



Iterative Design of an Immunization Information System in Pakistan

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Overview

- Background & Context
- Previous System - Vaccinator Tracking App
- Our System Architecture
- Iterative design of application
- Small Scale Testing & Findings
- Discussion & Conclusion

Immunization status in Pakistan

- 56% immunization in 2014
- Missed the Millennium Development Goal of 90% national immunization coverage
- One of two countries with polio





Vaccinators

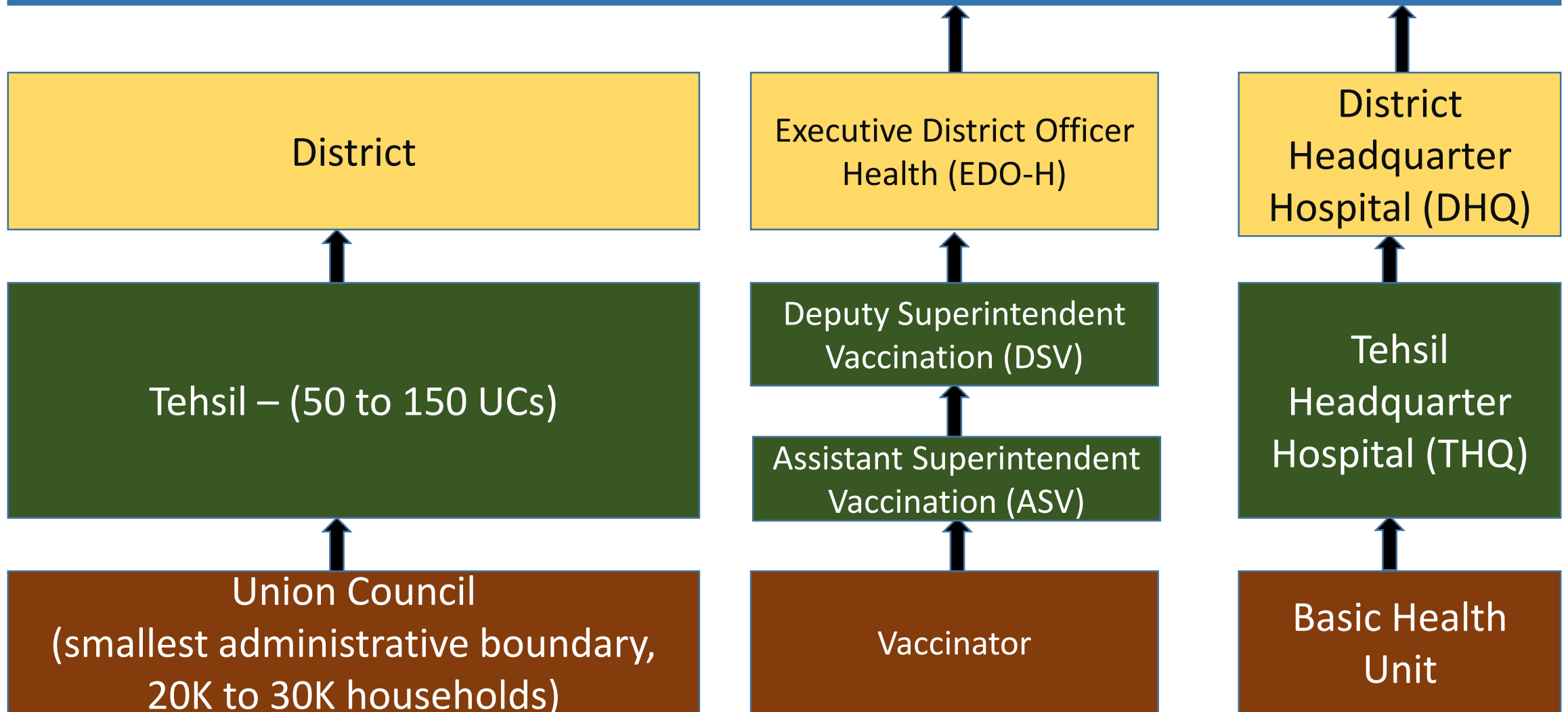
- Permanent employees
- Immunize at grass root level
- For underserved areas
- 3750 vaccinators in Punjab

National Immunization Schedule of Pakistan

Visit #	Child Age	Antigens
1	At Birth	BCG, OPV-0, Hep-B
2	At 6 Weeks	OPV-1, Penta-1, Pneumo-1
3	At 10 Weeks	OPV-2, Penta-2, Pneumo-2
4	At 14 Weeks	OPV-3, Penta-3, Pneumo-3
5	At 9 Months	Measles-1
6	At 15 Months	Measles-2

Table 1: EPI child Immunization Schedule

Secretary, Government of the Punjab, Health Department



محکمہ صحت پنجاب
رجسٹر ٹیکہ جات روزانہ کارکردگی
Daily Vaccination Register

[illegible]


محکمہ صحت پنجاب
مستقل رجسٹر برائے حفاظتی ٹیکہ جات
Permanent Vaccination Register

REMARKS	تعلقہ کیوں کے مضی اثرات (AEFI)	پیدائش پر محفوظ تھا Yes /No	تاریخ جب ٹیکہ لگایا گیا یا قطرے پلائے گئے															بچہ پیدائش کی تاریخ	مکمل پتہ اگر مکان نمبر نہ مل سکے تو والد / شادی کا پتہ درج کریں	ولادت زوجیت قومیت کے ساتھ	نام	کارڈ نمبر	نمبر شمار																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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EXPANDED PROGRAM ON IMMUNIZATION

