Preliminary results from direct-to-facility vaccine deliveries in Kano, Nigeria

Muyi Aina
Uchenna Igbokwe
Solina Center for International Development and Research

Rabiu Fagge
Kano State Primary Health Care Management Board

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General information on Kano state, Nigeria

Kano State has 44 LGAs

Kano at a glance

Population[1]	▪ 11 Million (2011)
GDP per capita[2]	▪ $1,288 USD
No. of children <1	▪ 0.44 Million
Infant mortality rate[3]	▪ 50 deaths per 1,000 children
Immun. coverage rate[4]	▪ BCG: 27.5% ▪ DPT3: 18.9% ▪ Fully immunised: 13.2%
Healthcare facilities	▪ 1,300 PHCs;, 1,142 providing RI services

SOURCE: 1. City population statistics; 2. Canback Dangtel C-GIDD, 3. MDG 2014; 4. Nigeria Demographic and Health Survey, 2013

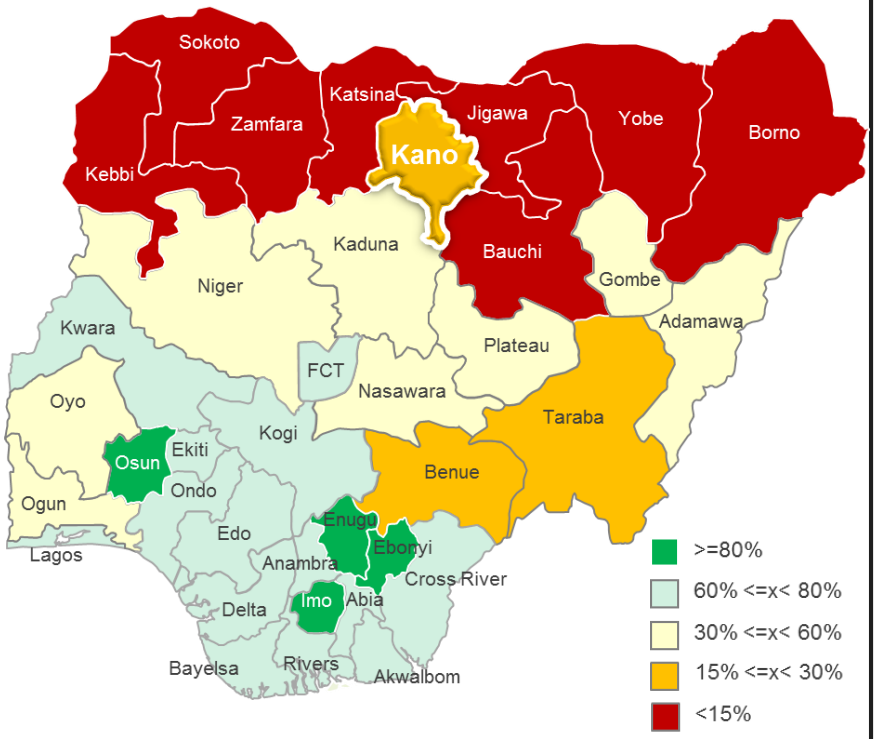
Historically, a weak vaccine supply chain system significantly contributed to poor immunization coverage rates in Kano

Key supply chain bottlenecks resulted in inadequate supply of vaccine for RI sessions…

1. Inadequate cold chain and poor maintenance limiting vaccine availability at service points
2. **Complex and ineffective distribution architecture causing frequent stock outs**
3. Inadequate and ad-hoc funding for vaccine transportation across all levels
4. Faulty vaccine forecasting and allocation which did not adequately reflect demand
5. Weak data management systems resulting in ineffective management decision making
6. Lack of proper supportive supervision due to funding limitations and capacity gaps

…and contributed to the poor vaccination coverage in Kano and other northern states

DPT3 coverage by state (NDHS 2013)



1. 'Baseline' Kano RI coverage survey conducted in 2014 showed a DPT3 coverage of 38%
2. This reflected the vaccination coverage status as @ Jan 2012 – May 2013

SOURCE: Kano RI program diagnostics; NDHS 2013; KanRICS 2014

A tripartite MoU to strengthen RI, enabled Kano state to embark on the ambitious transformation of its vaccine supply chain

Kano state, BMGF and Dangote Foundation executed an MOU in Nov 2012 to strengthen RI

The MoU supported interventions across core RI thematic areas:

- Governance (PHCUOR policy implementation)
- Service delivery
- **Vaccine supply chain**
- Supportive supervision
- Data management and use
- Community engagement and social mobilization

