Improving vaccine supply chains using mobile technology

Experiences from India

May 2015

Arun Ramanujapuram (Logistimo)
Dr. Bhrigu Kapuria (ITSU)

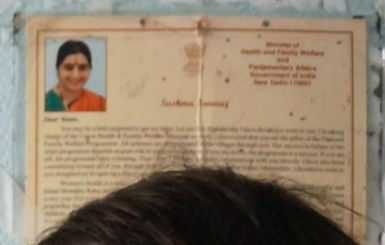# Agenda

- Context, Challenges, Solution
  - By Arun Ramanujapuram

- Impact in Uttar Pradesh, India
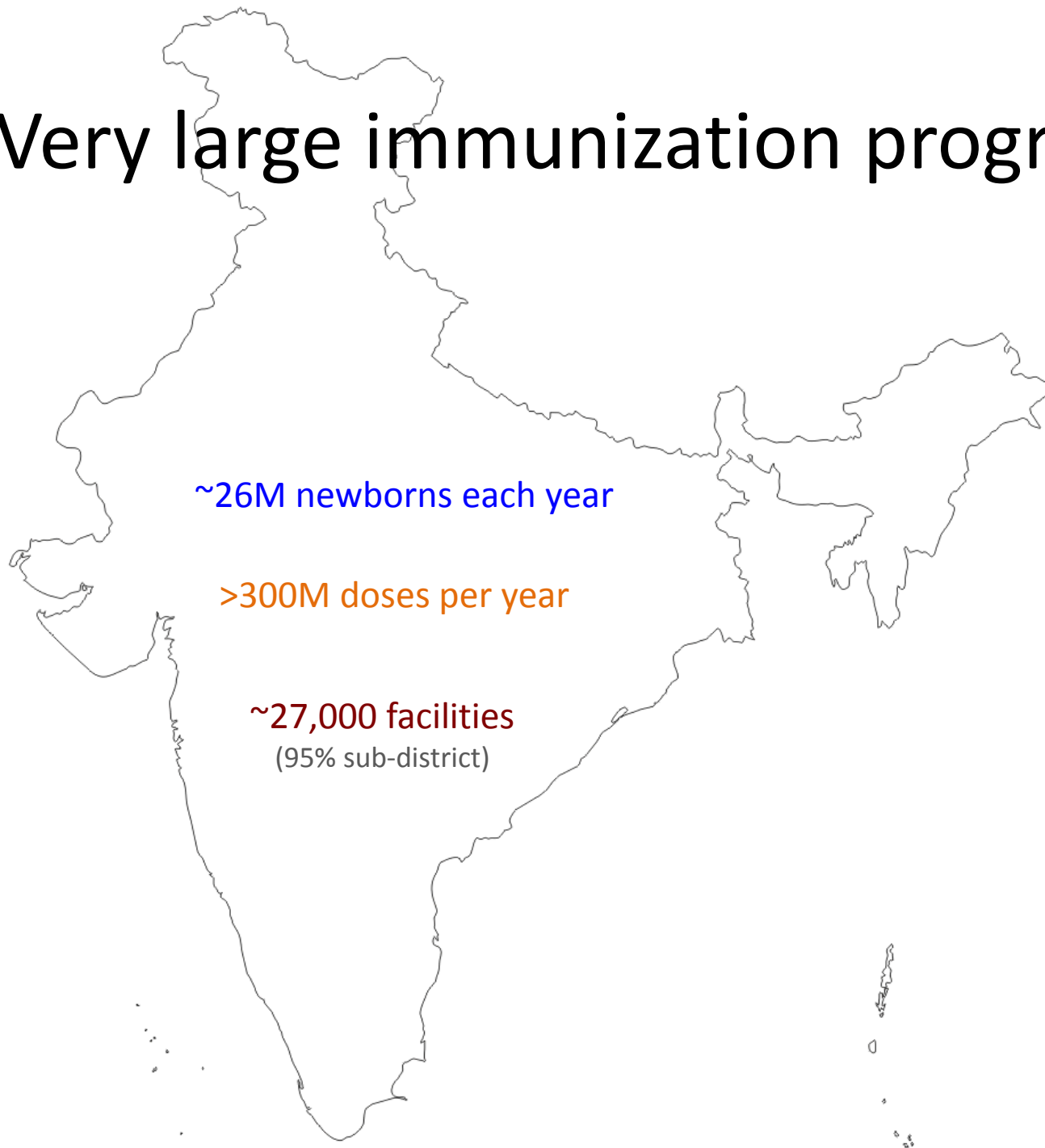 - Dr. Bhrigu Kapuria

- Q&A

Arunachal Pradesh

India: Very large immunization program

~26M newborns each year

>300M doses per year

~27,000 facilities
(95% sub-district)

5-6 level supply chain

National Store

State Store

Regional Store

District Store

Taluk Store

PHC/CHC

- Annual estimations
- Monthly targets
- Delivery and Pickup

Low resource environment

Low human resource capacity

Limited infrastructure
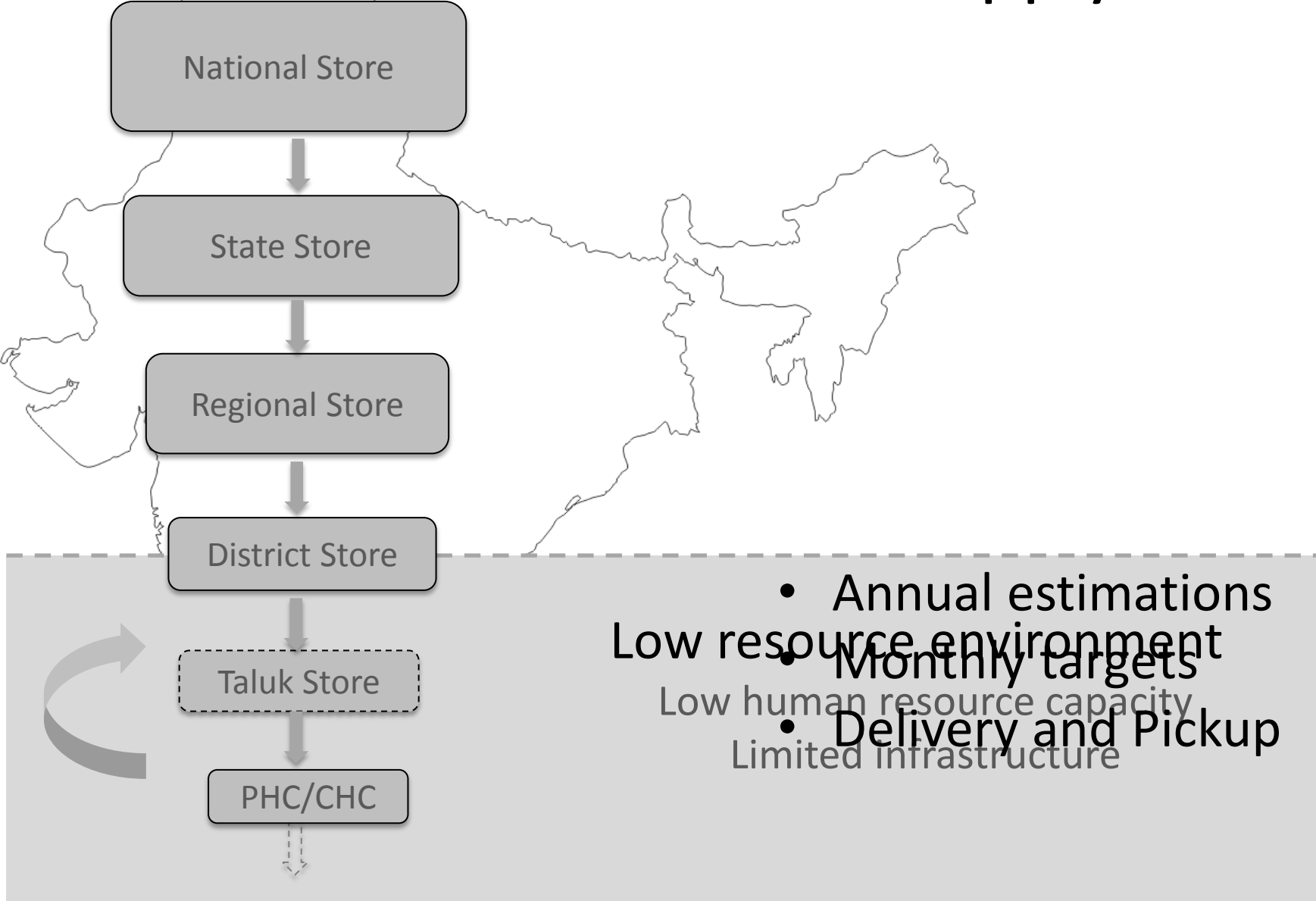
Critical issues

- No stock visibility from last-mile
  - Little or no reporting from last mile
- Sub-optimal stocking
  - Ad hoc management practices, hoarding and last-minute requisitions
- Ad hoc supply
  - No clear basis for supplying, ad hoc transfers
- Inconsistent recording
  - Not all transactions recorded always (e.g. discards, open vials)
- Inability to audit
  - Non-standard record keeping practices