حکومت پنجاب

Child Vaccination Card

يونسيف 

نام: _____

والد/سربراہ کنبہ کا نام: _____

تاریخ پیدائش: _____

یونین کونسل:

تحصيل / ثاؤن: _____ ضلع: _____

کارڈ نمبر: _____

Name of Antigen		ی بی آئی سنٹر کا نام:
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	BCG	تاریخ اجراء:
	OPV	

Vaccination Record

Vaccination Record			
Date of Vaccination			Name of Antigen
			BCG
			OPV
			Pentavalent <small>DPT, Hep-B, Hib</small>
			Pneumococcal
			Measles

۱۔ اگلے حفاظتی ٹیکہ کی تاریخ

3	2	1	0	Antigen
				OPV
				Pentavalent
				Pneumococcal
				Measles

حفاظتی ٹیکوں کا شیڈول

عمر	حفاظتی ٹیکے یا قطرے
پیدائش کے فوراً بعد	بی ای جی، پولیو (پیدائشی)
6 مہینے	OPV-1 Pentavalent - Pneumococcal -1
10 مہینے	OPV-2 Pentavalent - Pneumococcal-2
14 مہینے	OPV-3 Pentavalent - Pneumococcal-3
9 ماہ کی عمر کے فوراً بعد	Measles - 1
15 ماہ کی عمر کے بعد	Measles - 2

ہدایات:

- ۱۔ پیدا اٹھ کے بعد جتنا علم ممکن ہو سکے فوراً اپنے بچہ کو ٹیکوں کے حفاظتی مرکز میں لائیں۔
۲۔ حفاظتی ٹیکہ جات کے شیعہ دل کے مطابق ٹیکوں کو برس وقت پر عمل کرائیں۔
۳۔ اگر بچے کے بعد معمولی بخار ہو جائے تو یہ اس میں مول دیں۔ اگر بخار تیز ہو تو قرعہ ڈالنے سے رجوع کریں۔
۴۔ ذرا کھانسی، دست اور معمولی جراثیم میں بھی حفاظتی ٹیکے لگوانے کی ضرورت نہیں۔
۵۔ اس کا رد کو مستحسن کر رکھیں۔ سکول میں داخلے کے وقت اس کی ضرورت پیش آتی ہے۔

Research Questions:

Improve the coverage and retention of immunization in Punjab?

