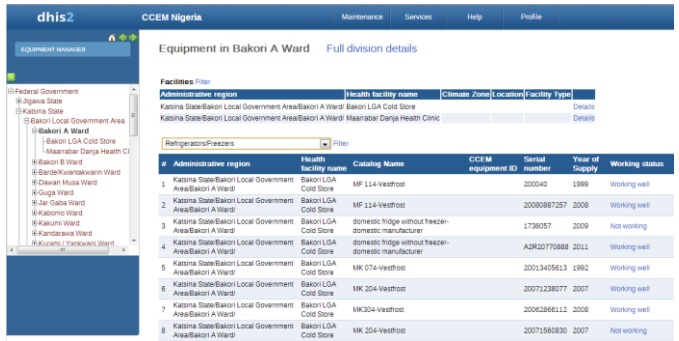
No accurate global equipment inventories

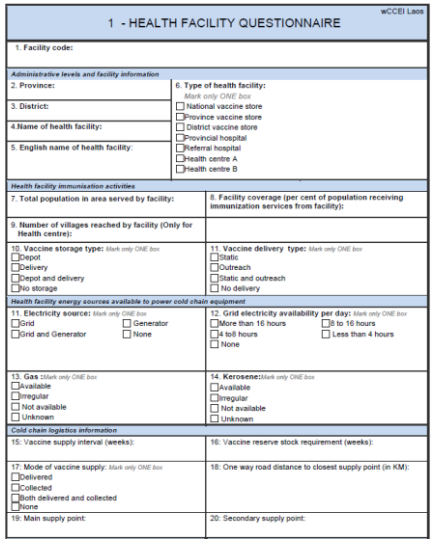
Inconsistent at the country level
- Inventories often become out of date
- Not updated for equipment changes
- Health facility information is also a challenge

Periodic efforts to collect inventory information for reporting
- Often restricted to sampling

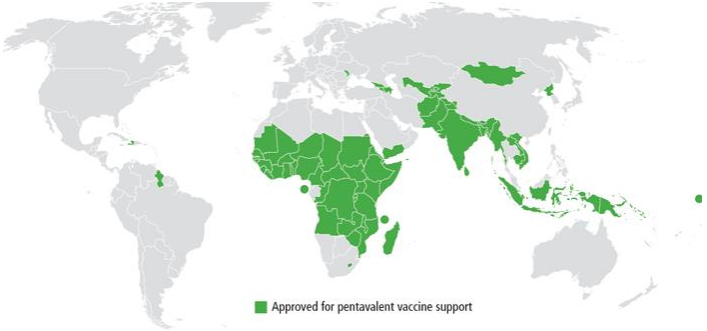
Fragmented data sources

Different health systems inside a country
- Public, Private, NGO, Faith-based





Vision



Country Cold Chain Information System

Country Cold Chain Information System

Country Cold Chain Information System

Global Cold Chain Information System

THE REPUBLIC OF UGANDA
MINISTRY OF HEALTH

JOHNS HOPKINS UNIVERSITY

unicef

World Health Organization

dulas

GAVI
THE GLOBAL ALLIANCE FOR VACCINES & IMMUNIZATION

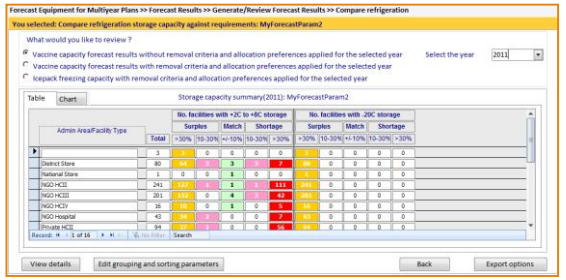
BILL & MELINDA GATES foundation

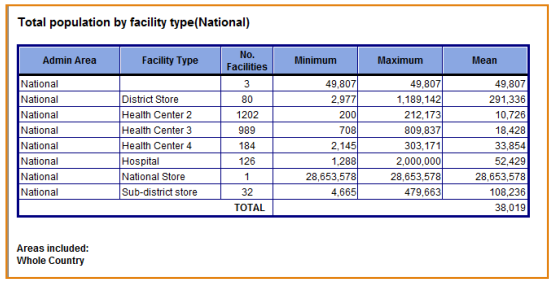
Part I: Visualizing the Cold Chain

Map based visualization
- GIS Coords
- Regions

Global Management Questions
- Country summaries
- Equipment trends
- Integrated analysis tools and models