Logistimo: Connecting the chain

Strategic Decision Makers
(using analytics)

State & District
Warehouse Managers

**Consumer of Analytics
(e.g. Manufacturers)**

**Channel Partners
(e.g. Wholesalers,
Distributors,
Dispatchers)**

Consumer

Transporter

**Micro-Entrepreneur
(e.g. Sales Agent,
Retailer, or Producer)**
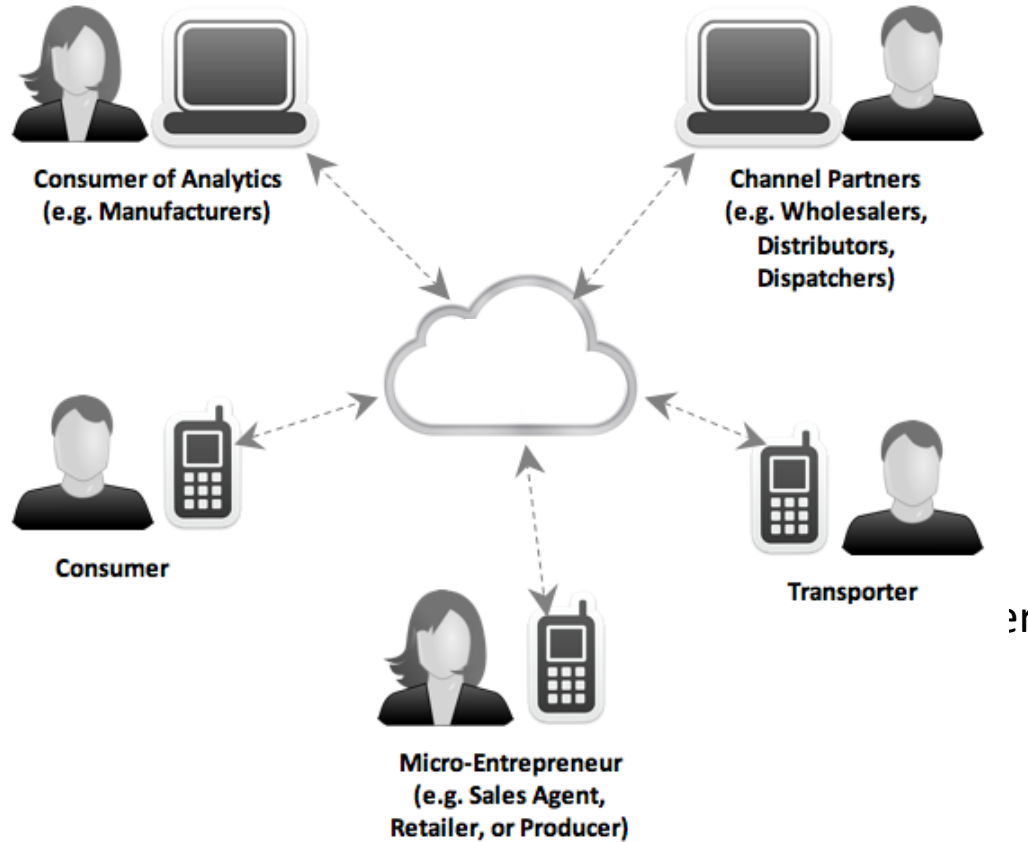
**Mobile-cloud technology gives visibility into stock consumption
Enables optimal decisions across the chain to ensure stock availability**

Key functionality

- Inventory management
- Order management
- Batch management
- Inventory optimization
- Workforce management
- Community management
- Notification / alerts
- Geo-tracking services
- Transport routing & scheduling
- Financial management
- Telemetry (e.g. temperature monitoring)

Managing logistics in 4 states

Uttar Pradesh
42 cold-chain points
8M people

Arunachal Pradesh,
Meghalaya
22 cold-chain points
0.2M people

Karnataka
300 cold-chain points
3M people

Monitoring temperature
in pilot mode

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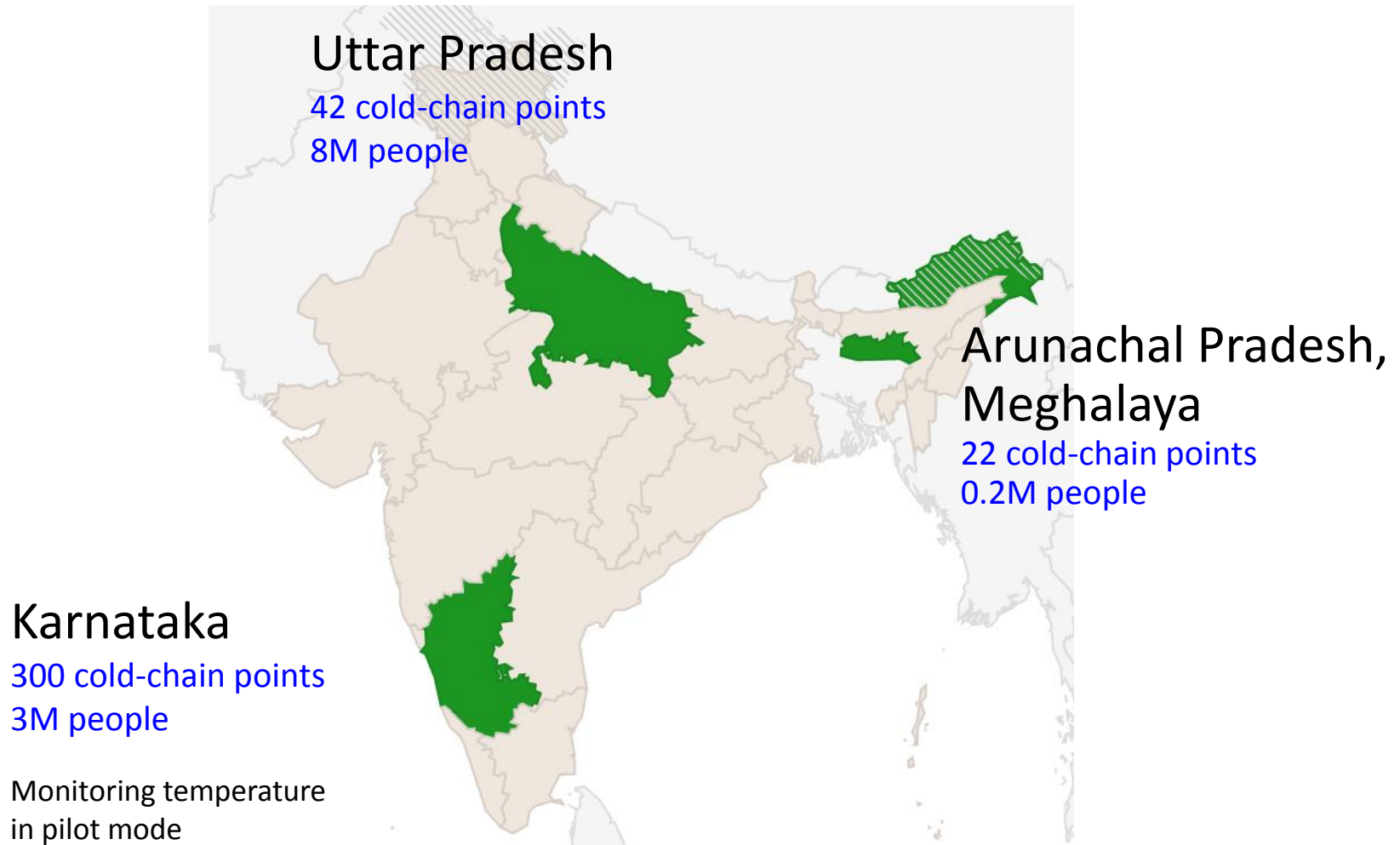
Uttar Pradesh

Key Challenges

PHC
Low human capacity

- No culture of data recording
- Lack management capacity
- Understaffed & overburdened
- Significantly lack IT skills

- 52% passed 12th grade (UP)
- 67% > 46 years (UP)
- X-ray technicians, ward boys
- Nurse handling everything
- Responsible for multiple PHCs (KA)

District
Low supervisory capacity

- Multitasking
- Poor decisions
- Capacity to act on data is low
- Lack computer skills

- Elderly store managers – technology averse (UP)
- Data entry operators not always available
- Churn of personnel
- Unfamiliar with web apps.