1. Deployed weekly dashboard on vaccine stock performance

2. Strengthened cold chain infrastructure at facilities and satellite stores

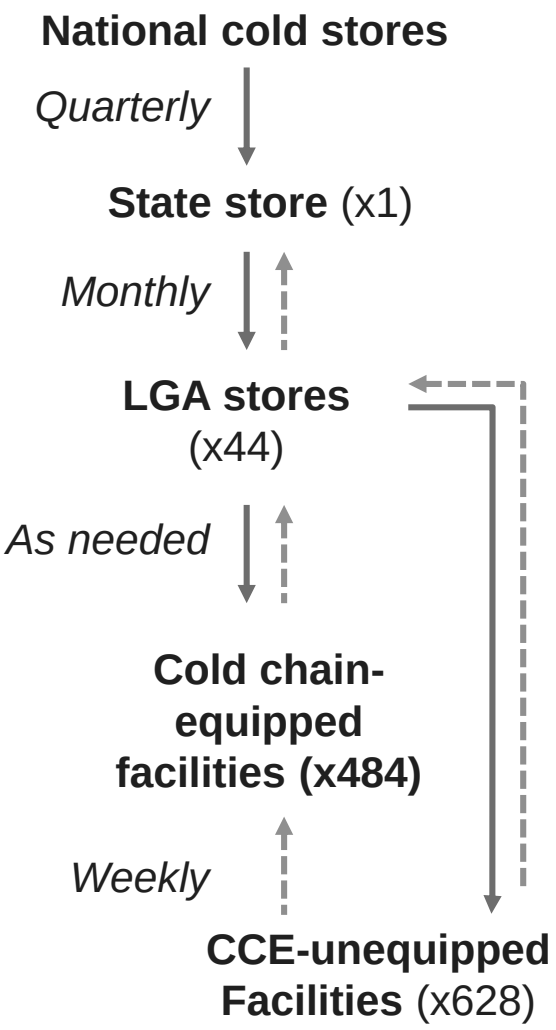
3. Re-designed the vaccine distribution architecture and engaged private vendor

4. Set-up working group to manage the transformation

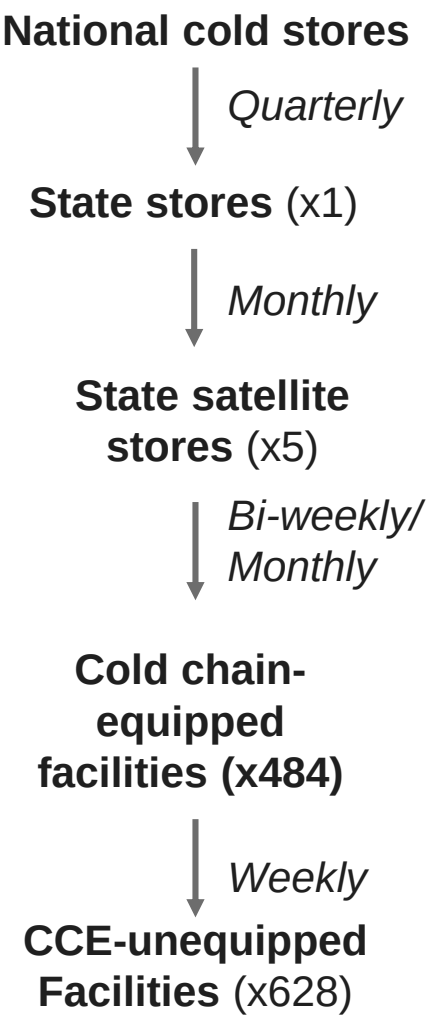
The re-designed architecture delivered vaccines directly to equipped health facilities from state satellite stores

Vaccines delivered Vaccines picked-up

A. Previous vaccine distribution architecture

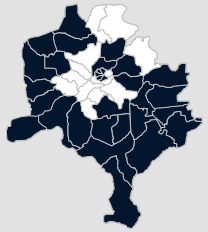
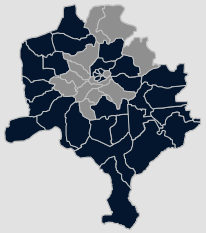


B. Re-designed vaccine distribution architecture



The new system utilized both insourced and outsourced approaches

LGAs covered by state
LGAs covered by private vendor

	Description	# satellite stores	# primary and cascade facilities	Primary to cascade ratio
Insourced 	**State-run:** ▪ Deliveries carried out by state drivers using state delivery trucks, and coordinated by state delivery manager	**2**	Primary: 212 Cascade: 142 354	**1 : 1.5**
Outsourced 	**Private vendor-run:** ▪ Vehicles and drivers provided by private vendor; deliveries coordinated by vendor delivery manager	**4**	248 + 454 702	**1 : 1.8**
Total 	***Note:*** *All inventory management and warehousing is managed by the state*	**6**	390 + 666 1,056	**1 : 1.7**

SOURCE: KSPHCMB, Solina analysis

Content

We conducted a retrospective review of program data to understand the effects of the direct deliveries on stock performance and vaccinations

Objective

- To describe the preliminary results from Kano's direct delivery operations

Approach

- Retrospective review of data on the performance of the program

Duration

- 20 months of implementation (June, 2014 – January, 2016

Sampling

- All equipped health facilities included in study sample for vaccine stock performance
- 30 representative facilities selected through a multistage stratified random sampling included in the vaccination analysis

Quantitative data

- Vaccine stock data obtained through physical stock counts at equipped facilities during deliveries
- Vaccination data obtained directly from immunization tally sheets at health facilities
- Cost data was obtained from expenditure reports, market survey and interviews
  - Capital costs were amortized to reflect annual costs

Qualitative data

- Targeted key informant interviews and focus group discussions with relevant stakeholders using structured questionnaires

