

Sample Transport Optimization

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ISB



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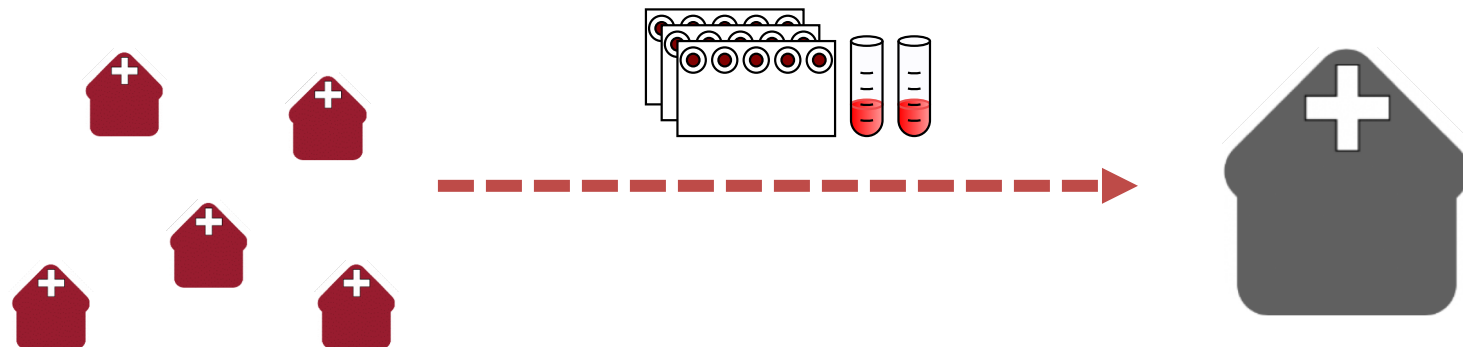
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Introduction

Sample transportation systems

Sample transportation systems are an essential link between healthcare facilities and medical laboratories.

- Healthcare facilities provide access to diagnostic services at a community level and collect diagnostic specimens (e.g. blood, sputum) from patients.
- Large centralized laboratories provide accurate and cost-effective sample testing.



Riders For Health Malawi

Malawi's national Sample Transportation Program is managed by **Riders For Health**.