PHC
Limited infrastructure

- Intermittent GPRS
- No GSM signal
- Erratic power

- Connections time out frequently
- No signal at PHC
- > 50Km to nearest signal point (AP)
- < 4 hours power

Karnataka

Arunachal Pradesh

Solution strategy

Simplicity

Technology

Easy
Robust
Personalized

Process

Physical
Digital

Redundancy

Devices

Phone
Tablet
Computer
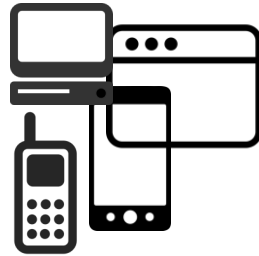
Human resources

>1 trained

Empowerment

PHC-level

Tracking
Auditing
Capacity

District & above

Monitoring
Better decisions
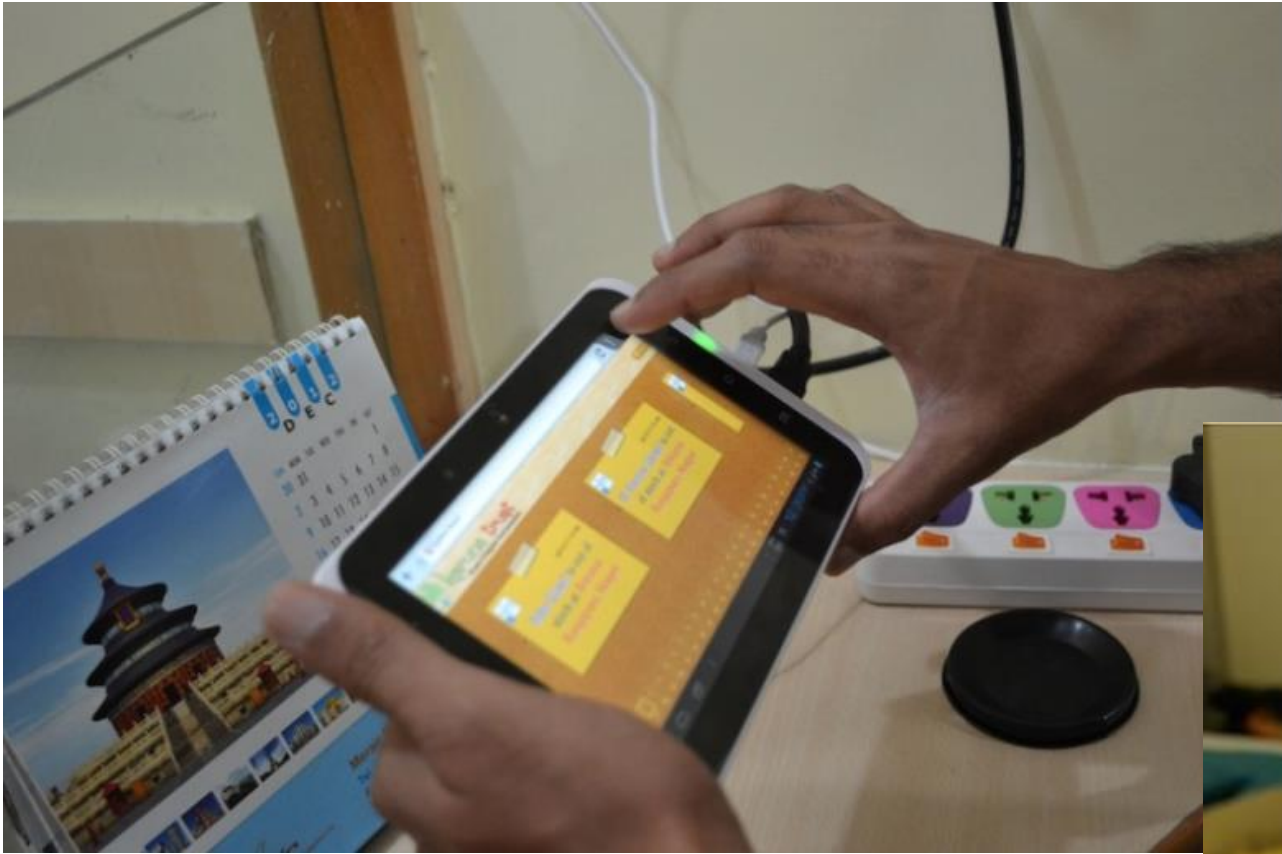
Empowering cold-chain handlers

Health worker enters:
 - issues
 - receipts
 - stock counts
 - discards
 - transfers
 - orders
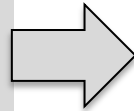
GPRS / SMS / Voice
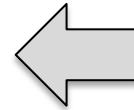
Health worker gets:
 - real-time stock views
 - alerts on low stock/expiry
 - delivery status
 - optimal stocking recommendations
 - consumption patterns
 - drugs usage information

Multi-modal interaction over Internet, SMS and Voice

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Monitor temperatures alongside stock quantity

Sl.No.	Material	Current stock		Min.	Max.	Last updated	
1	BCG (dose)	50		20	100	7/5/15 12:07 PM	🕐
2	DPT (dose)	200 6 day(s)		50	200	7/5/15 12:07 PM	🕐
3	Hepatitis B (dose)	10		15	50	19/12/13 4:56 PM	🕐
4	Measles (dose)	200 6 day(s)		30	90	7/5/15 12:07 PM	🕐
5	Pentavalent (dose)	200 6 day(s)		50	130	7/5/15 12:07 PM	🕐
6	Polio (dose)	400 6 day(s)		60	210	7/5/15 12:07 PM	🕐
7	Rabies Vaccine (dose)	10		5	25	5/3/15 4:22 PM	🕐
8	TT (dose)	200 6 day(s)		50	180	7/5/15 12:07 PM	🕐
9	Vaccine ILR	1	✅	0	0	13/5/15 5:24 PM	

Temperatures of Vaccine ILR of Yemalur

358776032695713 ✅

Normal

2°C - 8°C

5.5°C

13/5/2015 11.27.37
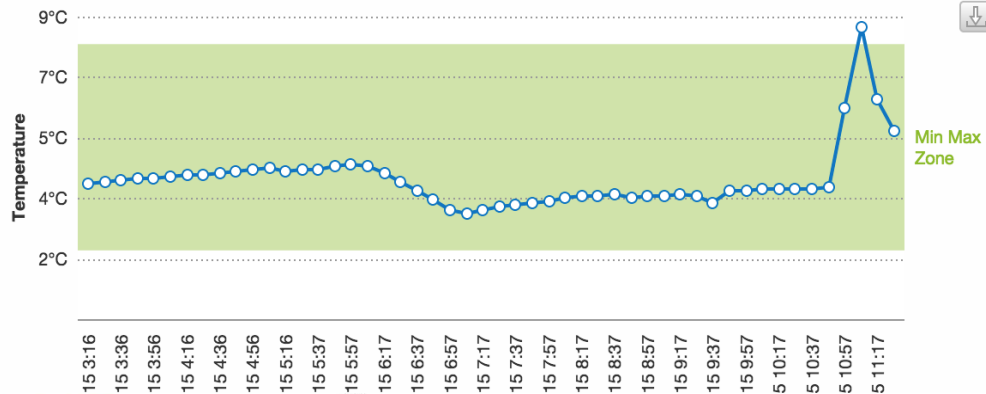
Hybrid approach to human capacity building

- Supervisory monitoring and evaluation
  - Empower supervisors with appropriate tools to monitor cold-chain handler capacity
  - Improve behavior on data entry and stock management

- Community development
  - Digital Bulletin Board to post incidents (e.g. stock outs) and receive solutions from anyone in the chain
  - Stronger networking for problem solving

Robust technology for low-resource environments

Logistics   Human resources   Analytics

Service Management Middleware

Transactions   Events   Locations   Devices
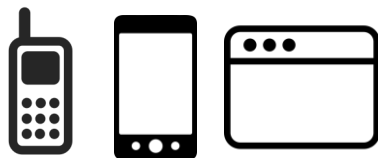
Device heterogeneity   GPRS   SMS   Voice

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Behavior changes after intervention

- Data recording behavior improved
  - Cold-chain worker entered data in a timely and consistent manner
  - Supervisors could spot weak users and intervene quickly to build capacity

- Cold-chain handler's inventory management discipline improved
  - Awareness of low stock situations improved
  - Response time to replenish stock improved
  - Orders were placed more optimally

- Supervisor's efficiency improved
  - Supervisors could focus more on low-performing users
  - System recommendations and reports enable better decisions

What we enabled

Coordinated logistics & Integrated channels

Catalyzed positive behavioral changes amongst cold-chain handlers

Enabled optimized & opportunistic decision support

Improved vaccine availability

Uttar Pradesh

AN - Ambedkar Nagar
GBN - Gautam Buddha Nagar
JPN - Jyotiba Phule Nagar
KN - Kanpur Nagar
SRN - Sant Ravidas Nagar
SKN - Sant Kabir Nagar