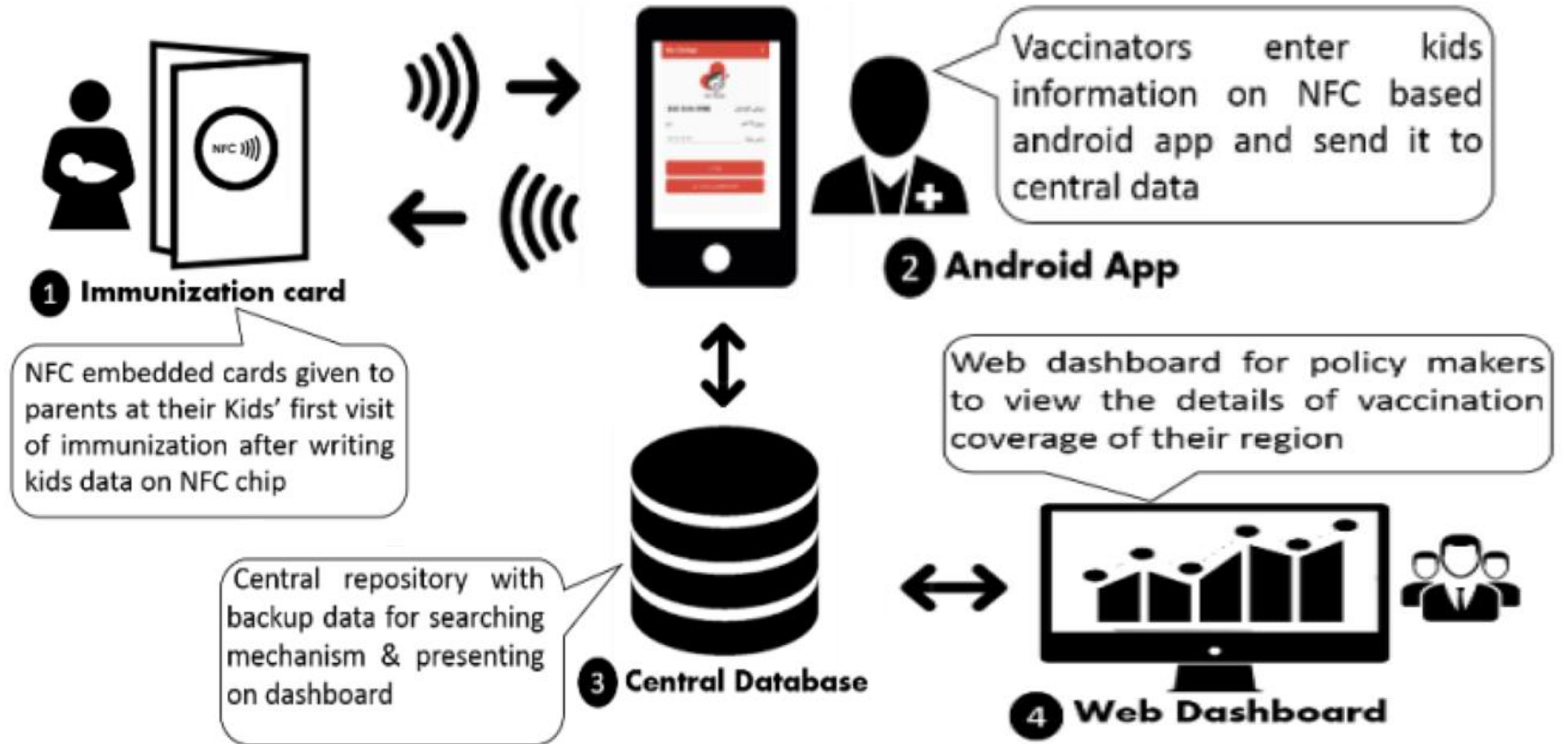
How can we

- Redesign the immunization card to be more informative for parents and useful for vaccinators?
- Support vaccinators work while collecting data ?
- Design the card and the application to facilitate Digital Health Records?

Our Pilot

- Geographical area:
 - Two districts : Sheikhupura and Sahiwal
 - Selective 70 Union Councils
 - Data Collection Methods:
 - Participant observation
 - Unstructured and semi-structured interviews
 - Surveys
 - Content analysis of government documents
- Through
- 30 meetings
 - 10 focus groups

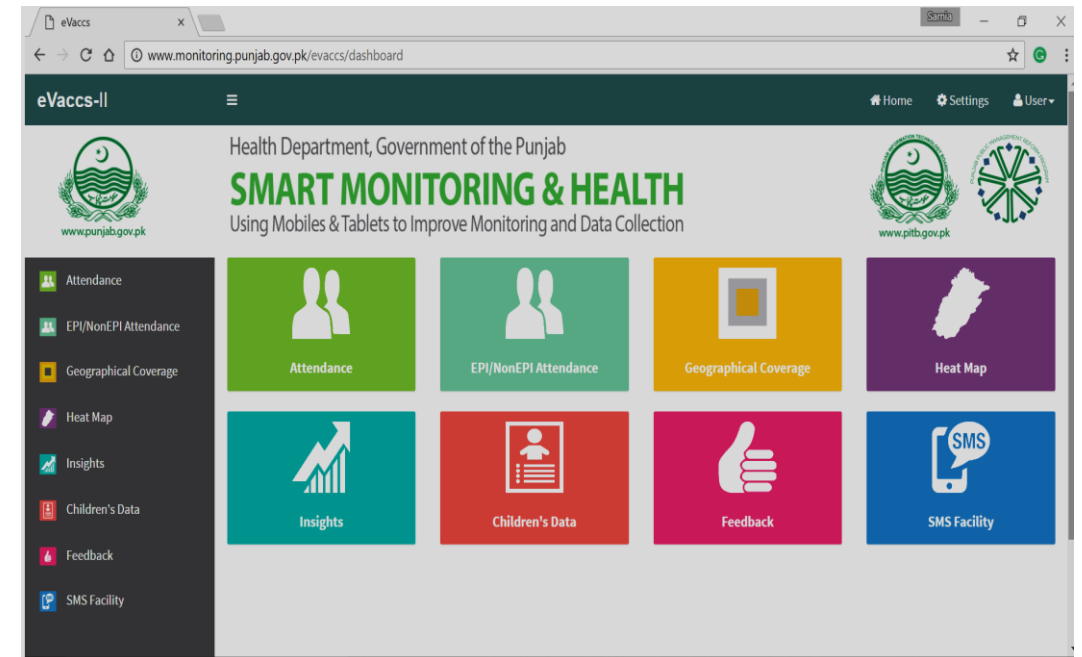
System Diagram



Previous System - a Smartphone Vaccinator Tracking App



- To increase vaccinator attendance and geographical coverage
- Digitized vaccinator attendance
- Geo-tagged Vaccinator visits
- Android based smart phone
- Customized, preloaded Android application



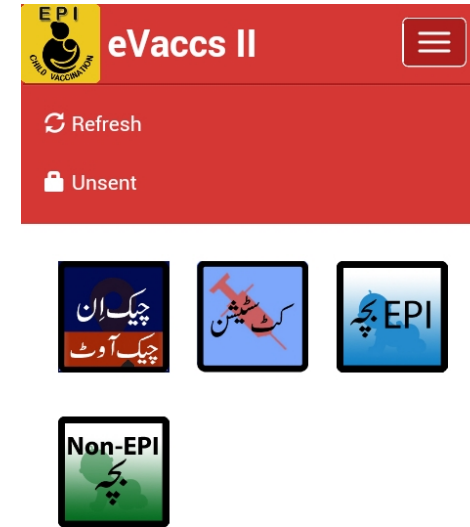
Previous system - E-vacccs





- Check-in and check-out
 - To mark vaccinator attendance
- Pictorial Evidence of Duties
 - Pictures of Remote vaccination centers
 - Pictures of Immunized Children
- Top Down Approach – No unique IDs