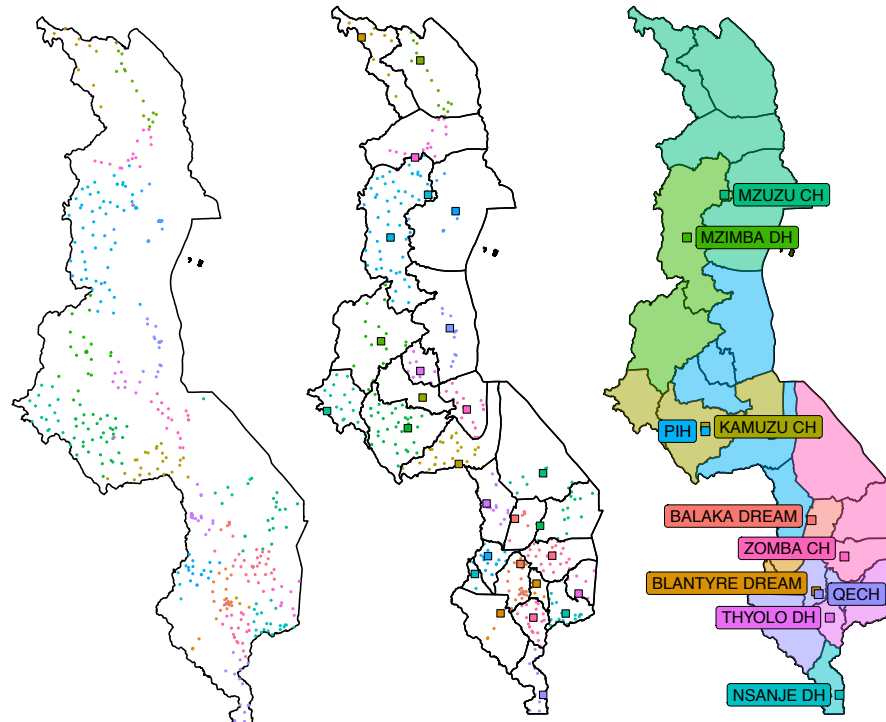
79 full-time
sample couriers

>600 health
facilities

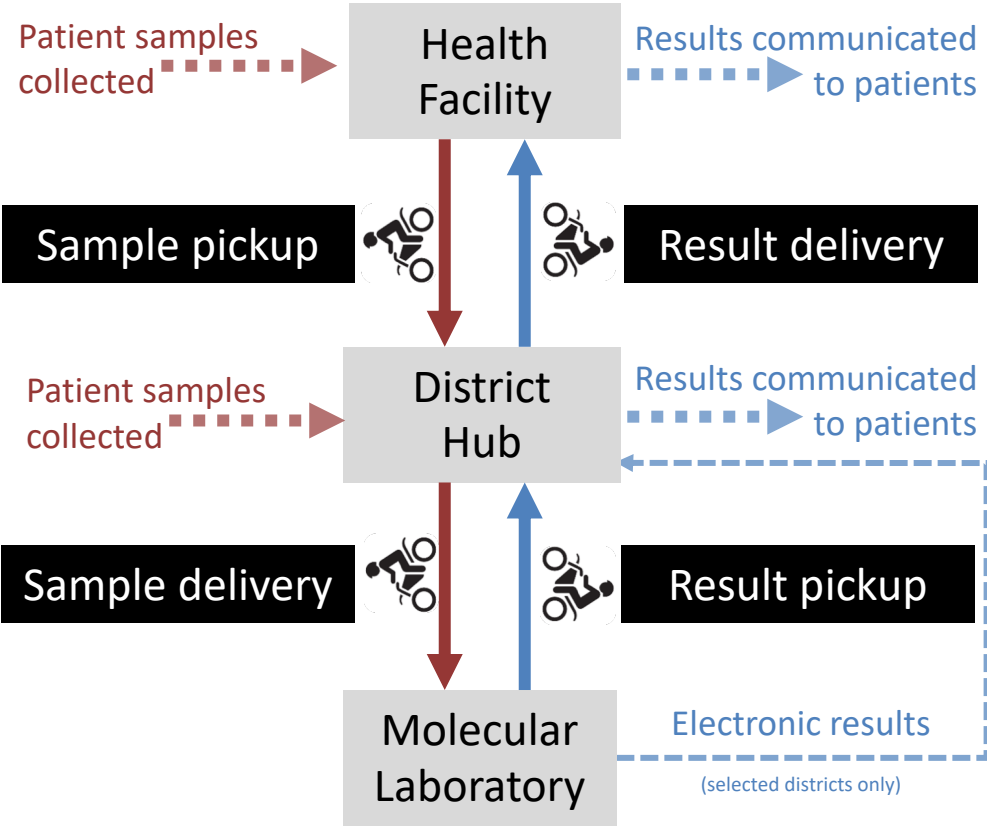
27 district
hubs

10 molecular
laboratories

40 000 samples
per month



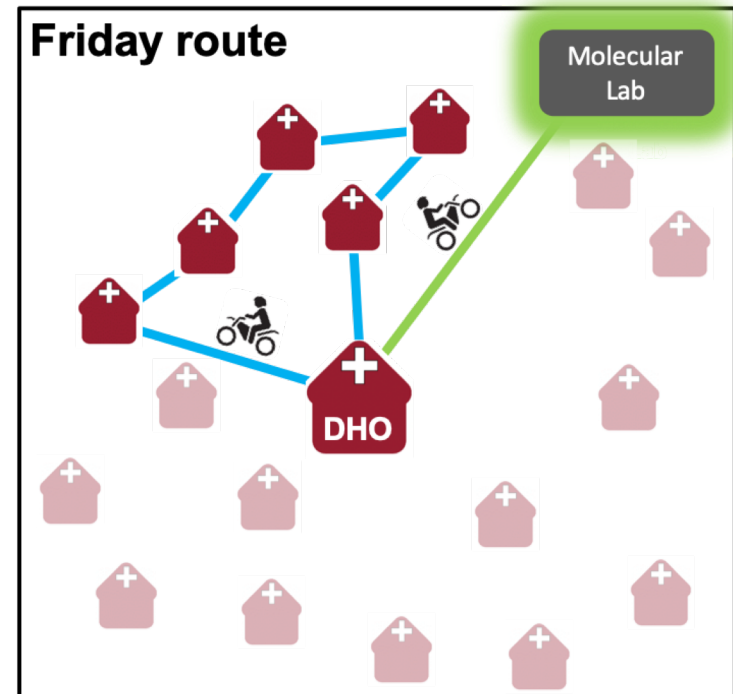
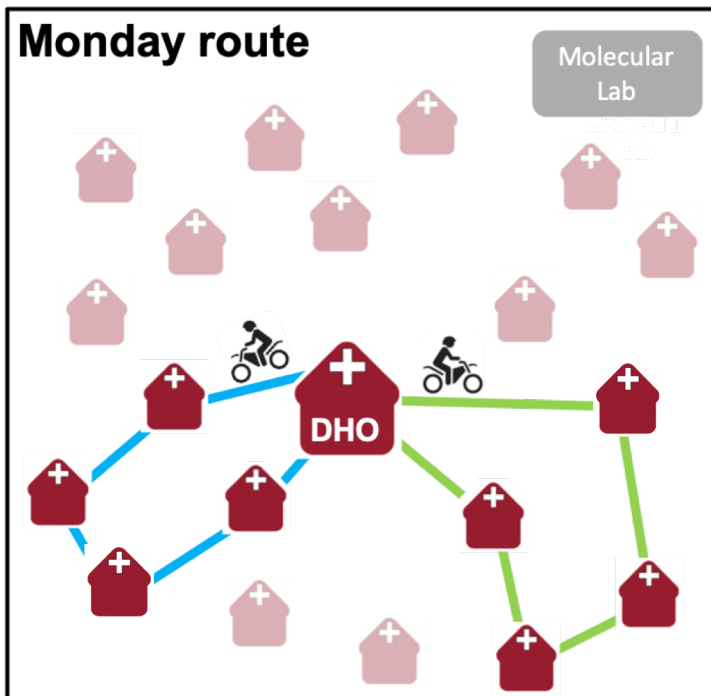
Sample transport network



ST operations

Current System

- RFH couriers follow a pre-determined weekly visit schedule (PUSH).
- Each health center is visited once or twice per week.
- Couriers go to the molecular laboratory once per week (most districts)