Management and Impact

2 Disctricts – Bareilly and Shahjahanpur

42 cold-chain points

2-level supply chain

Regional/Divisional Store

District Vaccine Store
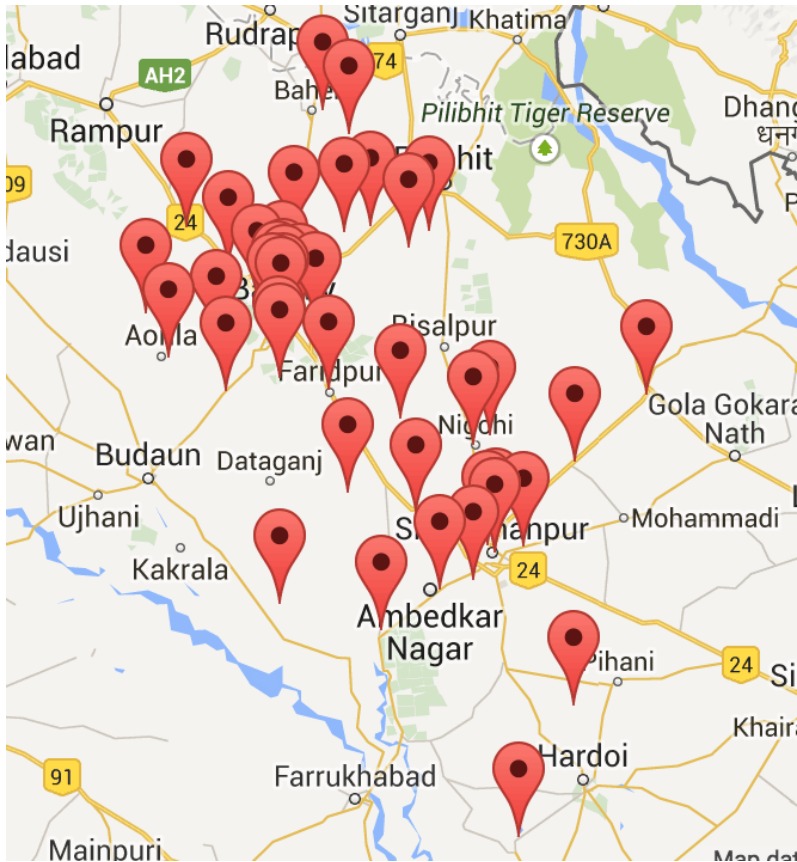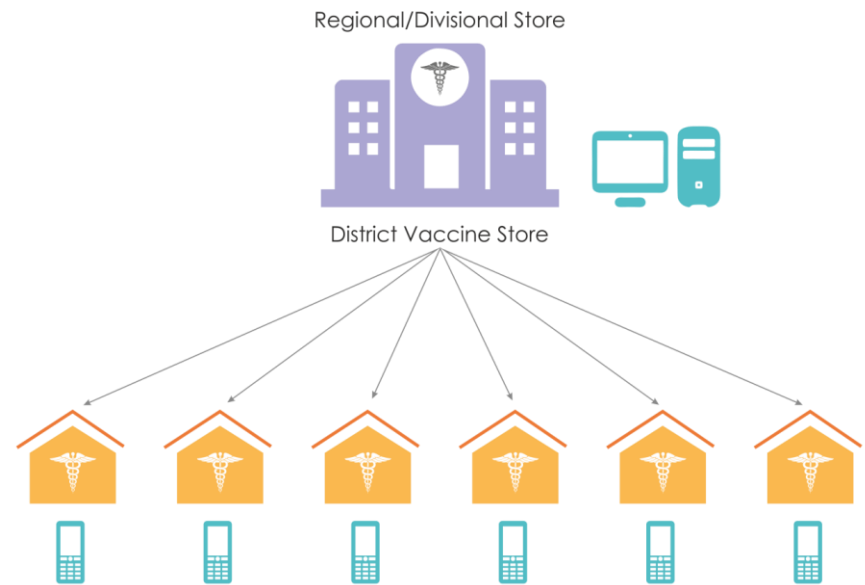
At the end of each session day, CCH enters total vaccine consumed in mobile application

DISTRICTS PROFILE
Bareilly & Shahjahanpur

7.4 million
Total Population

0.2 million
Estimated children
Below 1 year age

0.24 million
Estimated Pregnant
Mothers in 1 year

1.1 million
Total number of children &
Pregnant mothers targeted for
Immunization in 1 year

वैक्सीन वितरण रजिस्टर

सामु॰/प्रा॰ स्वा॰ केन्द्र का नाम: | वैक्सीन वितरण करने वाले कर्मचारी का नाम: | वैक्सीन प्राप्त करने वाले कर्मचारी का नाम: | सत्र का प्रकार (नियमित टीकाकरण/विशेष सप्ताह/अभियान/अन्य): | दिनांक:

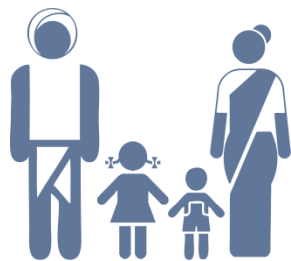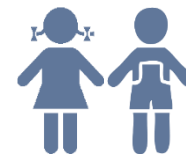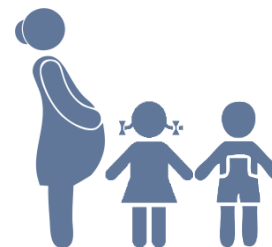|	बिना खुली वैक्सीन वायल्स - वितरित एवं वापस (वी॰वी॰एम॰ प्रयोग लायक अवस्था में)												सीरिंज			माल एवं काला प्लास्टिक बैग (हाँ या ना)	ओपन वैक्सीन वायल्स - वितरित एवं वापस (वी॰वी॰एम॰ प्रयोग लायक अवस्था में)
सत्र स्थल/उपकेन्द्र/न॰प॰क॰के॰ का नाम:	बी॰सी॰जी॰ डोजेज़	बी॰सी॰जी॰ डाइल्युएंट डोजेज़	टी॰ओ॰पी॰वी डोजेज़	ओ॰पी॰वी ड्रॉपर	खसरा डोजेज़	खसरा डाइल्युएंट डोजेज़	जे॰ई॰ डोजेज़	जे॰ई॰ डाइल्युएंट डोजेज़	डी॰पी॰टी॰ डोजेज़	हेपेटाइटिस-बी डोजेज़	टी॰टी॰ डोजेज़	पेन्टावेलेन्ट डोजेज़	0.1ml	0.5 ml	5 ml		डी॰पी॰टी॰ वायल्स
	वितरित मात्रा / वापस मात्रा	वितरित मात्रा / वापस मात्रा	वितरित मात्रा / वापस मात्रा	वितरित मात्रा / वापस मात्रा	वितरित मात्रा / वापस मात्रा	वितरित मात्रा / वापस मात्रा	वितरित मात्रा / वापस मात्रा	वितरित मात्रा / वापस मात्रा	वितरित मात्रा / वापस मात्रा	वितरित मात्रा / वापस मात्रा	वितरित मात्रा / वापस मात्रा	वितरित मात्रा / वापस मात्रा	वितरित मात्रा / वापस मात्रा (अप्रयुक्त)	वितरित मात्रा / वापस मात्रा (अप्रयुक्त)	वितरित मात्रा / वापस मात्रा (अप्रयुक्त)		वितरित
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शुद्ध उपयोग = (वितरित मात्रा-वापस मात्रा)	बी॰सी॰जी॰ डोजेज़	बी॰सी॰जी॰ डाइल्युएंट डोजेज़	टी॰ओ॰पी॰वी डोजेज़	ओ॰पी॰वी ड्रॉपर	खसरा डोजेज़	खसरा डाइल्युएंट डोजेज़	जे॰ई॰ डोजेज़	जे॰ई॰ डाइल्युएंट डोजेज़	डी॰पी॰टी॰ डोजेज़	हेपेटाइटिस-बी डोजेज़	टी॰टी॰ डोजेज़	पेन्टावेलेन्ट डोजेज़	0.1ml	0.5 ml	5 ml

My Stock - Aonla 05:49

View stock
Enter issues
Enter receipts
Enter stock counts
Enter discards

Select | Logout

Data for Management

Stock view

Sl.No.	Material	Current stock		Availability [weeks]	Min.	Max.	Last updated	
1	BCG (dose)	400		4.4444447	180	440	7/5/15 10:43 AM	
2	BCG diluent (dose)	400		4.4444447	180	440	7/5/15 10:43 AM	
3	DPT (dose)	1380		3.1363637	880	2190	6/5/15 7:20 PM	
4	Hepatitis B (dose)	1120		3.2	700	1750	6/5/15 7:20 PM	
5	JE diluent (dose)	695		3.8611112	360	900	6/5/15 7:20 PM	
6	JE Vaccine (dose)	695		3.8611112	360	900	6/5/15 7:20 PM	
7	Measles (dose)	730		4.0555553	360	900	7/5/15 10:43 AM	
8	Measles diluent (dose)	730		4.0555553	360	900	7/5/15 10:43 AM	
9	OPV dropper (piece)	63		2.7391305	45	111	7/5/15 10:43 AM	
10	tOPV (dose)	1260		2.7391305	900	2220	7/5/15 10:43 AM	
11	TT (dose)	1490		4.806452	610	1500	7/5/15 10:43 AM	