Insights about E-vaccs from vaccinators

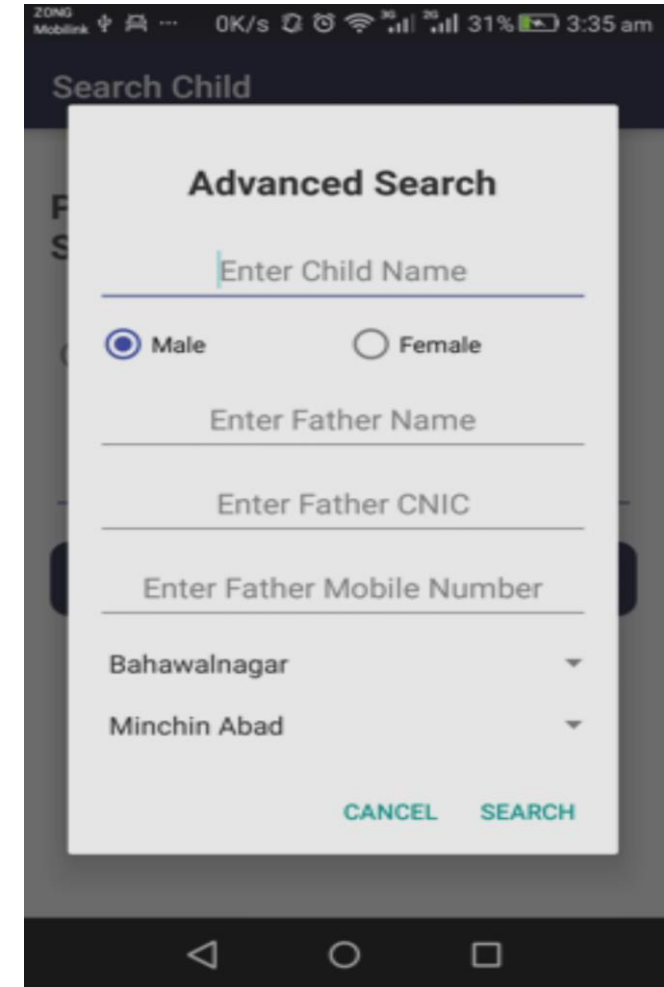
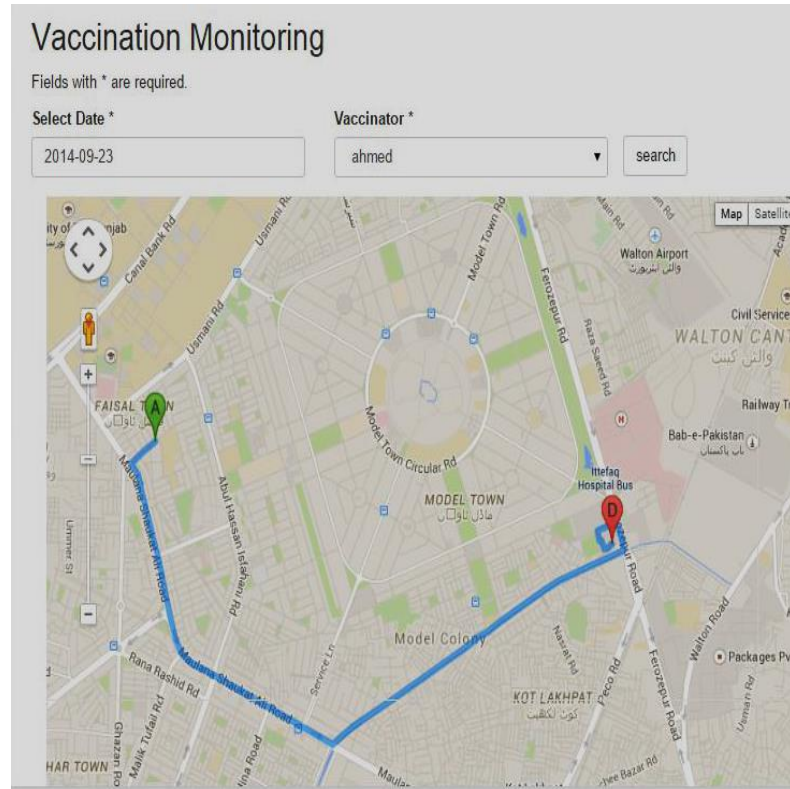
- Internet connectivity to upload data
- Missing attendance
 - Uploading prerequisite to check-out for the day
- Separate data submission for each record
 - N clicks for N record upload



Unsent Data	
	2015:05:13 22:24:09
	2015:05:13 22:24:35
	2015:05:13 22:24:54
	2015:05:13 22:25:07

First iteration – Building on top of E-vaccs

- Plan My Day
 - Optimized movement
- Delay Tolerance
- Single Click image Upload



Feedback on version 1

- Translation of Application in local languages
 - Preferred data entry in English alphabets
 - Application text and prompts to be in Urdu
- Defaulters List
- Removing Plan my day

The screenshot shows a mobile application interface for registering a child. The title bar at the top is dark blue with the text 'Register Child' in white. Below the title bar, the form fields are as follows:

- Child Name:** A text input field.
- Gender:** Two radio button options: 'Male' (selected) and 'Female'.
- Date of Birth:** A text input field containing '2014-05-01'.
- Father Name:** A text input field.
- Father CNIC:** A text input field containing '32106-3445556-2'.
- Father Mobile #:** A text input field.
- Address:** A text input field.
- District:** A dropdown menu with 'Bahawalnagar' selected.
- Tehseel:** A dropdown menu with 'Minchin Abad' selected.

At the bottom of the form is a dark blue button with the text 'REGISTER' in white. The bottom of the screen shows the standard Android navigation bar with back, home, and recent apps icons.