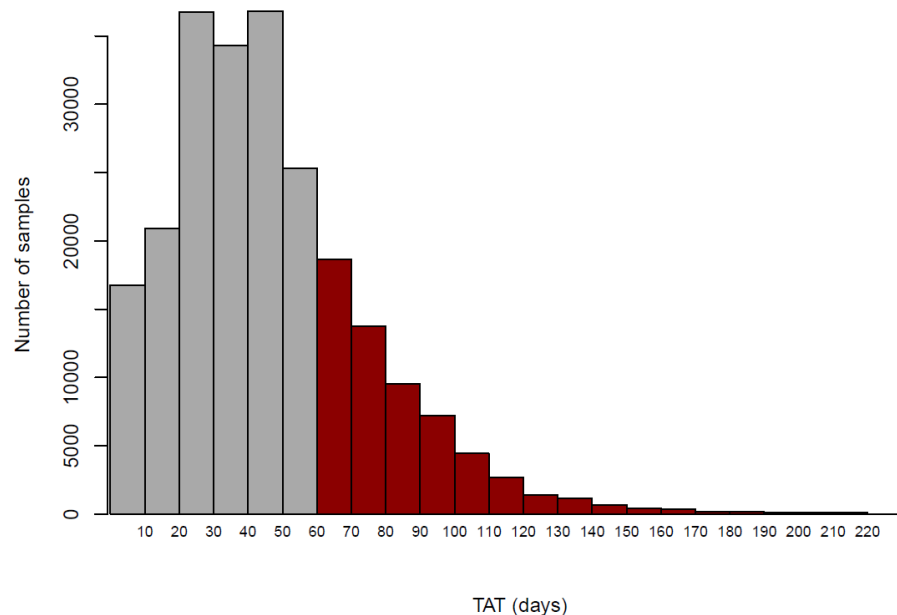
PUSH system challenges

- **Wasted capacity:** couriers visit facilities even if there are no samples or results.
- **Lack of flexibility:** visits are skipped due to public holidays, road conditions etc. This causes samples to wait at facilities for several days.
- **Poor prioritization:** trips to low-volume sites generally have the same priority as trips to high-volume sites, and molecular labs are visited less frequently than most healthcare facilities. Samples and results can wait for several days at these high-demand locations.

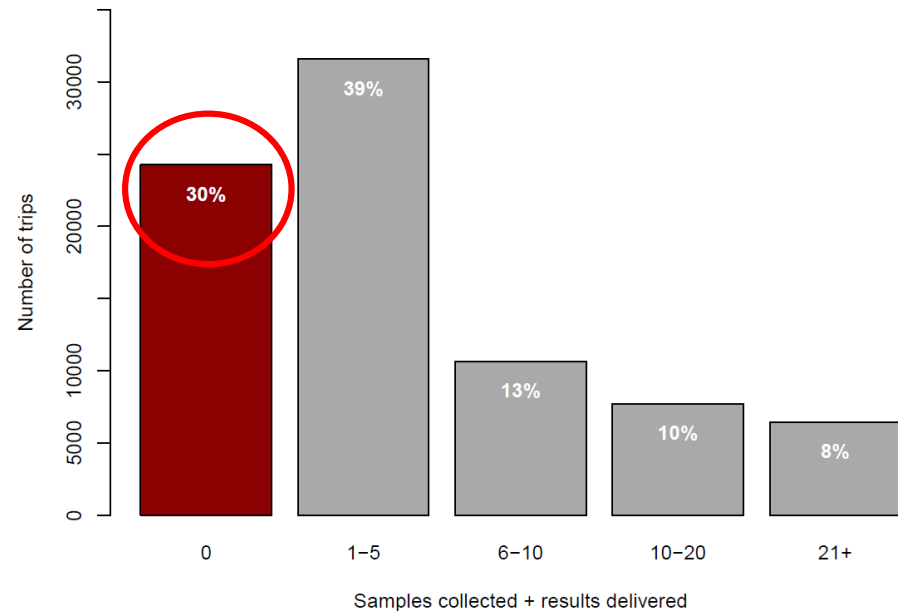
Motivation for ST optimization

In 2017, approximately 30% of visits to healthcare facilities were unnecessary because no samples or results were available for the facility

Sample TATs in 2017



Samples and results per trip in 2017



Approximately 25% of results delivered by RFH arrived more than 60 days after sample collection.

Optimized sample transportation

Optimized sample transportation strategy

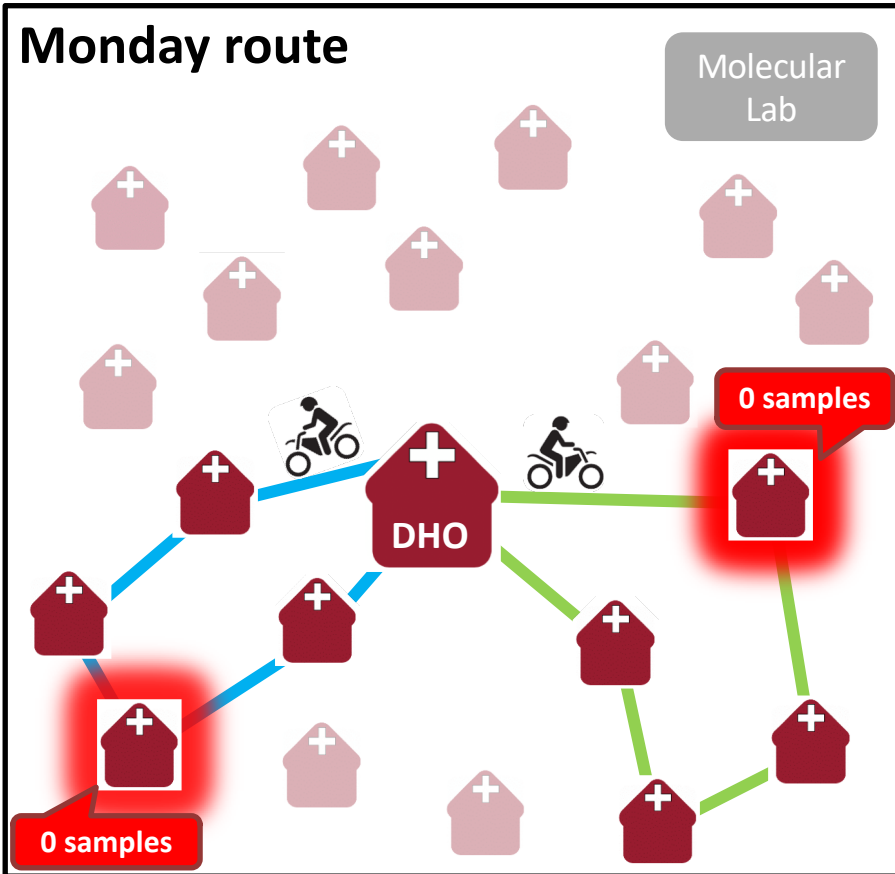
RFH couriers will follow a flexible schedule that will allow them to visit any facility on any day. (PULL)