Inventory trends

'BCG (dose)' Inventory trends
From: 1/5/2010 To: 31/5/2015 Entity: Civil Lines

Min Max Zone

Closing Stock   Stock adjustment
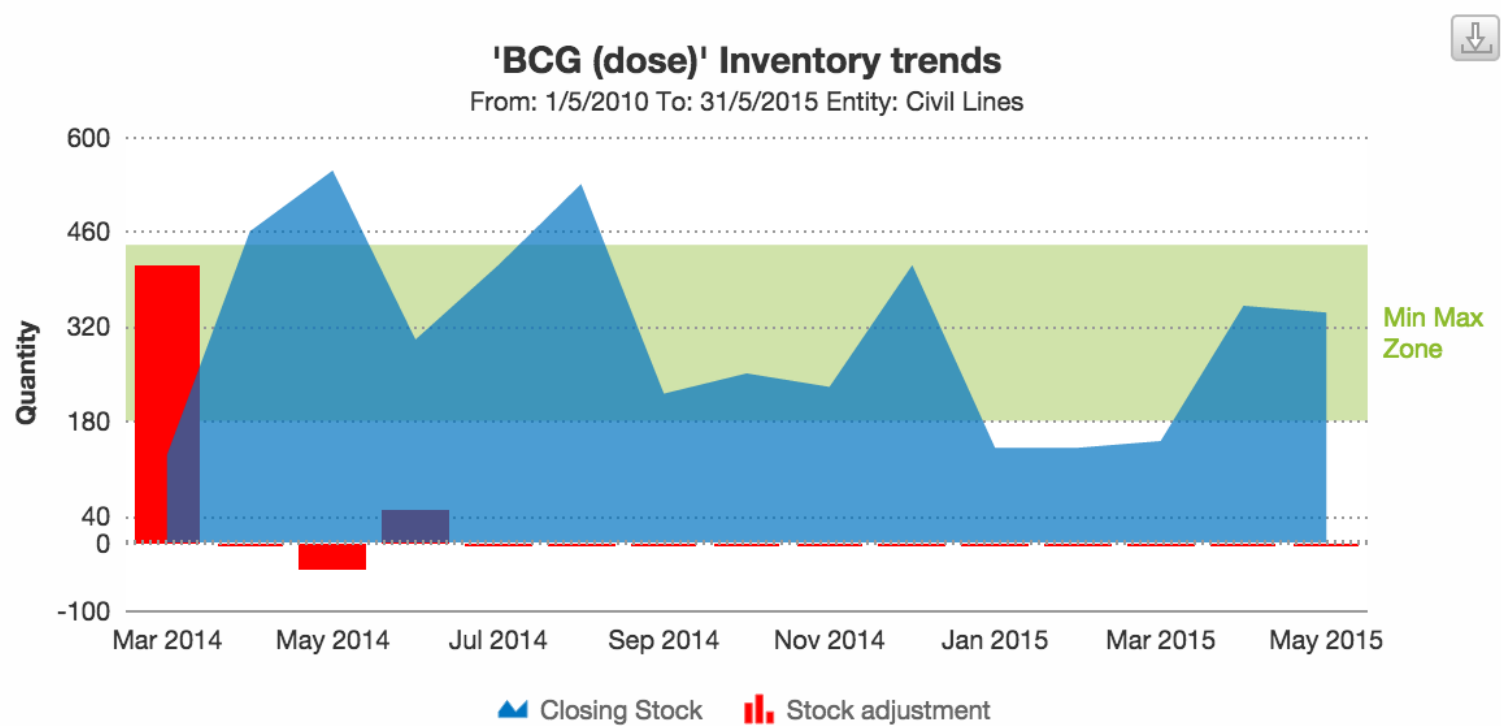
Download as CSV

Monthly consumption

	Aug-2014							Jul-2014						
	BCG (dose)	DPT (dose)	Hepatitis B (dose)	JE Vaccine (dose)	Measles (dose)	tOPV (dose)	TT (dose)	BCG (dose)	DPT (dose)	Hepatitis B (dose)	JE Vaccine (dose)	Measles (dose)	tOPV (dose)	TT (dose)
Aonla	320	660	645	410	320	680	510	240	540	560	245	240	620	400
Baheri	1770	2190	2170	1480	1405	3480	2320	1870	2340	2460	1545	1550	5740	2500
Bhamora	1630	2580	1950	1165	1560	3340	2110	1670	2810	1670	1085	1480	3640	1980
Bhojipur	740	1890	2460	1095	1075	2320	1560	910	2020	2080	1000	995	4060	1460
Bithrichainpur	1470	2660	2190	1665	1665	3440	2210	1760	2990	2460	1790	1685	4400	2100
CB Ganj	650	1210	1120	545	545	1540	860	570	1160	1105	510	475	1360	870
Civil Lines	350	720	700	395	400	900	780	390	680	680	440	495	1080	770
Dalelnagar	760	2050	1940	1225	1300	2960	2110	760	2220	2220	1320	1160	2800	2340
Faridpur	1380	3700	3700	1785	1525	3460	2990	2070	4043	3100	1445	1420	4560	2930
Fatehganj West	750	1550	1640	960	940	1980	1890	920	1930	1920	1135	1125	3580	2130
Izzatnagar	460	780	870	350	380	1000	790	360	790	810	410	410	1220	690
Jagatpur	650	1610	1230	810	730	1660	1660	420	980	920	520	520	1080	830
Kunadanda	1220	1720	1470	1160	1185	2220	1700	1060	1200	1020	840	1155	3580	1200
Kyara	1480	3730	3330	1605	1605	2900	2950	1480	4780	2990	1660	1660	4580	2940
Majhganwa	2190	2520	2290	1595	1430	2740	2820	2470	4720	4290	2910	2585	6140	5110
Meerganj	780	1550	1690	1135	1325	3300	1790	760	1610	1700	960	945	3220	1850
Mudia Navi Bux	610	1680	1680	775	780	2400	1630	670	1540	5560	755	765	3420	1510
Nawabganj	1130	1890	2140	1245	1125	2320	2200	1140	2810	2370	1335	1205	3980	2170
Old City - Bareilly	760	1500	1100	715	715	1420	1260	490	860	840	440	445	1120	600
PPC Bareilly	780	1760	2010	795	695	1580	1510	790	2400	2120	730	760	1820	1590
Ramnagar	910	2360	2320	1270	1165	1100	2450	920	2550	2560	1465	1235	2500	2470
Shergarh	1410	1850	1570	1145	1145	1680	1960	2020	2350	1950	1425	1420	4480	2310
Subhash Nagar	470	950	800	500	490	920	800	480	930	930	600	550	1140	560

Activity

Issue Activity
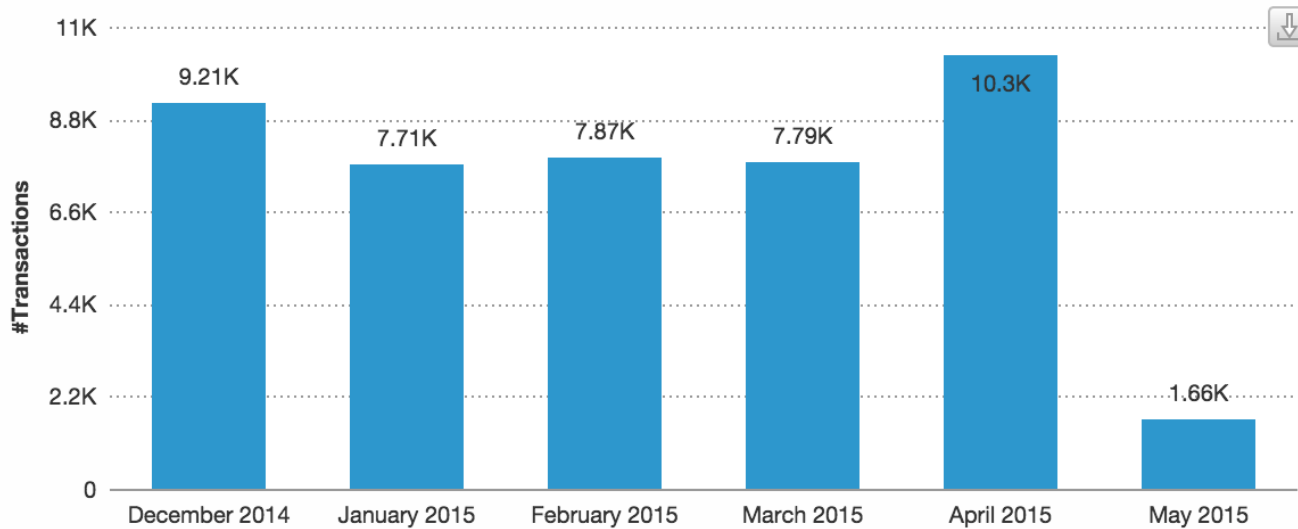
Issues	11-Apr	12-Apr	13-Apr	14-Apr	15-Apr	16-Apr	17-Apr
Date	11-Apr	12-Apr	13-Apr	14-Apr	15-Apr	16-Apr	17-Apr
Day	Sat	Sun	Mon	Tue	Wed	Thu	Fri
	30	29	28	27	26	25	24
bhawalkhera	X					X	
mirzapur	X						X
nigohi	X	X				X	
kanth	X					X	
khutar	X	X			X		
dadral		X			X		X
kalan	X				X	X	
jaitipur	X					X	
shahajahpur		X				X	
powayan	X					X	
tilhar	X				X	X	
khudaganj	X	X					X
jalalabad	X					X	
banda	X					X	
cityarea	X				X		
sindhuali	X				X	X	