Iteration 2 – Four Core Functions

- Register a new child
- Scan a card (upon visit)
- View all children of Union Council
- Search a child



1 - Registration of Children

- Basic Information about the Baby:
 - Date of Birth
 - Gender
 - EPI number
- Information about guardians:
 - Name of guardian
 - Relation to the baby
 - National Identity (citizen) number
 - Mobile number
- Picture of the baby

The screenshot shows a mobile application interface for registering a child. The status bar at the top indicates 'ZONG Mobilink', signal strength, 96% battery, and the time 3:57 pm. The app title is 'Register Child'. The form fields are as follows:

- ای پی آئی نمبر (EPI Number): A text input field.
- سینٹر کا نام (Center Name): A text input field.
- بچے کا نام (Child's Name): A text input field.
- Gender: Two radio buttons labeled 'لڑکا' (Boy) and 'لڑکی' (Girl).
- تاریخ پیدائش (Date of Birth): A date picker showing 'DD/MM/YYYY'.
- سرپرست کا نام (Guardian's Name): A text input field.
- شناختی کارڈ نمبر (National Identity Number): A text input field with a placeholder '#####-#####-#'. Below it is a label '03##-#####'.
- موبائل نمبر (Mobile Number): A text input field.
- والدہ کا نام (Mother's Name): A text input field.
- تصویر کھینچنا (Take Photo): A red button at the bottom.

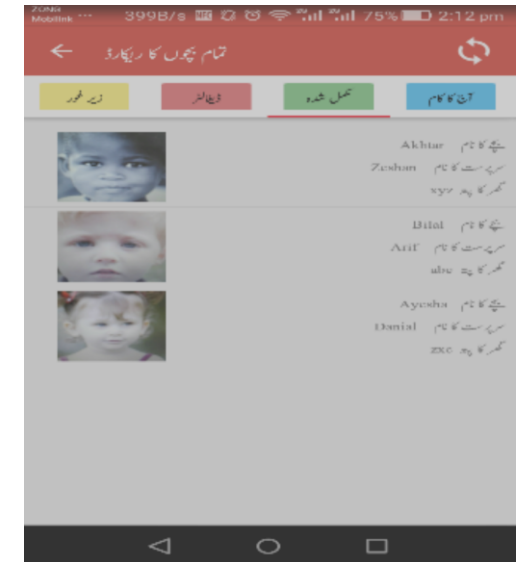
2 - Scan a card

- Shows the exact visit on the screen
- Reducing search time



3 - View all children of Union Council

- (Immunization) Defaulter Children
- (Immunized) On-time Children
- (Immunization) Completed Children



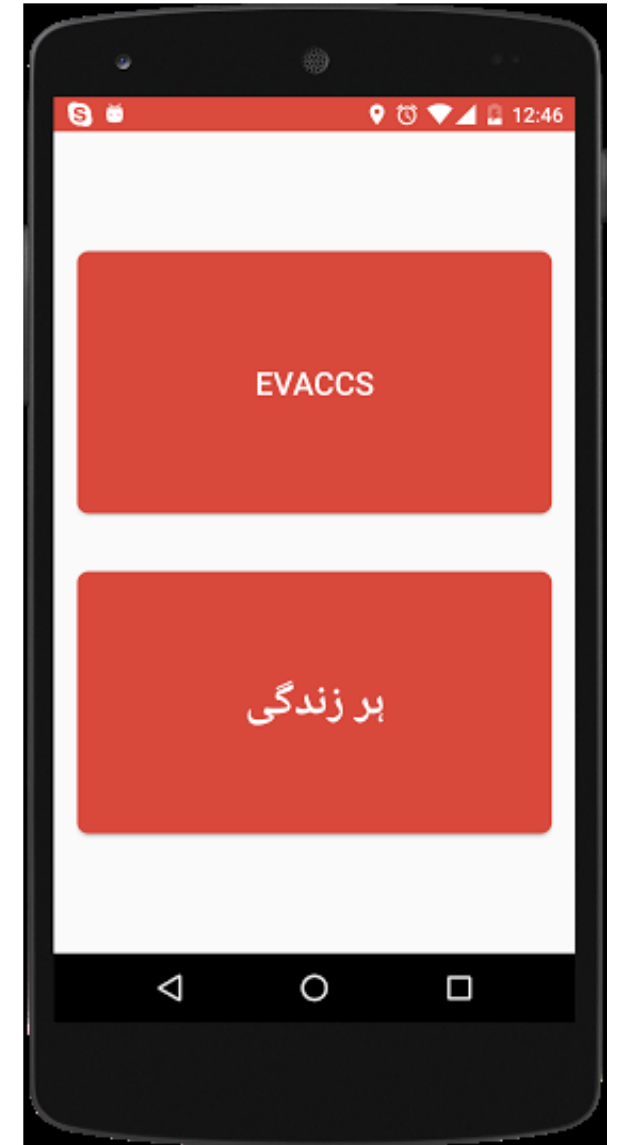
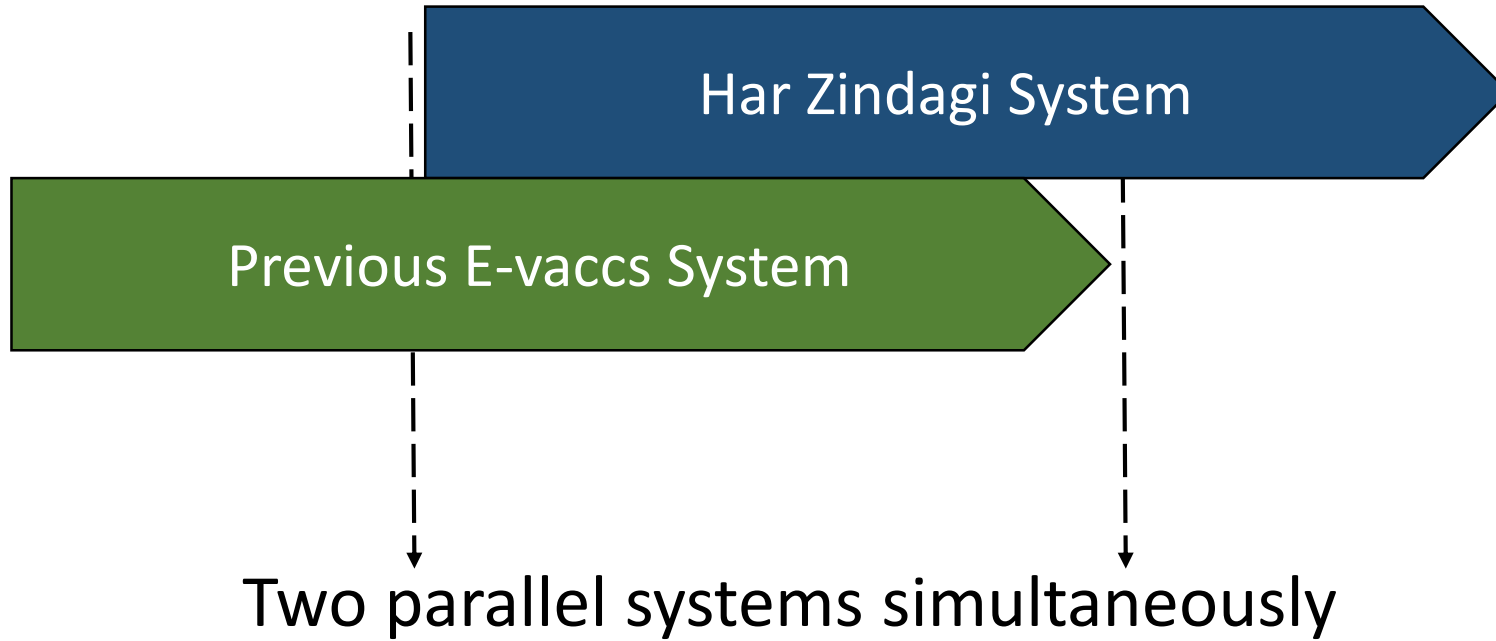
4 - Searching a child