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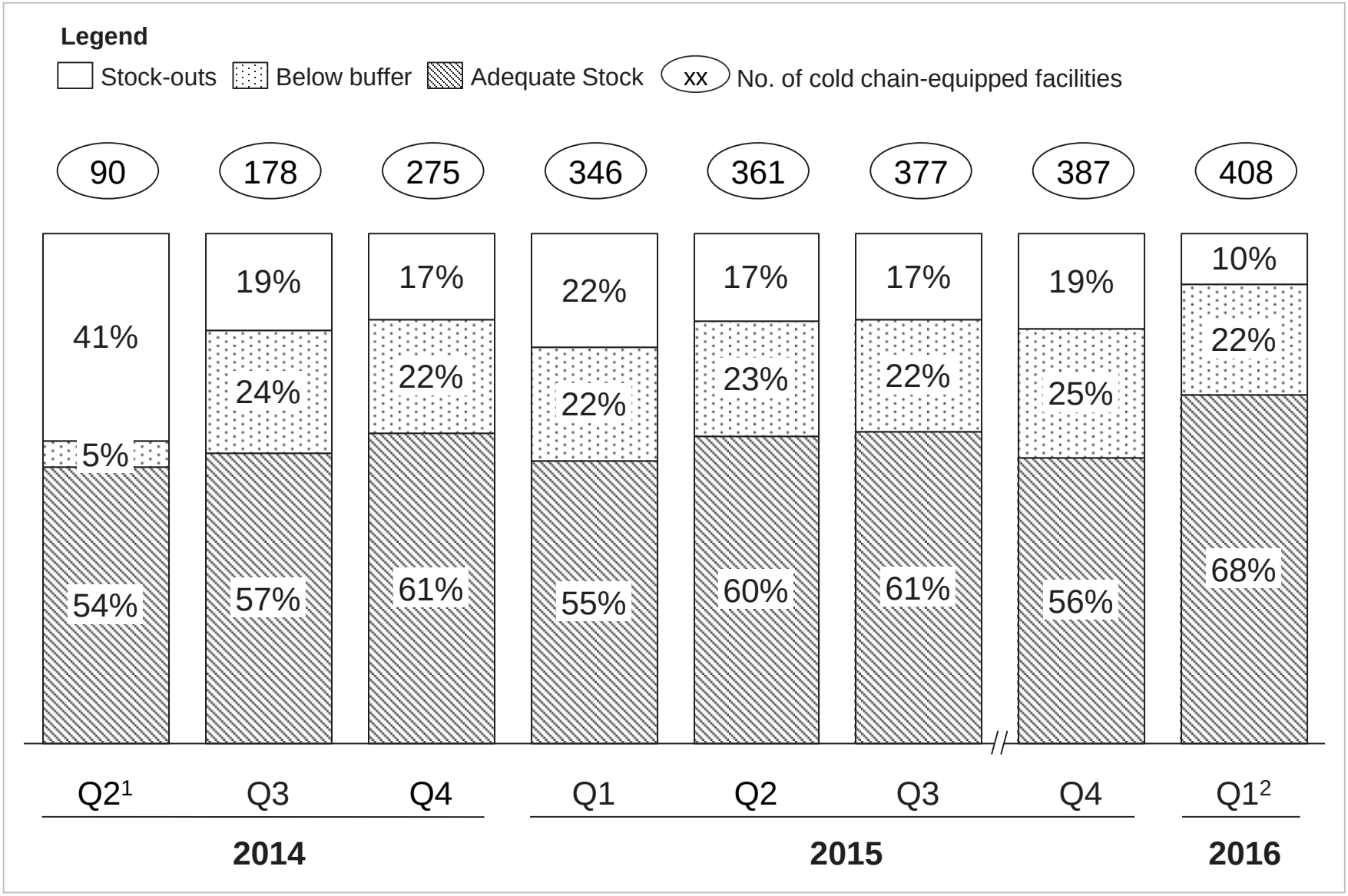
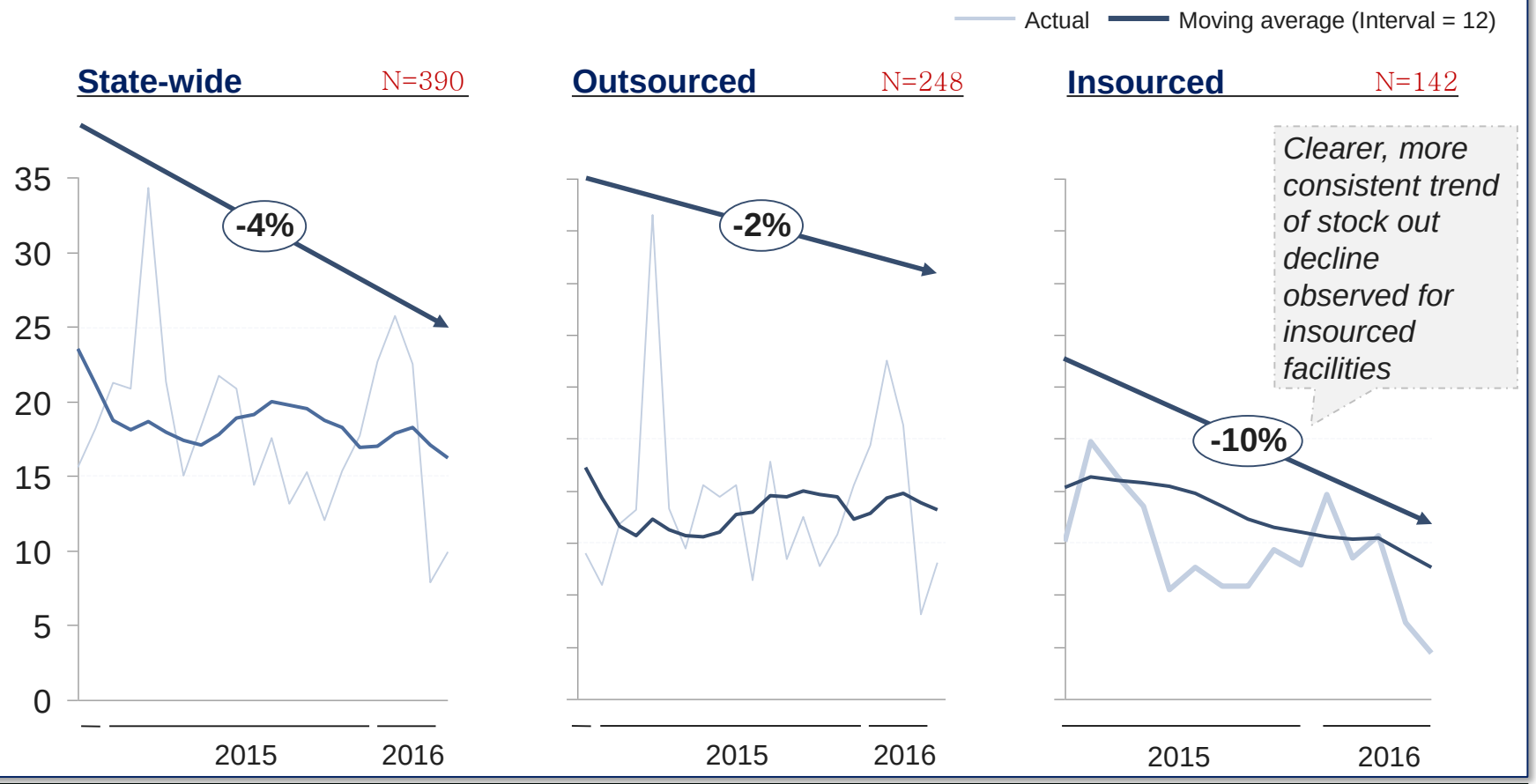
There was a significant reduction in stock outs at CCE equipped facilities following the implementation of direct deliveries