- Reduce the number of unnecessary visits to facilities with no samples or results to be fetched.
- Schedule more frequent trips to the molecular laboratory and high-volume facilities.
- Improve the flow of samples through each stage of the ST process

Optimized sample transportation: example (1)

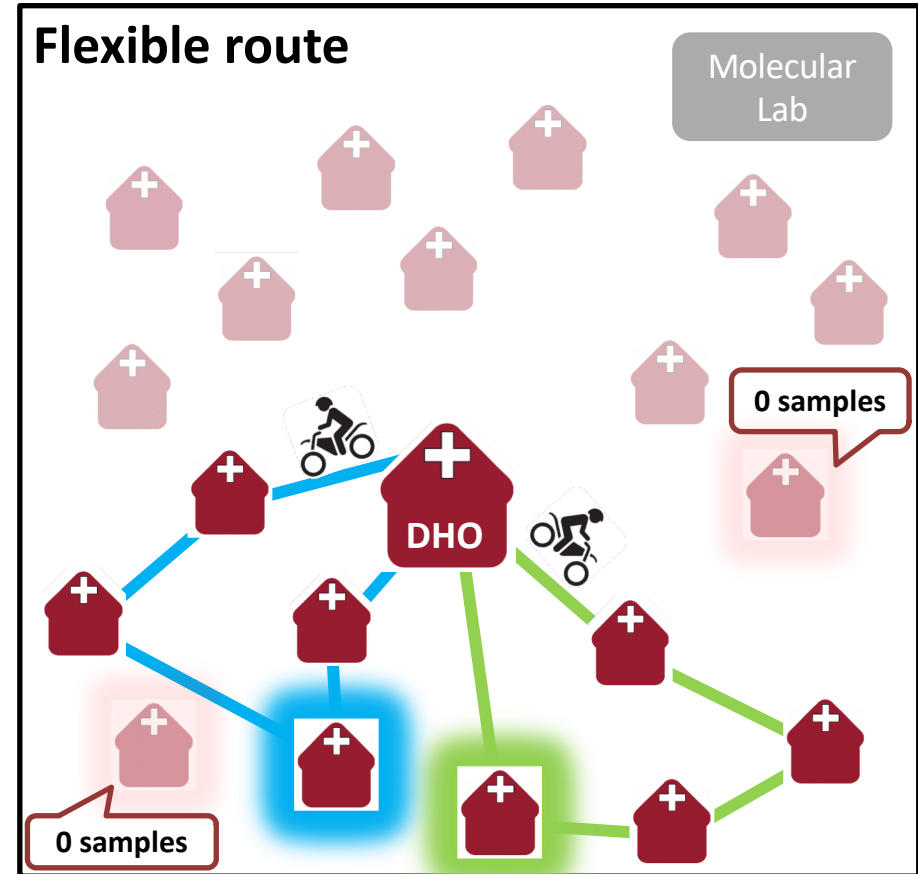
Old system

Monday route



New system

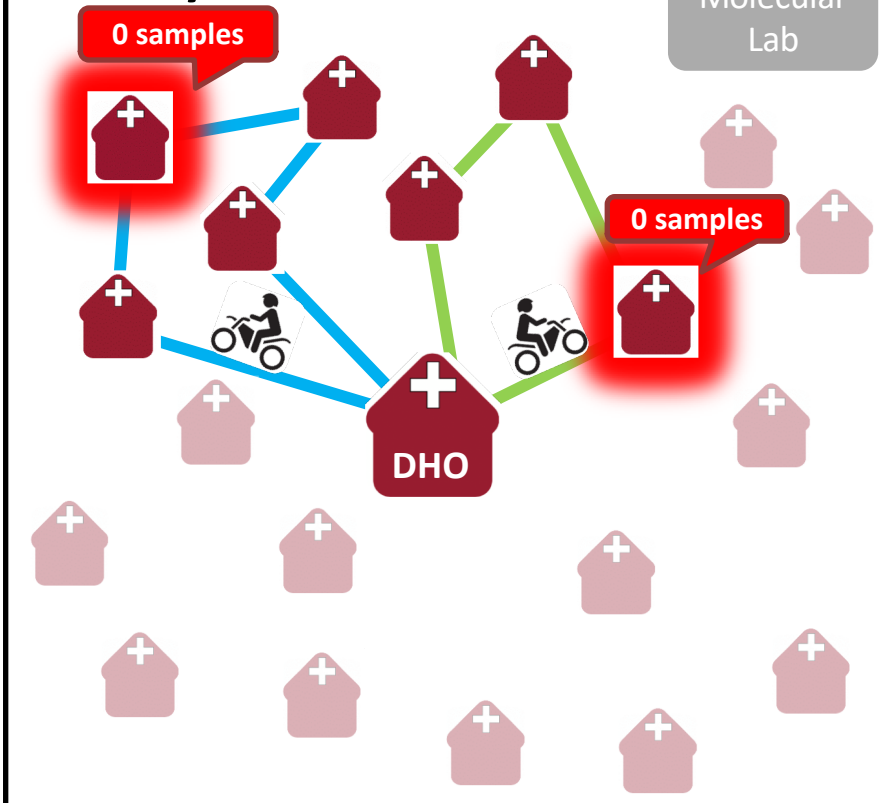
Flexible route



Optimized sample transportation: example (2)