- Reasons for Searching
 - Frequent lost cards
 - Forgot to bring with them
 - Movement and displacement
- Search Methods
 - Online Search
 - Offline Search using SMS

Iteration 3: Additional Features

- Facial detection for photographs
- Update application remotely
- Data recovery (from central server) on fresh install
- Calculation of next due date
- Image compression for uploading

Backward compatibility



Learning from E-vaccs

1st Iteration

2nd Iteration

3rd Iteration

Field Testing

Small scale app testing with users

- Methodology:
 - 50 vaccinators from 2 districts
- Two step process:
 - Step 1: Training for using the new app:
 - Presentations and videos in Urdu and Punjabi
 - 2 hour long trainings
 - Followed by question and answer session
 - Step 2: Task based assessment



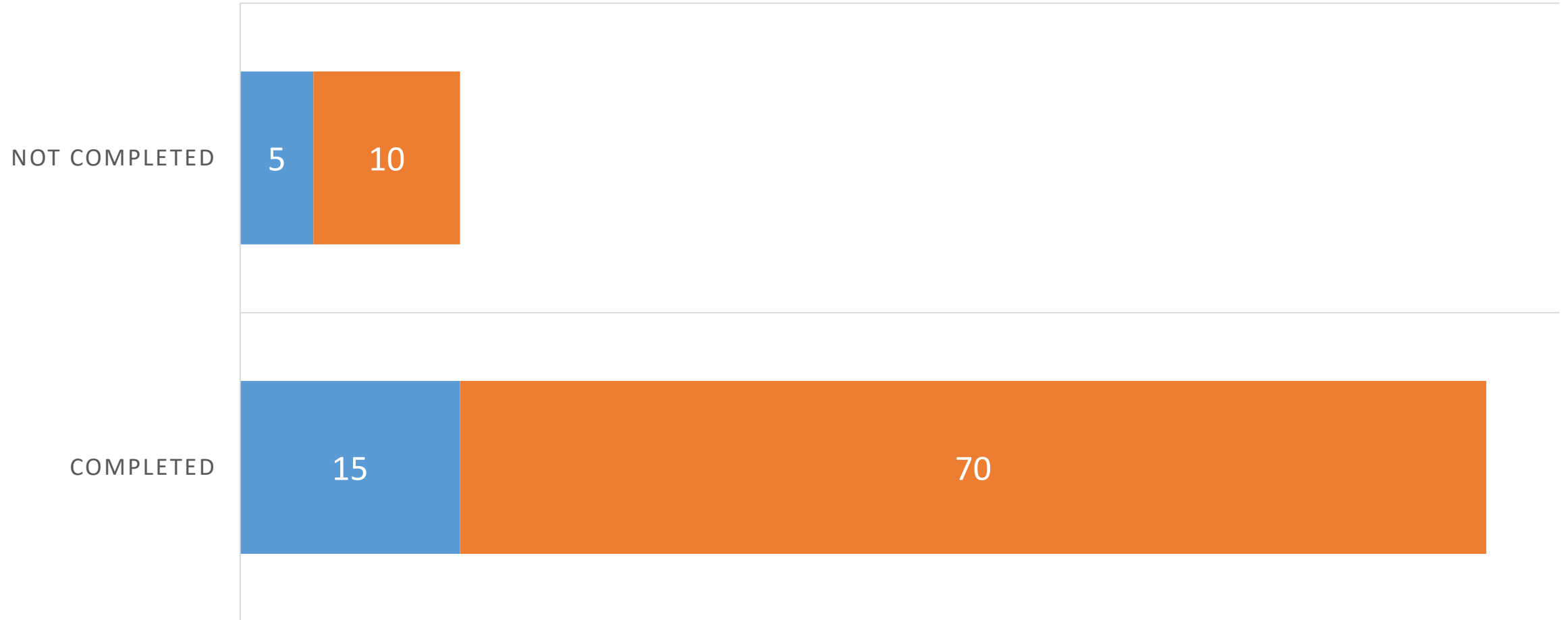
Task Based Assessment

- Groups with 3 to 4 vaccinators
 - Avg. 21 years of service
- Performed tasks:
 - Registering a child
 - Recording a visit (with card)
 - Recording a visit (without card)
 - Searching child
- Average time: 5 minutes
- Technical staff for support
- Research staff for participant observation