Detailed Activity Report

Transactions	R.I Vaccines																																											
	BCG (dose)				BCG diluent (dose)				DPT (dose)				Hepatitis B (dose)				JE Vaccine (dose)				JE diluent (dose)				Measles (dose)				Measles diluent (dose)				OPV dropper (piece)				tOPV (dose)				TT (dose)			
CCP	I	R	S	D	I	R	S	D	I	R	S	D	I	R	S	D	I	R	S	D	I	R	S	D	I	R	S	D	I	R	S	D	I	R	S	D	I	R	S	D	I	R	S	D
old city - bareilly	40				40				210				190				80				80				30				30				11				220				170			
faridpur																																												
meerganj	80				80				180				180				90				90				90				90				19				380				180			
fatehganj west	20				20				280				250				100				100				80				80				27				540				250			
kunadanda	70				70				90				70				70				70				70				70				9				180				80			
nawabganj																																												
shergarh	50				50				160				150				70				70				80				80				20				400				170			
bithrichainpur	60				60				190				200				105				105				105				105				25				500				200			
baheri									130				190				125				125				125				125				26				520				120			
jagatpur	30				30				80				80				40				40				40				40				8				120				80			
subhash nagar	70				70				220				220				110				110				110				110				14				280				210			
aonla	30				30				50				50				25				25				25				25				4				80				40			
ramnagar	10				10				120				120				560				60				60				60				14				280				140			
bhojipur	10				10				80				90				75				75				75				75				12				240				160			
mudia navi bux																																			150								
bhamora	10				10				340				260				170				170				165				165				28				560				170			
dalelnagar	260				290	30			400				400				170				170				170				170				29				580				370			
civil lines																																												
ppc bareilly	90				90				260				280				120				120				120				120				14				280				220			
majhganwa	80				80				300				300				215				215				205				205				20				400				440			
cb ganj	50				50				90				90				25				25				25				25				5				100				100			
izzatnagar	10				10				90				90				40				40				40				40				5				100				80			
kyara	60				60				480				240				120				120				120				120				24				480				240			

- Error in value
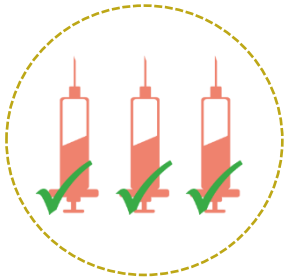- Entered receipt of RI Vaccines
- Stock count entry
- discards entry
- diluent/dropper value not tallying

Impacts

EXPECTED OUTCOMES

IMPROVED STOCK AVAILABILITY

through better visibility and standardized procedures

REAL TIME DATA VISIBILITY

at all cold chain points along with real time temperature monitoring

TOOLS AND REPORTS

reports to facilitate decision making in vaccine logistics management

STRENGHTENED HEALTH SYSTEM

through Human Resource, Capacity Building and Leveraging technology
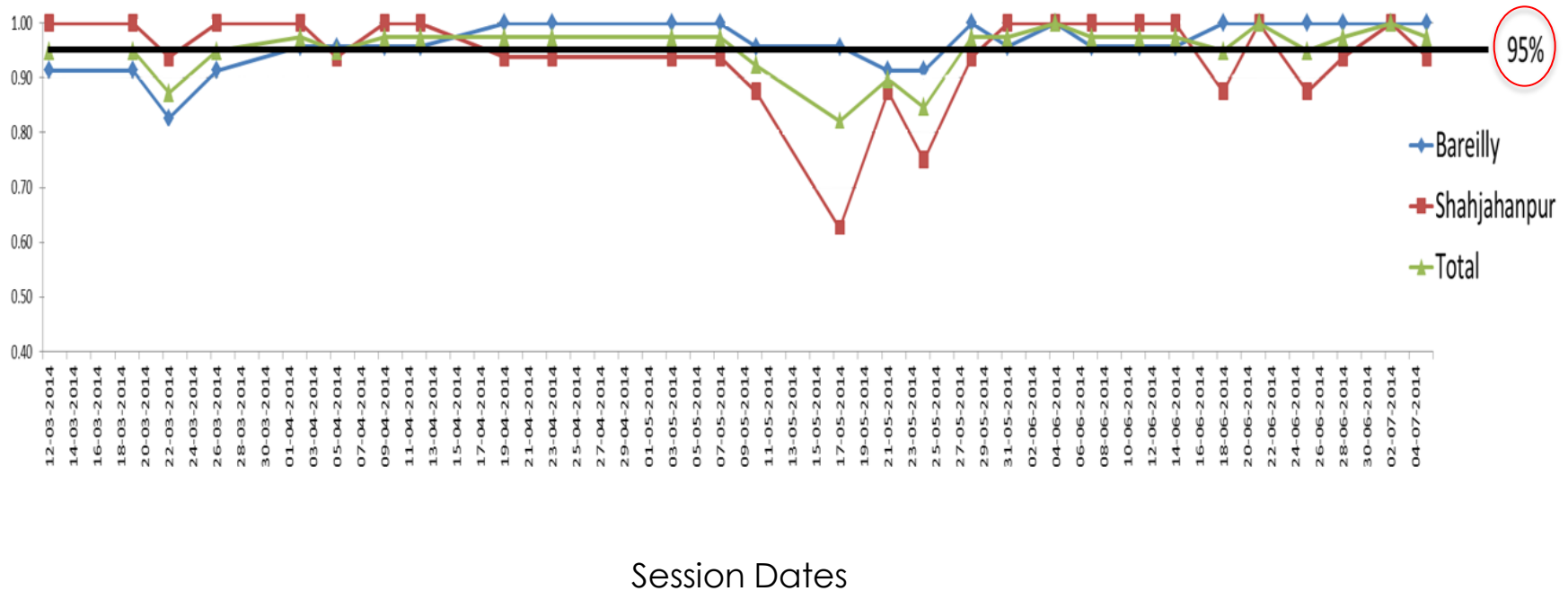
REPLICABLE MODEL
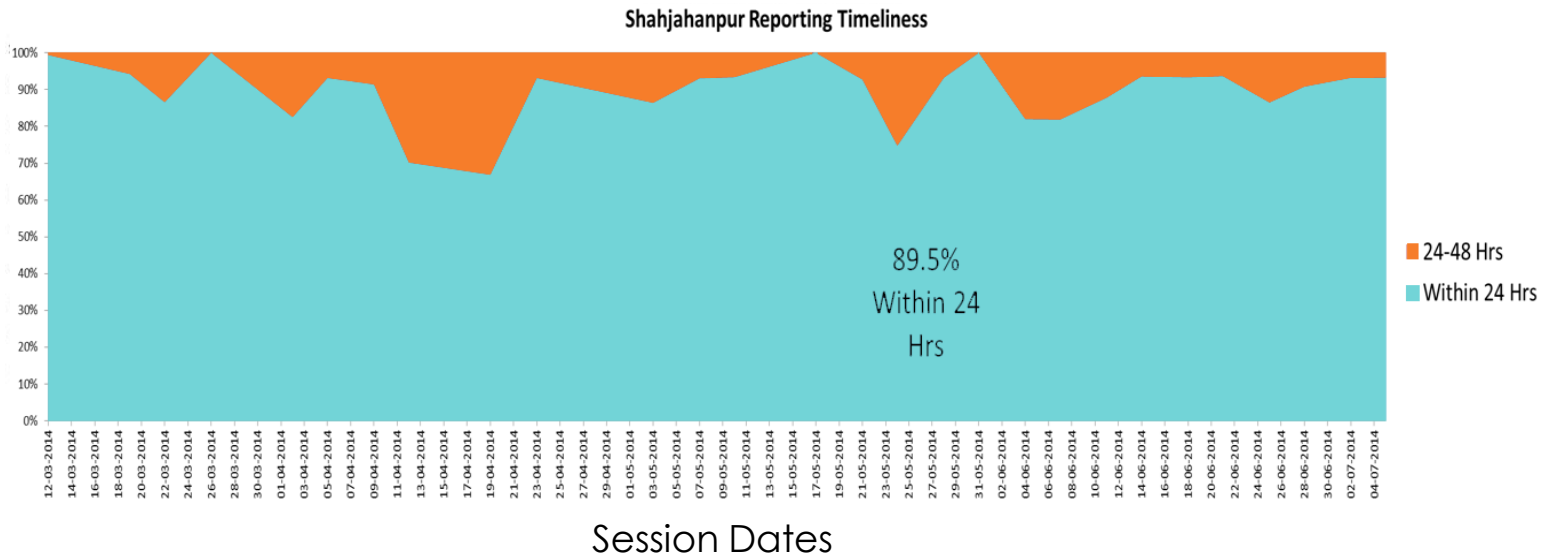
for state/Nation-wide scale up