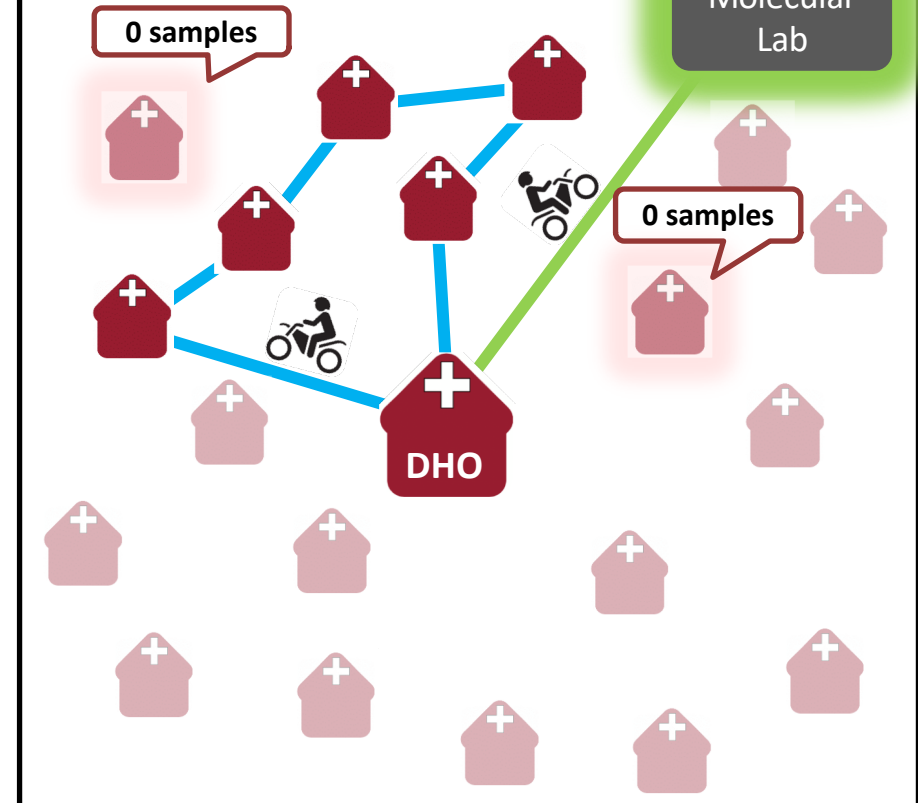
Old system

Tuesday route



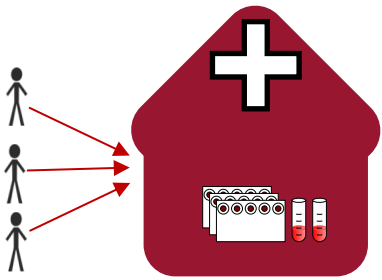
New system

Flexible route

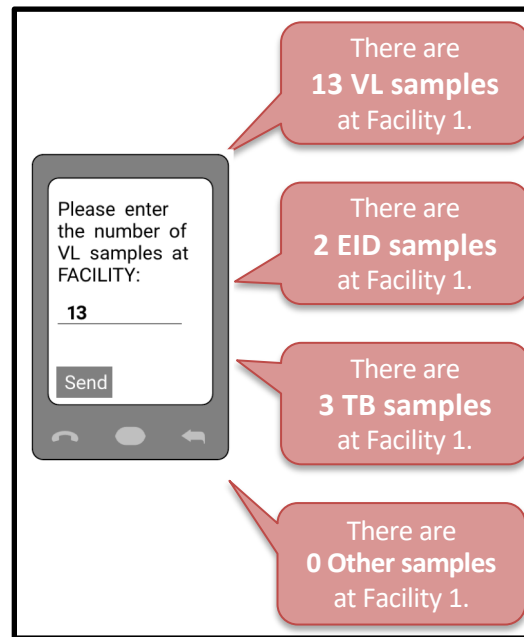


Process overview

Facilities
Collect samples and notify RFH



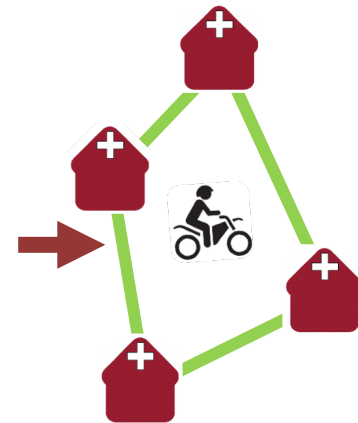
USSD System
Information sharing between facilities and RFH