TASK COMPLETION PERCENTAGE BY USERS

■ Asked for help ■ Did not ask for help



Learning from E-vaccs

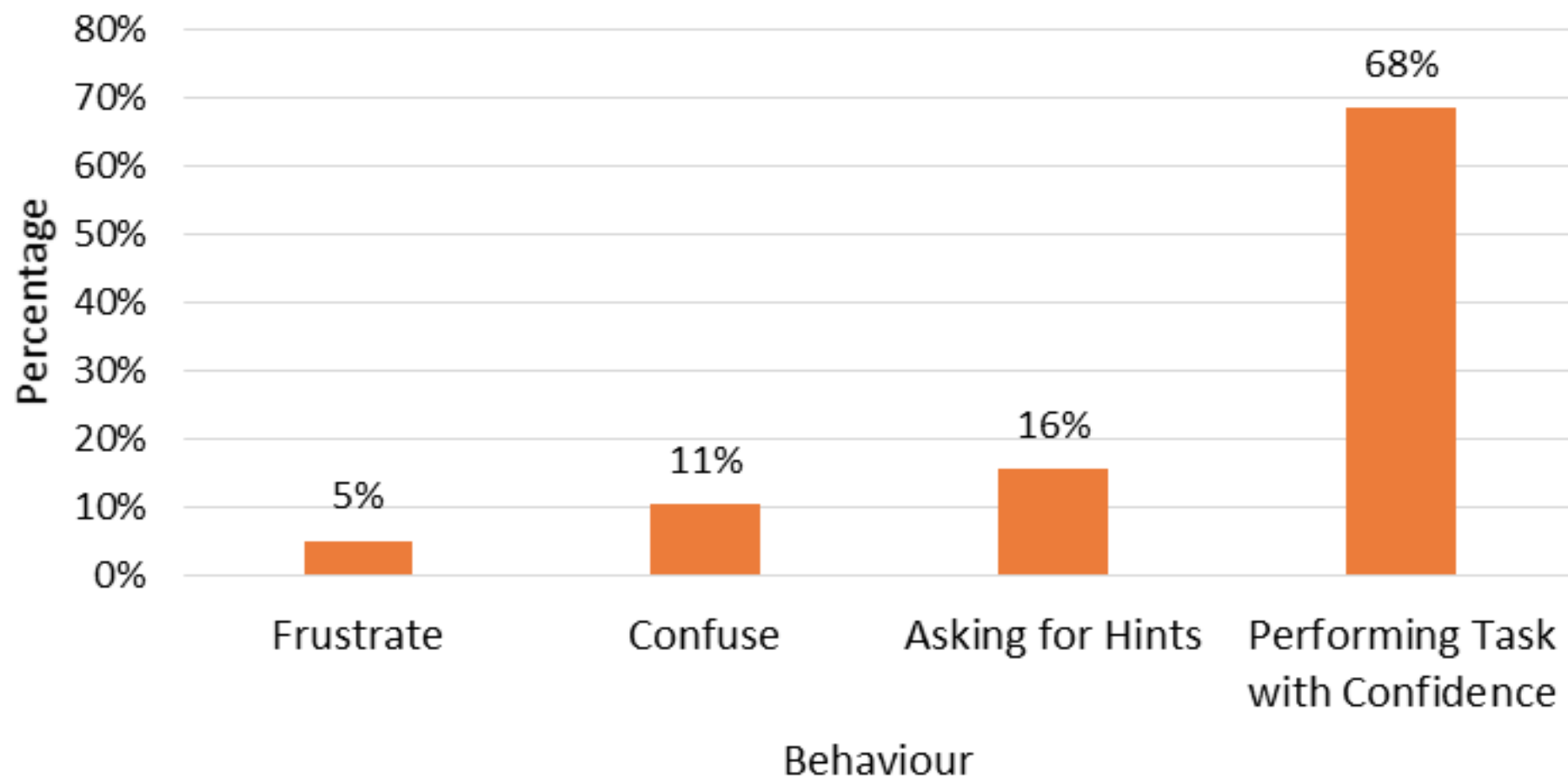
1st Iteration

2nd Iteration

3rd Iteration

Field Testing

Behavioural response while using app



Learning from E-vaccs

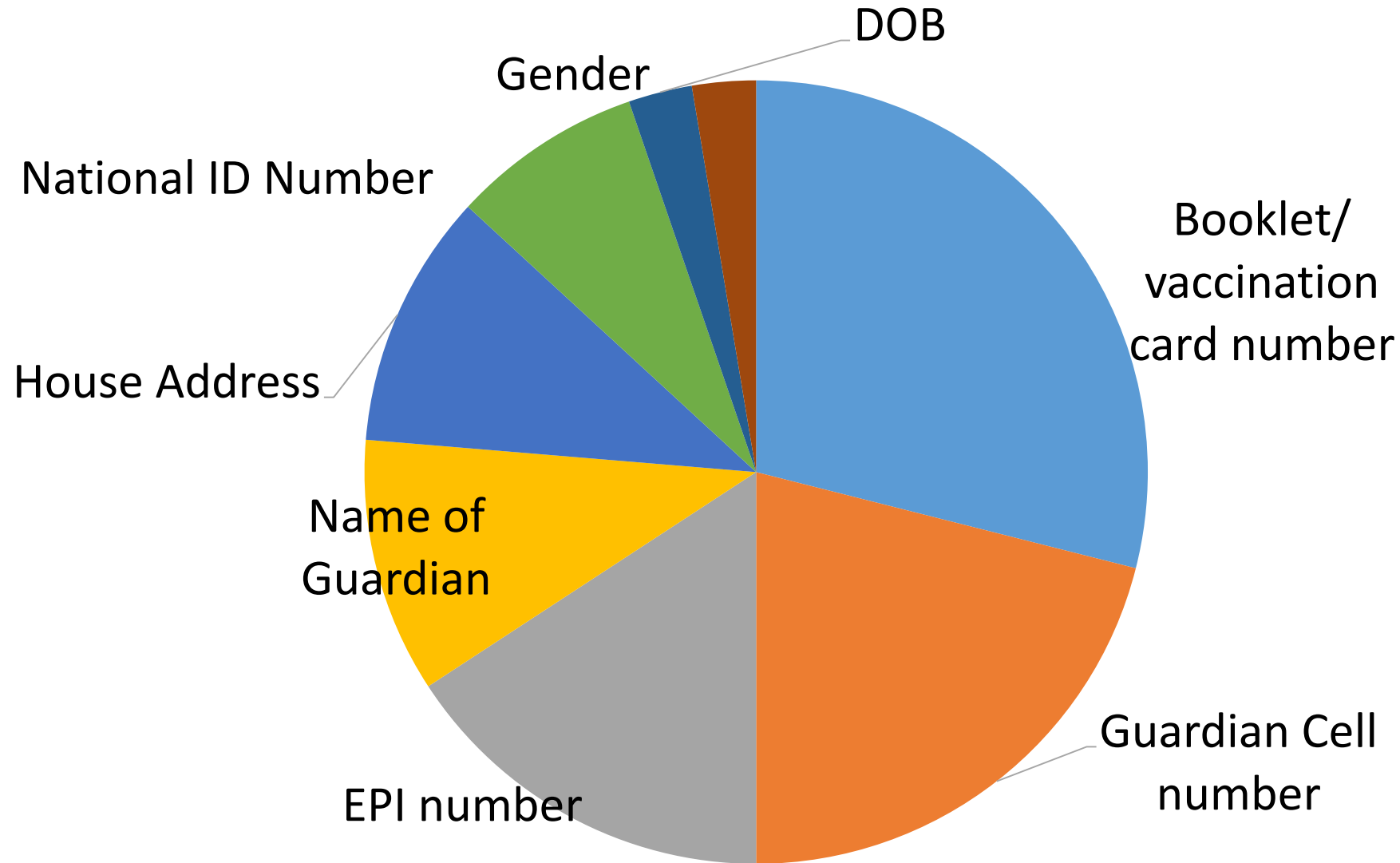
1st Iteration

2nd Iteration

3rd Iteration

Field Testing

Frequency and Nature of Errors



Learning from E-vaccs

1st Iteration

2nd Iteration

3rd Iteration

Field Testing

Qualitative Findings

Liked Features

- Data retrieval through NFC
- Face recognition
- Defaulters list
- Efficient record searching
- One click upload

Disliked Features

- Twice image capturing
- Duplicate entries on card

Suggestions

- Daily immunized list
- Offline check-out

Vaccinator's feedback

*“These vaccinators are not educated enough to learn everything in one go. You should give them more training sessions but **make sure** that for all next training session, **supervisors are not around, especially if you want them to speak out and to give you their honest opinion.**” [Vaccinator]*

Discussion

- Seeking feedback with top down deployments
- Contradictory requirements of vaccinators and policy makers
- Look out for Implicit & Explicit requirements
- Need for validation of requirements by field knowledge

Future Work & Recommendations

- Simpler technology solutions for usability, administrative and security concerns
- Data binding to IMEI, pictorial evidence, GPS location to verify presence, Customization to users
- Consumers of data needed to add a feedback loop
- Parents need to be incentivized for immunization coverage

Acknowledgments

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Thank you

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