REPORTING RATES

The reporting rates for both the districts – Bareilly and Shahjahanpur are seen **consistently between 80% - 90%**
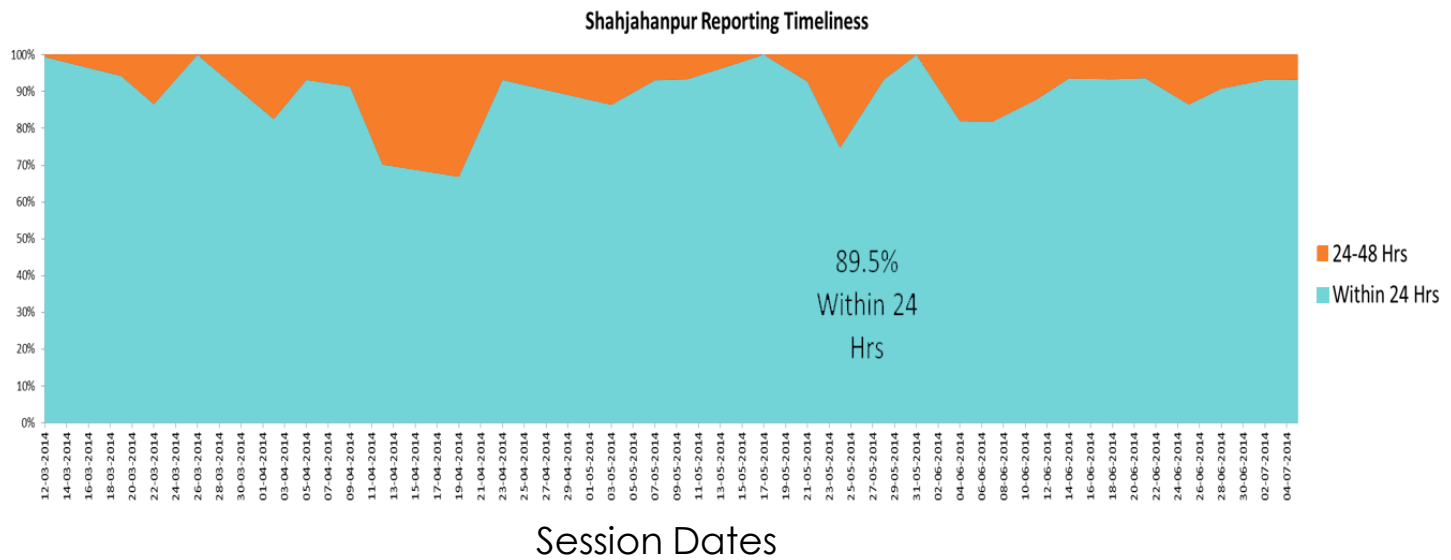

LogiWeb Access Rate - Session Days

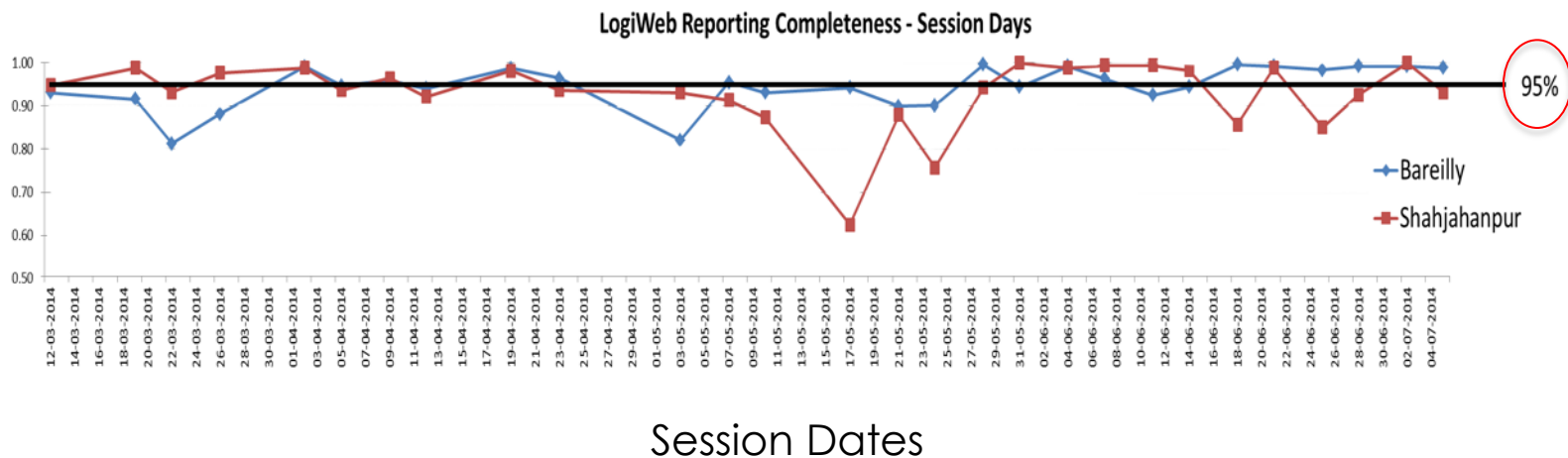Session Dates

TIMELINESS RATE

Is the data reported on time?

Shahjahanpur Reporting Timeliness

89.5%
Within 24
Hrs

■ 24-48 Hrs
■ Within 24 Hrs

Session Dates

TIMELINESS RATE

Is the data reported on time?

Shahjahanpur Reporting Timeliness

89.5%
Within 24
Hrs

Session Dates

Legend:
- 24-48 Hrs
- Within 24 Hrs

COMPLETENESS RATE

Is the data reported complete?

LogiWeb Reporting Completeness - Session Days

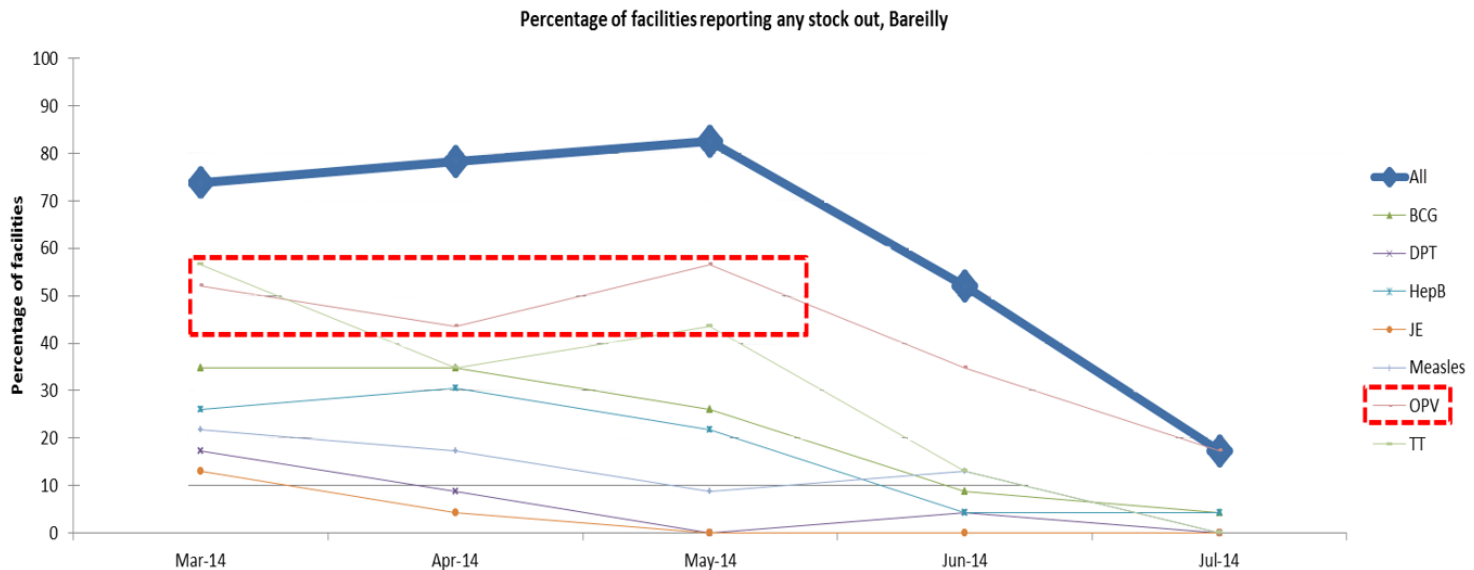Session Dates

Both the districts have consistently reported **above 80%** of complete data in reporting the utilisation/ net consumption of all the vaccines, diluents and droppers

STOCK-OUT REPORTING RATES

BAREILLY: 70-80% of cold chain points reported stock out in initial months which has now dropped significantly.