Stock out rates have declined across facilities receiving vaccines through both insourced and outsourced models

Percentage of antigens stocked out at primary facilities receiving direct deliveries in Kano *(%)*

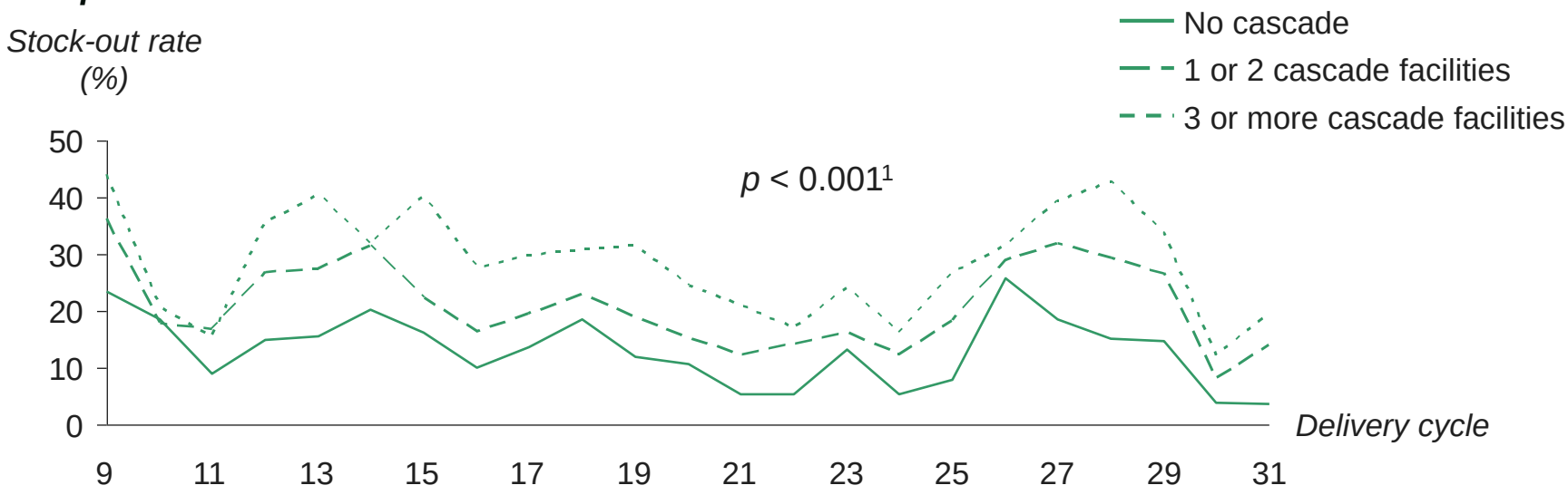


- Greater ownership and accountability for stock performance results by LGA CCOs (who participate more regularly on vaccine deliveries to insourced facility) is driving the consistent stock out decline
- It will be critical to ensure LGA CCOs take full ownership of deliveries from inception regardless of the model deployed