Country Cold Chain Management
- Equipment management
- Allocation
- Reporting

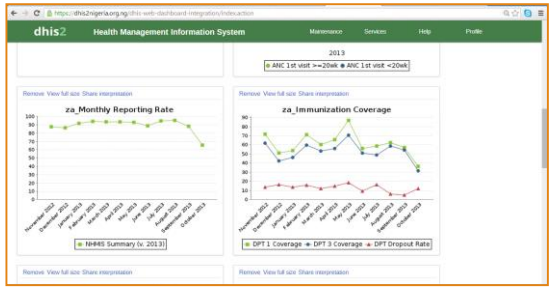


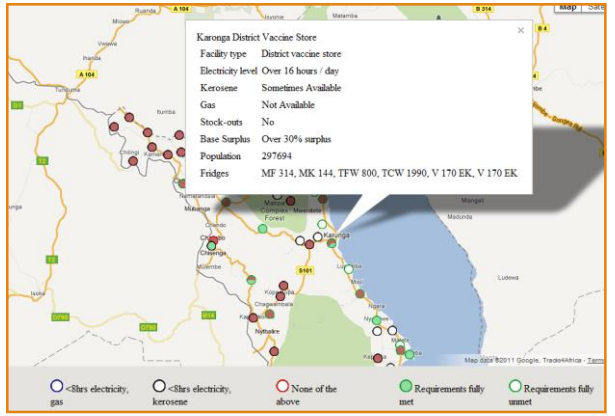


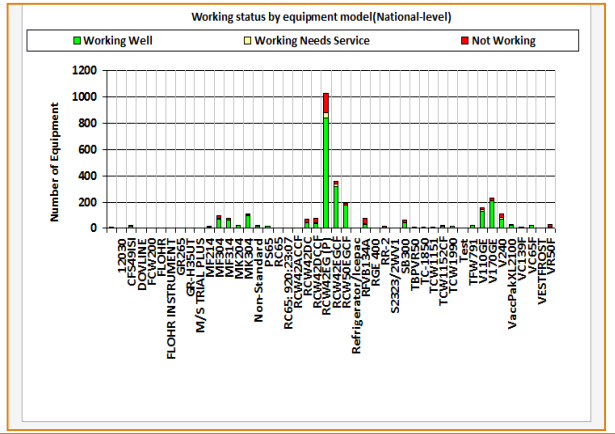
Total population by facility type(National)

Admin Area	Facility Type	No. Facilities	Minimum	Maximum	Mean
National		3	49,807	49,807	49,807
National	District Store	80	2,977	1,189,142	291,336
National	Health Center 2	1202	200	212,173	10,726
National	Health Center 3	989	708	809,837	18,428
National	Health Center 4	184	2,145	303,171	33,854
National	Hospital	126	1,288	2,000,000	52,429
National	National Store	1	28,653,578	28,653,578	28,653,578
National	Sub-district store	32	4,665	479,663	108,236
		TOTAL			38,019

Areas included:
Whole Country







Part II: Data Management

Cold Chain Equipment Inventory

- Basic equipment and facility information
- Tracking of performance and maintenance

Remote data updates

- Keeping data up to date is the critical challenge
- District cold chain supervisor responsible for managing equipment
- Mobile App is feasible for district supervisors

Integrate with other Health Information Systems

Ownership by the country

ODK-X

Mobile data collection on Android Phones. Project started at University of Washington by Professor Gaetano Borriello

Open Data Kit 1.0 aka ODK

- Submission of forms

Open Data Kit 2.0 aka ODK-X

- Synchronization with a database

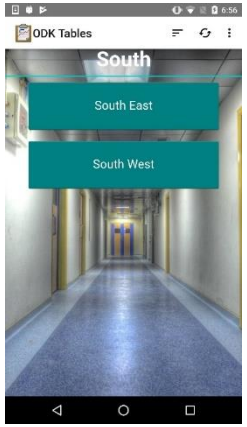
Open source tools. Strong commitment to contributing to global good software

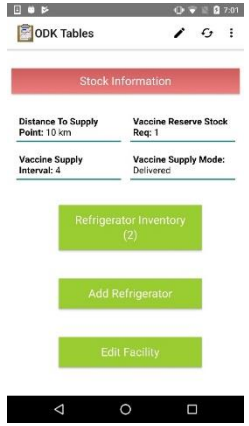
Cold Chain App

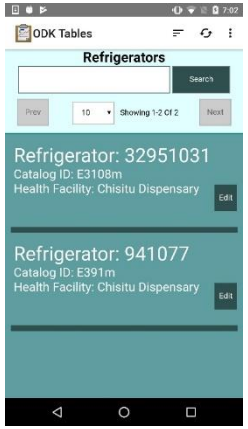
App built on top of the ODK-X platform

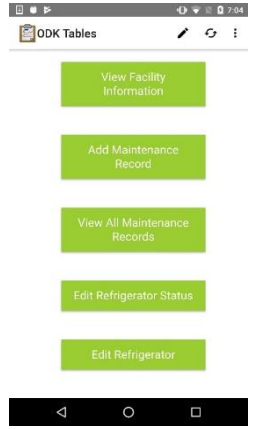
- Combination of ODK Survey and ODK Tables
- Written in Java Script