Percentage of facilities reporting any stock out, Bareilly

NO. OF DAYS OF STOCK-OUTS

The average number of days reporting stock outs per month has steadily reduced from 4 days to 1 day since the launch of eVIN

Avg days of stock out, per vaccine, per month - Bareilly

BAREILLY
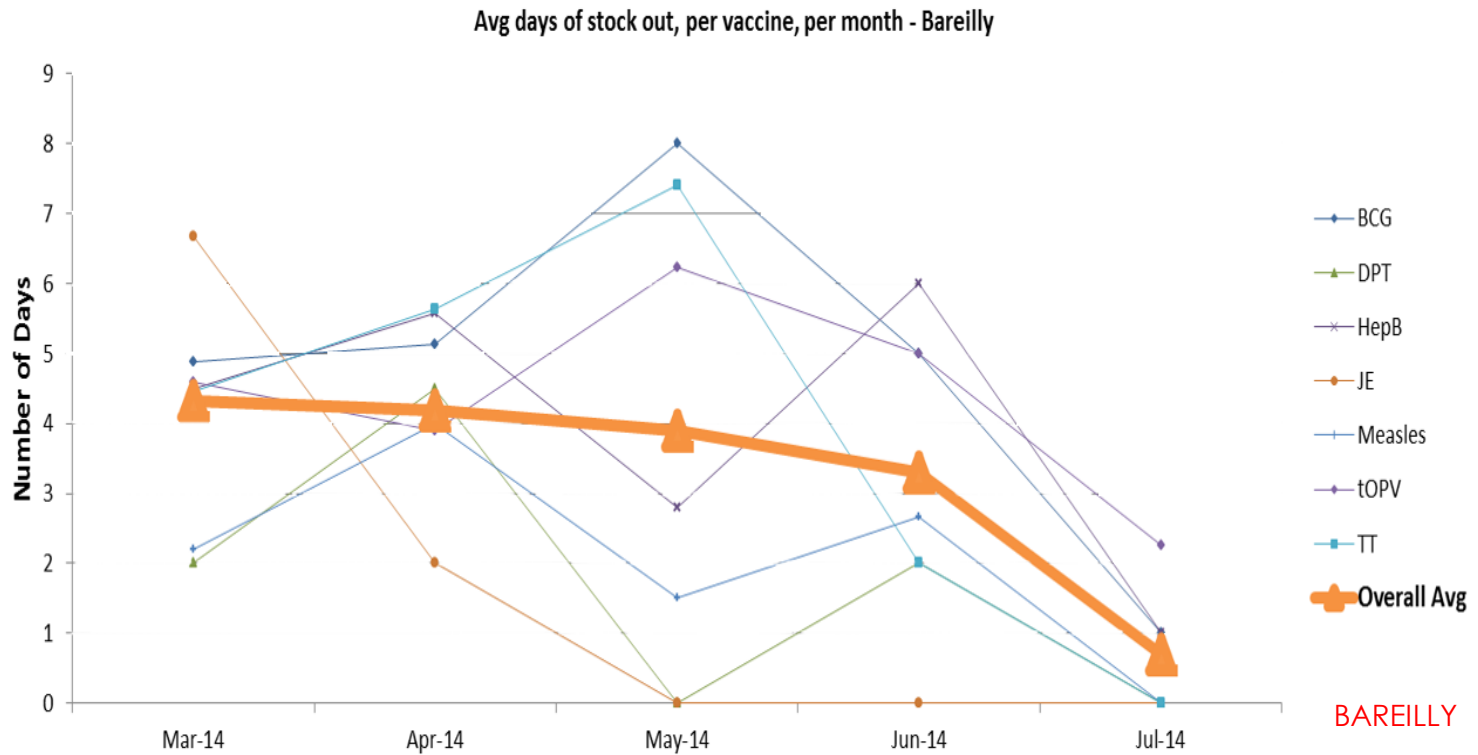
Data Quality Indicators

- Average Access Rate, per session day: 90%

- Average Completeness Rate, per session day: 87%

- Average Timeliness Rate, per session day: 87%

- Data Accuracy: 82%

Feedback from End Users

- *''When I send the message on stock, I become tension free* (I feel relieved) *because my data is updated.* (I get to know) *I have this much* (available stock). *I feel good that my stock is well maintained''* [CCH].

- *"After the implementation of eVIN, if we are in need of any data, such as how many vaccines is there with us, then we open the application and immediately we come to know about it. Earlier we used to search that on register"* [CCH].

- *"Good thing (about the mobile based application) is that my reporting is easy because of it. I have exact information about the vaccine stock and how much requirement I'll have"* [CCH].

- *"....(with the mobile based application) the work was made very easier. Actually first* (in the pre-eVIN phase) *I had to take the reports from here and get it for the DIO.* (With eVIN application) *I just* (need to) *click it from the phone and the report is delivered"* [CCH].

Stock Outs – first 6 months of eVIN

SKU stock out instances on session days, District 1
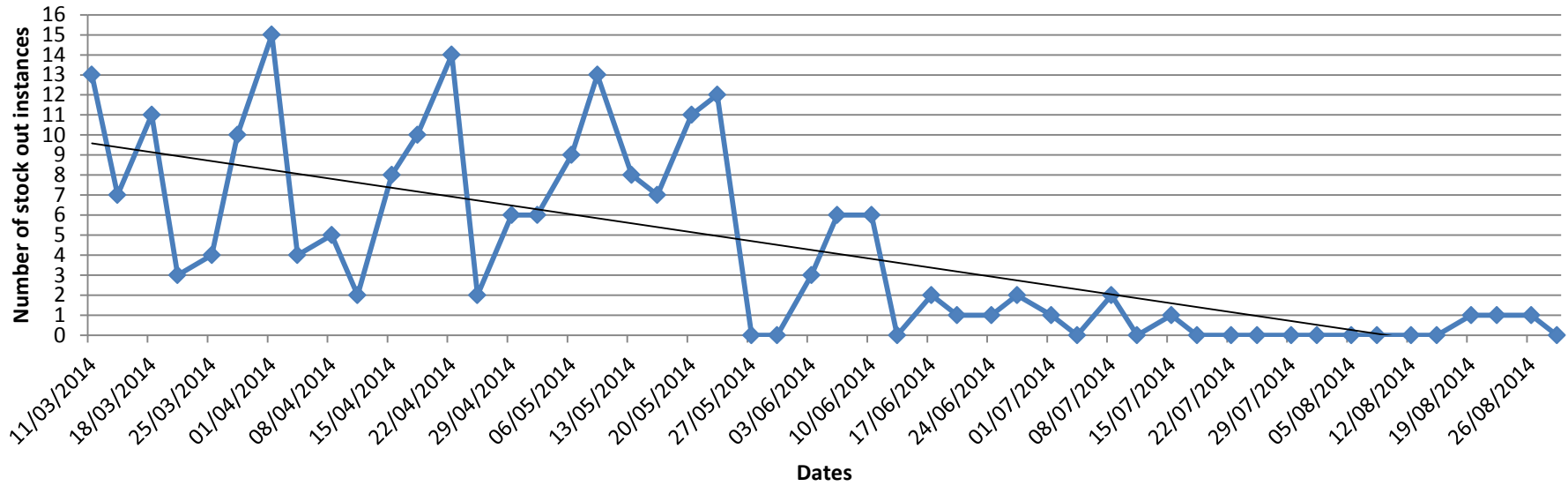
SKU stock out instances on session days, District 2
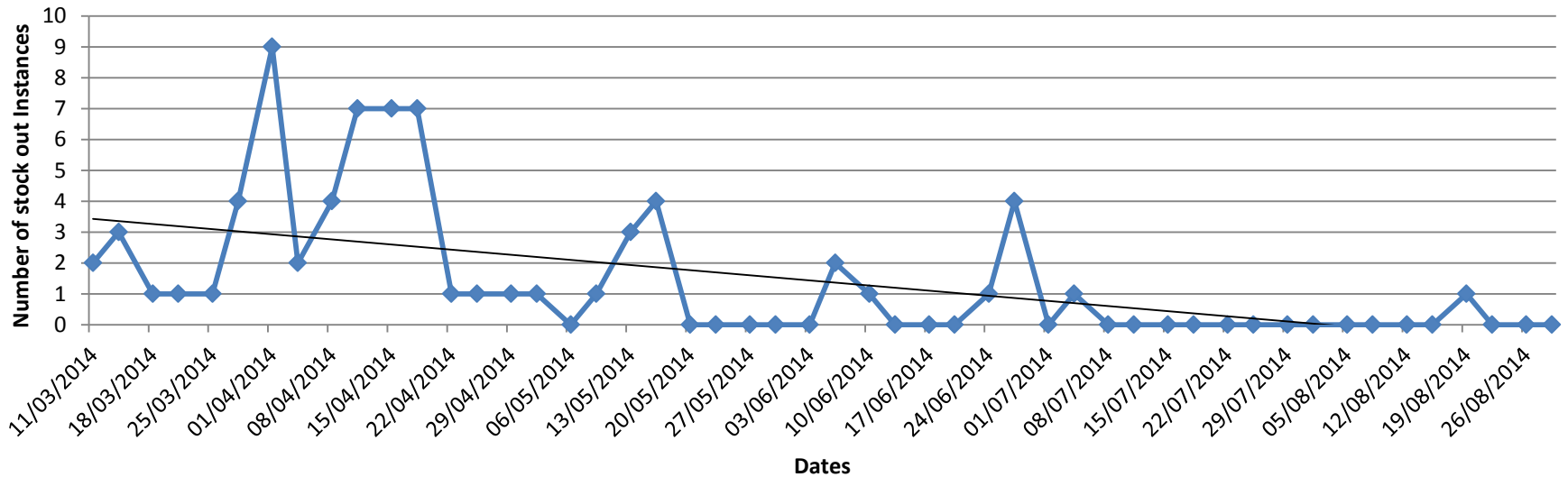
Summary

- Low resource environments pose significant challenges to achieve data quality from the last mile
  - Simple, but robust, technology and processes are essential
- Data on both human activity and material movement are essential
  - Both human capacity and inventory have to be optimized
- People are well-intentioned and will evolve towards better performance
  - Empowerment and appropriate capacity building are important in combination
- Supervisory capacity needs to enhanced in the initial stages
  - Bandwidth and capacity to act on data need to be upgraded, with full support from District/State
- The model can scale with robust technology
  - Scale poses additional challenges, and it needs good technology address it

Thank you

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