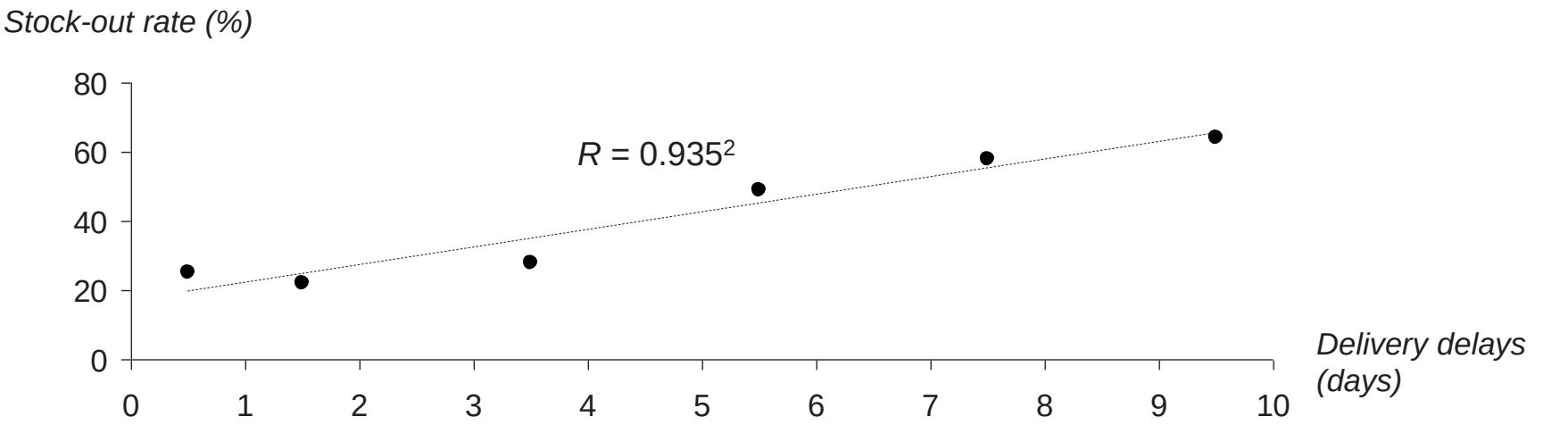
SOURCE: Kano stock performance dashboard, Team analysis

Delivery delays and increasing numbers of cascade facilities negatively impacted the stock performance

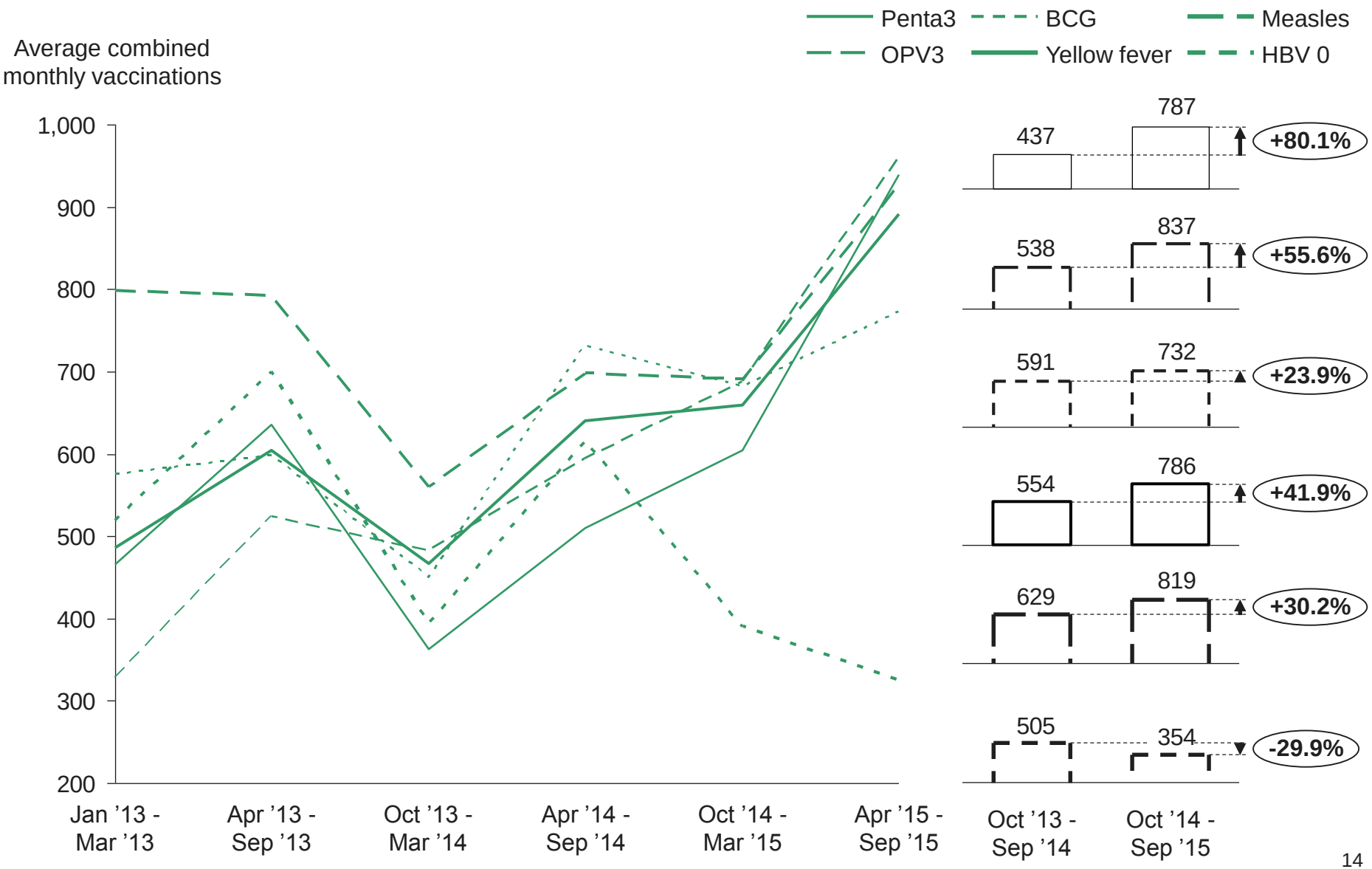
a. Impact of cascade facilities on stock-out rates