Manage a database of health facilities and refrigerators associated with facilities

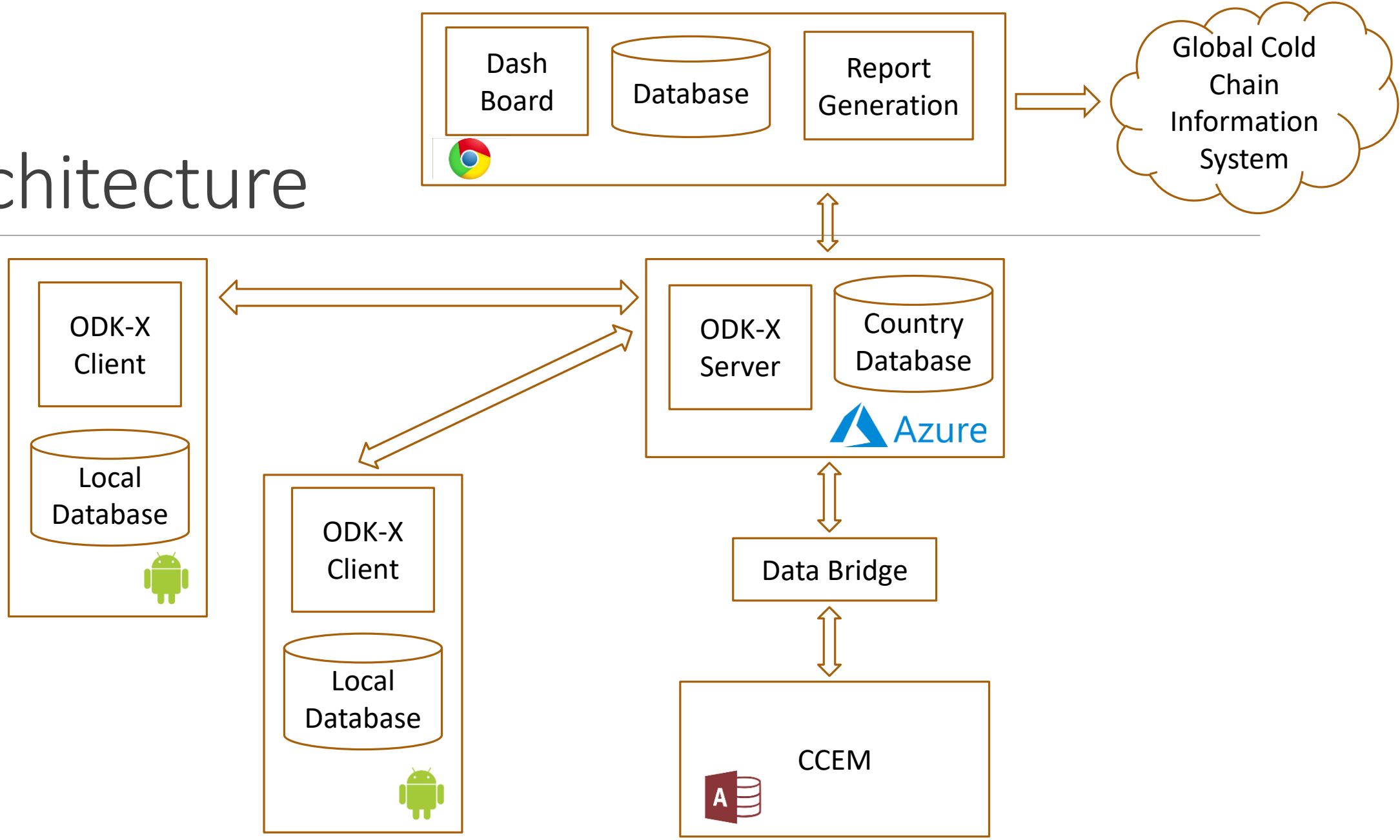








Architecture



Project Status

Cold Chain Visualization project – team YAASS

Cold Chain App prototype

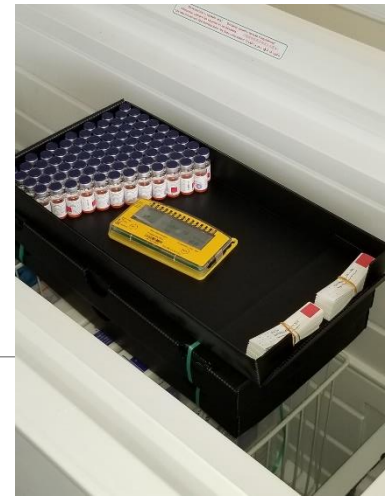
WHO Deployment

- Haiti, Pakistan, DRC, Bangladesh
- Sentinel Surveillance officers

GAVI Deployment – Uganda

- Two regions - Kampala and Wakiso (13 Districts)
- Expansion to national scale underway

Questions and Discussion



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