ST optimization
Monitor sample volumes and deploy couriers

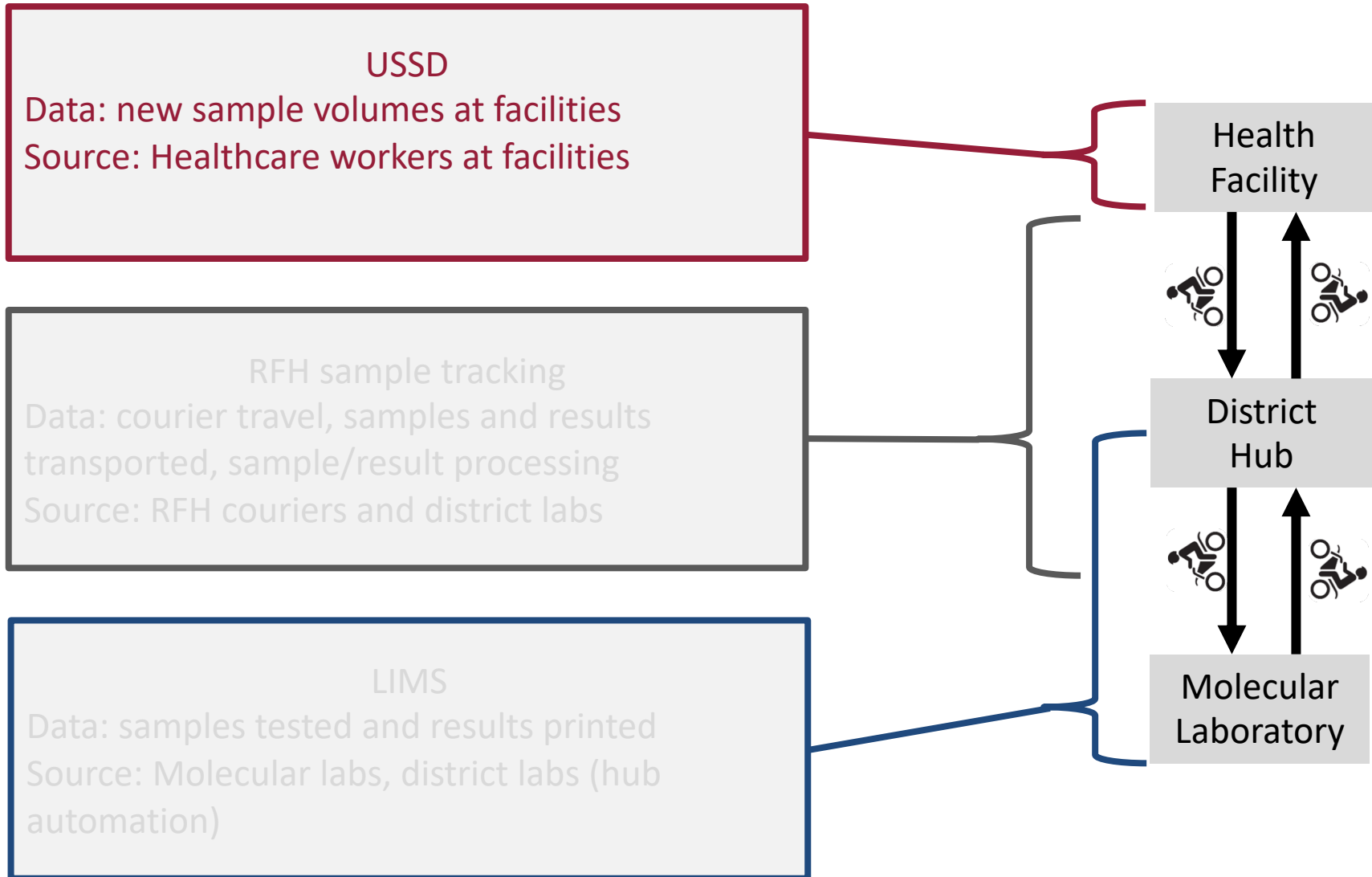


Couriers
Transport samples



Information sharing

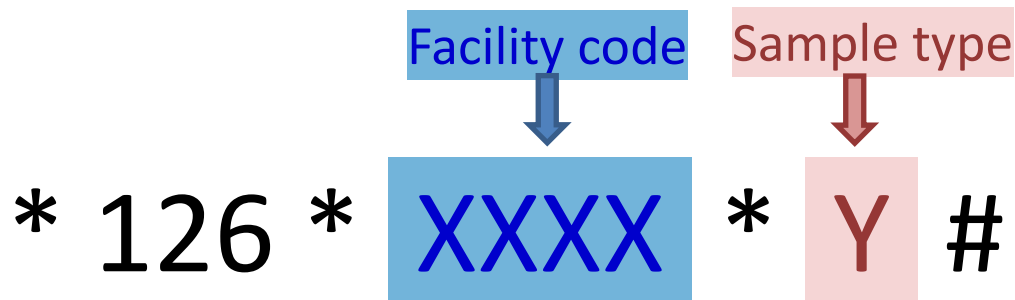
Sample tracking



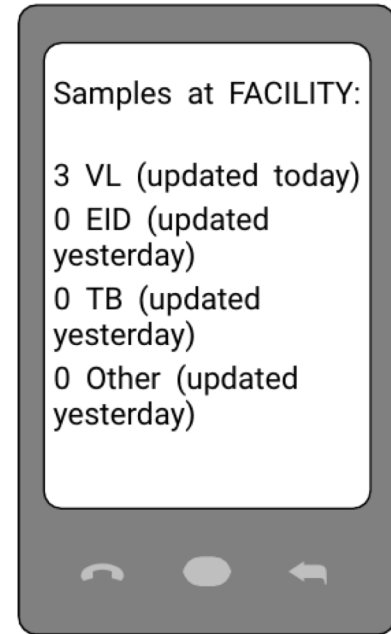
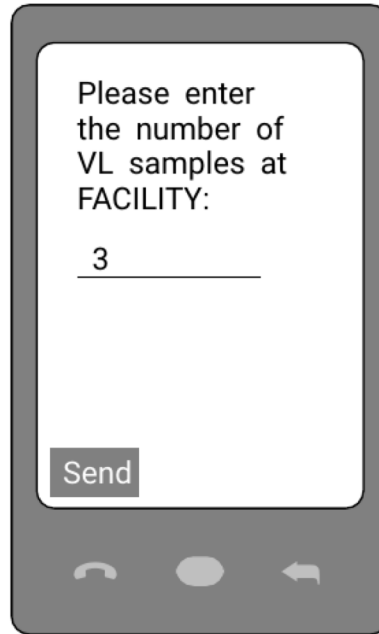
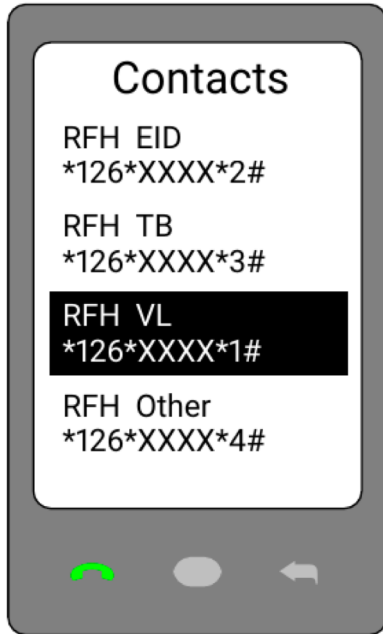
USSD sample reporting system

Healthcare staff at facilities will communicate with Riders For Health using a USSD (short code) system.