b. Impact of delivery delays[3] on stock-out rates



There was a 1-year lag before a corresponding increase in vaccinations (all vaccines except HepB) was observed



Beyond improved stock performance, direct deliveries yielded additional benefits for the RI program

More focus on service delivery: Health worker spend more time delivering services to clients.

Improved stock data management: The model created visibility into facility stock levels through onsite information capture

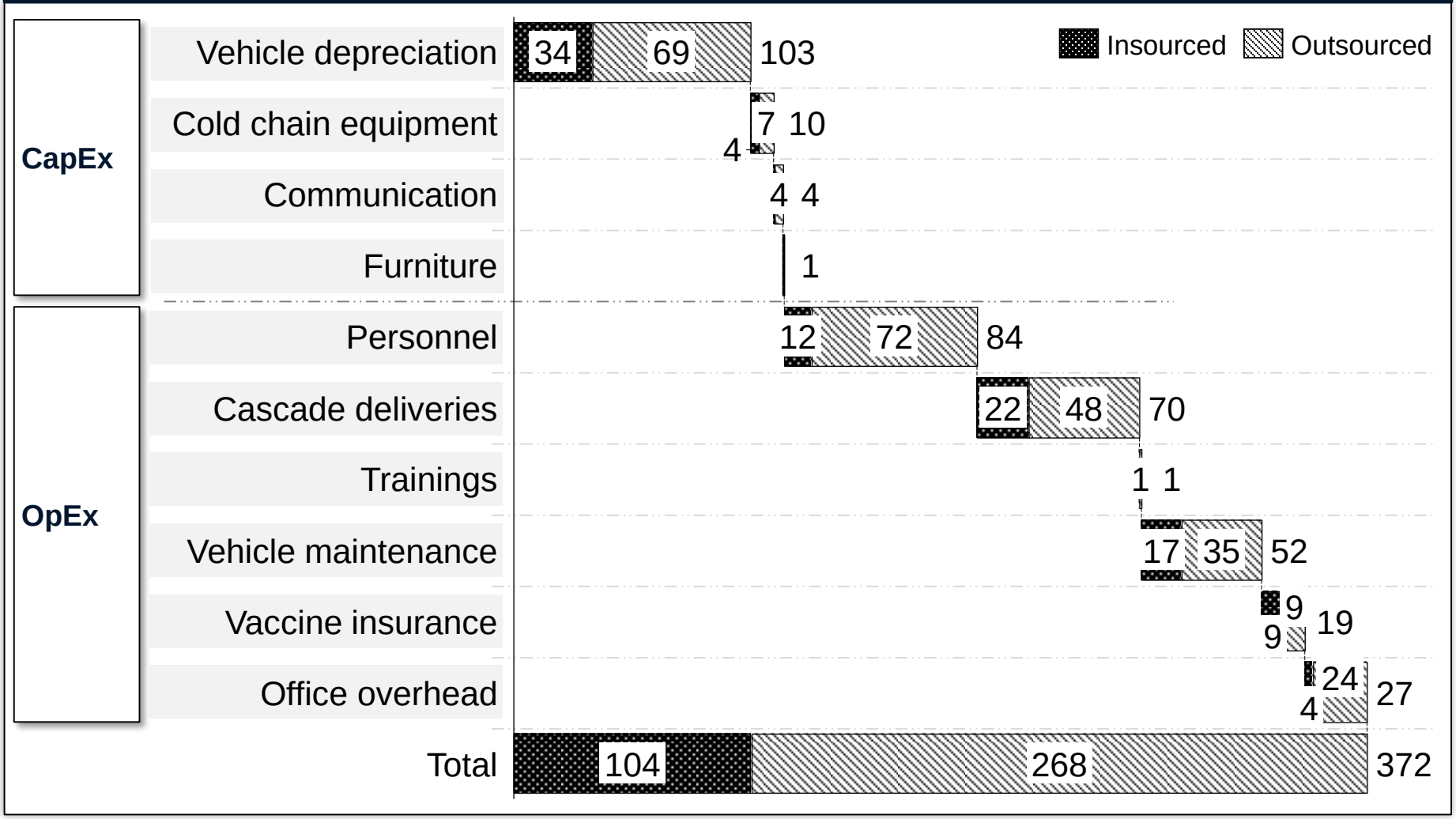
Additional opportunities for supervision: Logisticians mentor facility personnel on vaccine management, handling and CCE maintenance on delivery visits

Other benefits

- Distribution of other PHC items e.g. data tools
- Regular monitoring of CCE functionality
- Retrieval of safety boxes

Vehicle depreciation, personnel and vaccine distribution to unequipped facilities were responsible for the bulk of direct delivery costs

Summary of annual program costs of Kano's direct vaccine delivery program[1]
(US$, 000)



1. Bi-weekly delivery costs for a year. Costs of insourced and outsourced not comparable as they are not on the same scale

The annual cost of vaccine distribution per child < 1 in Kano was US$0.74

Summary of annual program costs of Kano's direct vaccine delivery program[1]

		Overall	Insourced	Outsourced
# primary facilities (#)		390	142	248
# cascade facilities (#)		666	212	454
Bi-weekly deliveries *(US$[2])*	Annual cost per child[3]	0.7[6]	0.6	0.8
	Unit cost per ward[4]	36.7[6]	28.1	41.6
	Unit cost per delivery[5]	29.7[6]	22.0	34.1

1. Bi-weekly delivery costs for a year. Costs of insourced and outsourced not comparable as they are not on the same scale
2. Naira value converted to USD @197NGN/USD
3. Annual cost of vaccine distribution per child
4. Unit cost of distribution per ward – includes cost of cascade deliveries
5. Unit cost per health facility receiving vaccines annually
6. Cost are weighted insourced and outsourced scale

SOURCE: Team analysis

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We have learnt some lessons from Kano direct delivery experience (1/2)

1. Private vaccine distributors need **an upstream role in health facilities stock allocations** for outsourcing to be maximally effective.

2. **Scale matters**; so better to run either a outsourced model or an insourced system for economies of scale

3. Fewer deliveries result in higher per-delivery costs but lower total program costs. Government should continue to **plan facility CCE requirements to accommodate at least monthly deliveries**

4. Beyond costs, running a direct delivery program (insourced or outsourced) requires **significant management and analytic capacity within the state**

5. A strong governance structure and **sustainable and reliable funding and fund flows** were critical to successful implementation of the program.

SOURCE: Team analysis

We have learnt some lessons from Kano direct delivery experience (2/2)

6. Although we cannot necessarily generalize trends in the few sentinel facilities to the entire state, it was **encouraging nonetheless that vaccinations are trending upwards**

7. The **one year lag before vaccinations started to rise could be due to the slow reestablishment of trust** in the health system, following a prolonged history of eroded community confidence

8. Benefits and potential pitfalls exist for both insourced and outsourced approaches**. Ultimately, important trade-offs need to be made in selecting the best suited approach for each setting.**

9. **Concurrent operation** of both insourced and outsourced programs enabled Kano **build in-house capabilities in vaccine logistics, while benefiting from private sector innovations**

SOURCE: Team analysis

Content

Conclusion

- As newer, more expensive vaccines are introduced into national EPI programs, reformer governments need to continually innovate.

- Though the Kano experience provides guidance on implementing direct vaccine deliveries at scale, policy makers and implementers need to interpret these findings and make program decisions that take into account their own broader contexts to ensure ownership and sustainability.

- Future studies need to review results of alternative delivery approaches; like properly funded traditional pull systems or ‘fully outsourced’ systems before conclusions can be reached on the best suited model for prospective reformers

- Cost effectiveness analysis that assess incremental costs per point improvement on the primary outcome measure (e.g. DALYs) will provide a basis for objective comparison of alternative models

Thank you for listening

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Preliminary results from direct-to-facility vaccine deliveries in Kano, Nigeria ☆

Muyi Aina[a], Uchenna Igbokwe[a], Leke Jegede[a], Rabiu Fagge[b], Adam Thompson[c], Nasir Mahmoud[b]

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https://doi.org/10.1016/j.vaccine.2016.11.100

http://www.sciencedirect.com/science/article/pii/S0264410X1730052X

Back-up slides

Reanalysis of the trends excluding 5 outlier cycles showed statistically significant reduction in stock outs across both delivery models

Delivery model	# cycles	Stock outs		Below buffer		Adequate stock	
		slope	p-value[1]	slope	p-value[1]	slope	p-value[1]
All delivery cycles							
Combined	33	-0.48	0.005	+0.41	0.111	-0.07	0.789
In-sourced	26	-0.49	0.001	-0.73	0.006	+1.22	0.002
Out-sourced	33	-0.33	0.110	+0.40	0.192	-0.07	0.828
Excluding outlier cycles[2,3,4]		slope	p-value[1]	slope	p-value[1]	slope	p-value[1]
Combined	28	-0.65	0.001	+0.59	0.001	+0.10	0.600
In-sourced	21	-0.52	0.004	-0.79	0.018	+1.31	0.000
Out-sourced	28	-0.55	0.005	+0.53	0.001	0.02	0.936

1. 2 sided test of null hypothesis that slope = 0 at alpha of 0.05.
2. Cycle 9 excluded because of poor performance following 5 days delays in commencement of the delivery cycle due to state wide stock-out of 5 antigens.
3. Cycle 16 (Feb 2015) excluded due to outlier poor performance following 2 missed cycles caused by state-wide health worker strikes.
4. Cycles 28, 29 and 30 excluded due to poor performance caused by back to back transitions from bi-weekly to monthly deliveries and from 1 state store to 6 satellite stores.

SOURCE: Kano stock performance dashboard, Team analysis

1 Weaknesses with the old vaccine distribution system were identified to guide targeted system design options

Features of the delivery system	The old system was multi-layered, complex and mostly ineffective	The streamlined vaccine delivery system addressed the weaknesses of the old system…	…to yield a number of benefits
Direction of vaccine movement	Pull system relied on service providers having financial incentives to ensure vaccine availability	Vaccines are now delivered to the health workers who can focus on their work at the facilities	Time gained is spent attending to more clients
Number of storage tiers	High number of stakeholders required in the ordering process across all 3 storage tiers (state/satellite, LGAs and facilities)	Reduced number of ordering points and transportation legs by skipping 44 LGA nodes	Reduced number of stops before the service points
Financial flow	Limited accessibility of funds for deliveries from the LGAs to service points	Reduced number of transactions required to complete a delivery cycle by bypassing the LGAs	Simplified funding system managed solely by state
Performance management	No clear ownership and accountability for supply chain performance due to complexity	State logistics officer and SLWG fully accountable for processes and results of the chain	SLWG in place to sustainably run the system

*Opportunities to **leverage the private sector to complement governments' efforts** in improving vaccine distribution were also considered as part of the system re-design*

SOURCE: Team analysis

2 Some international best practice examples were also considered to guide the system re-design

Streamlining example

Streamlining plus outsourcing example

	Intervention summary	Effects of intervention on supply chain
Senegal (St, Louis region)	Supply chain architecture streamlined by **moving vaccines directly from regional (state) stores to health facilities** using "moving warehouses"	▪ 33% rise in vaccine availability at facilities from baseline, plus ~100% timely deliveries ▪ No change in costs compared to traditional non-streamlined system
South Africa (Western Cape province)	Vaccine procurement, warehousing and distribution **outsourced to a private logistics company;** and then streamlined to improve efficiency	▪ More cost-effective than previous Government-run system ▪ Improvement in timeliness of deliveries and improved accuracy in quantities ordered
Thailand (Country-wide)	A **vendor-managed inventory system (VMI) deployed** for vaccine supply management and distribution; **distribution subcontracted to a private logistics company**	▪ ~20% cost savings for total procurement and distribution costs in the first year ▪ Reduction in volume of vaccines distributed and time spent in storage

Implications for vaccine supply chain systems

1. Reducing the number of levels vaccine have to go through in the chain results in efficiency gains through reduction of time spent in storage, improved allocation accuracy and consequently reduced costs.
2. Outsourcing appropriate components of the supply chain to the private sector has the potential to significantly increase supply chain performance, and at the same time strengthen in-house government capacity to manage supply chain.

SOURCE: Optimise Study (PATH), Team analysis

The direct deliveries reduced time spent by health workers collecting vaccine and missed opportunities due to vaccine stock outs

Clients[1]

"I have never been told that there are no vaccines for immunization"
- Client at Middle road Health Facility

"I have never had such problem such as coming to hospital just to be told that there is no syringe."
-Client at Garangamawa PHC

Previously we have to wait for the arrival of the injection but now we always come and there is availability of it. When we come, they immunize our children. We don't experience waste of time
- Clients at Rijiya Lemo PHC

Manager'

"Health workers do not spend money out of their pockets anymore to pick up vaccines"
- Zonal Director, Gwale SPHCMB zone

"It allows us to properly support health facility in-charges with on the job training regarding vaccine and data management"
- SLO, Kano SPHCMB

100% of health workers were satisfied with direct deliveries because it allowed for more time for active caring for patients

RI partner

"Health workers now have time to do primary duties rather than going to the LGA cold store to pull vaccines "
- CHAI representative, Kano

Facility health workers

"I used to go before and collect vaccines but now we have it enough and there is no shortage"
- Health worker at Middle Road MCH, S/Gari West Ward, Fagge LGA

"Even if our patient delivers we send the vaccine to the labour room to give the baby BCG and OPV because we have it available"
- Health worker at Rijiya Lemo PHC, Fagge LGA

SOURCE: Team analysis