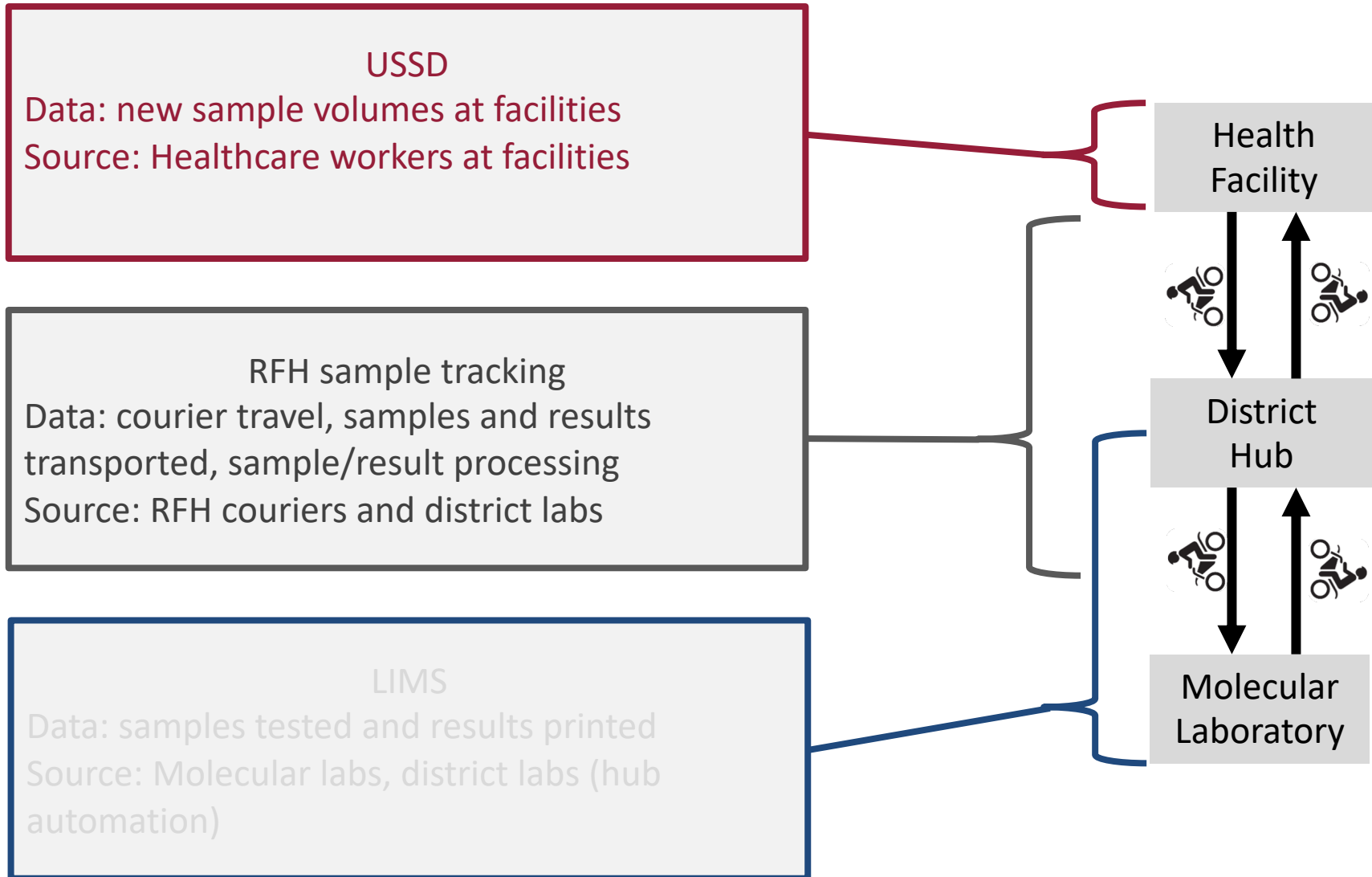
- The USSD system is **free** to use (no airtime is required).
- The USSD system can be accessed from **any** TNM or Airtel cellphone.
- Each facility will receive a unique USSD code to report their samples.



USSD system usage



Sample tracking

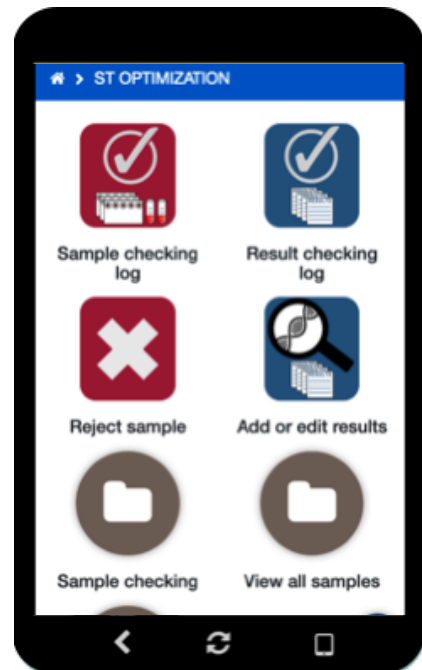


Sample tracking application



RFH couriers record the following data in a CommCare app:

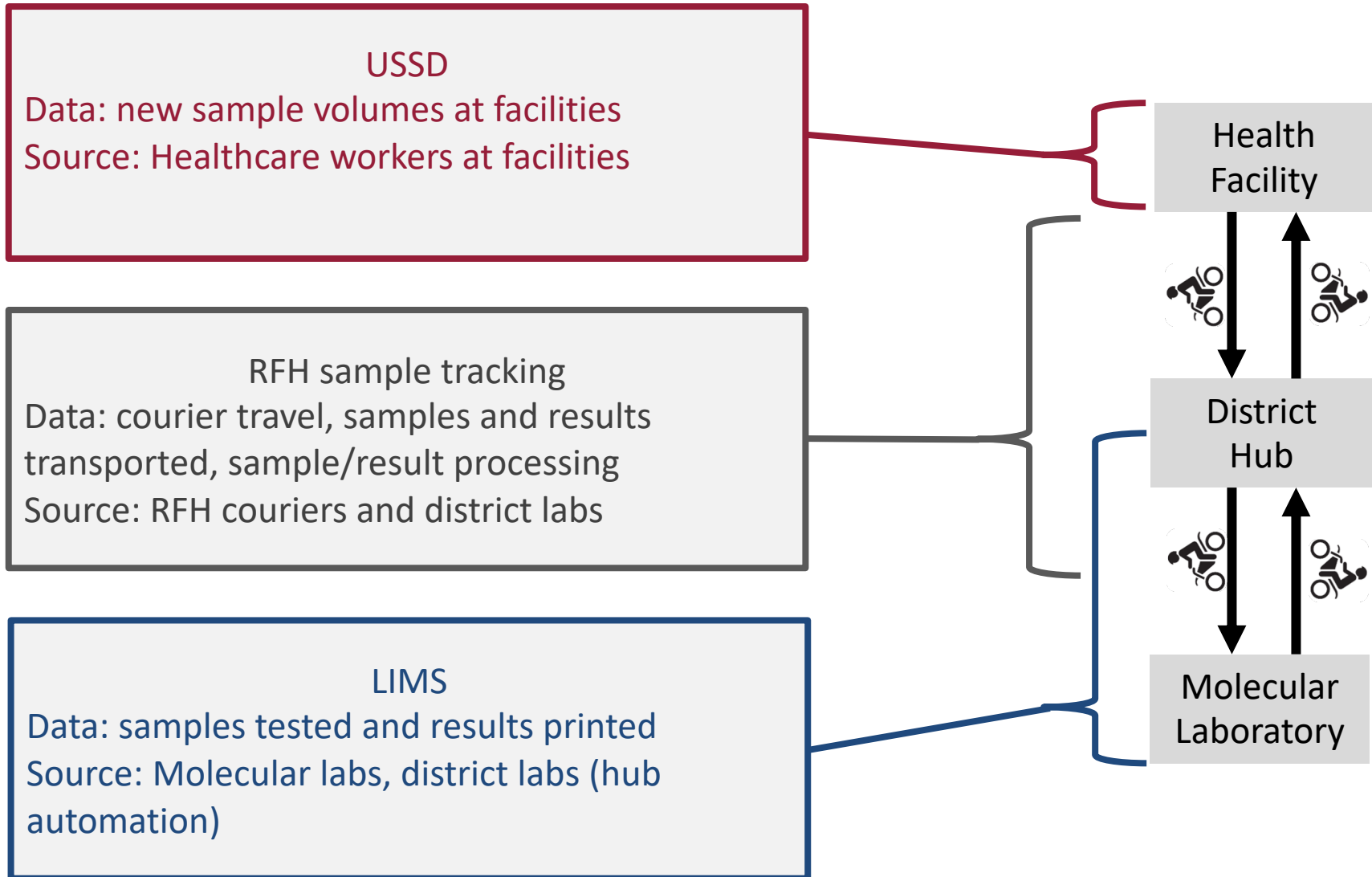
- Trip logs (date, time, locations, mileage)
- Sample details (barcode/ID, sample type, patient info, facility)
- Transportation dates (sample/result pickup and delivery)
- Result details



District labs can access the app to view and update sample records:

- Sample quality checks and/or rejection
- Result entry and approval

Sample tracking



Laboratory Information Management System

The national LIMS database provides timestamps for sample testing and result printing at molecular labs.

- LIMS data can be linked to records entered by RFH couriers using sample barcodes
- Result printing data is used to schedule trips to molecular labs
- Hub automation: if test results are printed in district labs, these timestamps are used to schedule result delivery to facilities.

Implementation

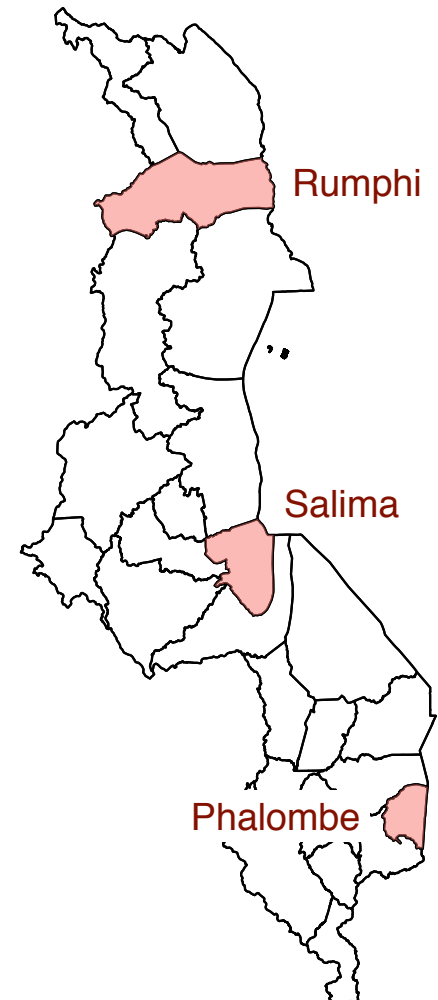
Implementation districts

Three districts were selected for initial implementation:

- Rumphu (North)
- Salima (Central)
- Phalombe (South)

Sample transport operations:

- 2 couriers per district
- 16-18 facilities
- Referral to out-of-district molecular labs (Mzuzu, Kamuzu, Zomba)



Population & ST operations

North

- Low population density
- Low HIV prevalence
- Long distances
- Low sample volumes



South

- High population density
- High HIV prevalence
- Short distances
- High sample volumes

Timeline

- **December 2018:** NHSRC approval
- **March 2019:** sample tracking upgrades and training (couriers and district laboratory staff)
- **June 2019:** USSD training (healthcare facility staff)
- **July 2019:** field team orientation
- **August 2019:** start of ST optimization

Assessment

Field trial assessment

- Feasibility
 - Data systems (performance and participation)
 - Routes and workload
 - Communication and logistics
- Impact (ongoing analysis)
 - Does the system perform better than previous fixed schedules?
 - How much do optimized routes reduce ST delays?

USSD training sessions

Format:

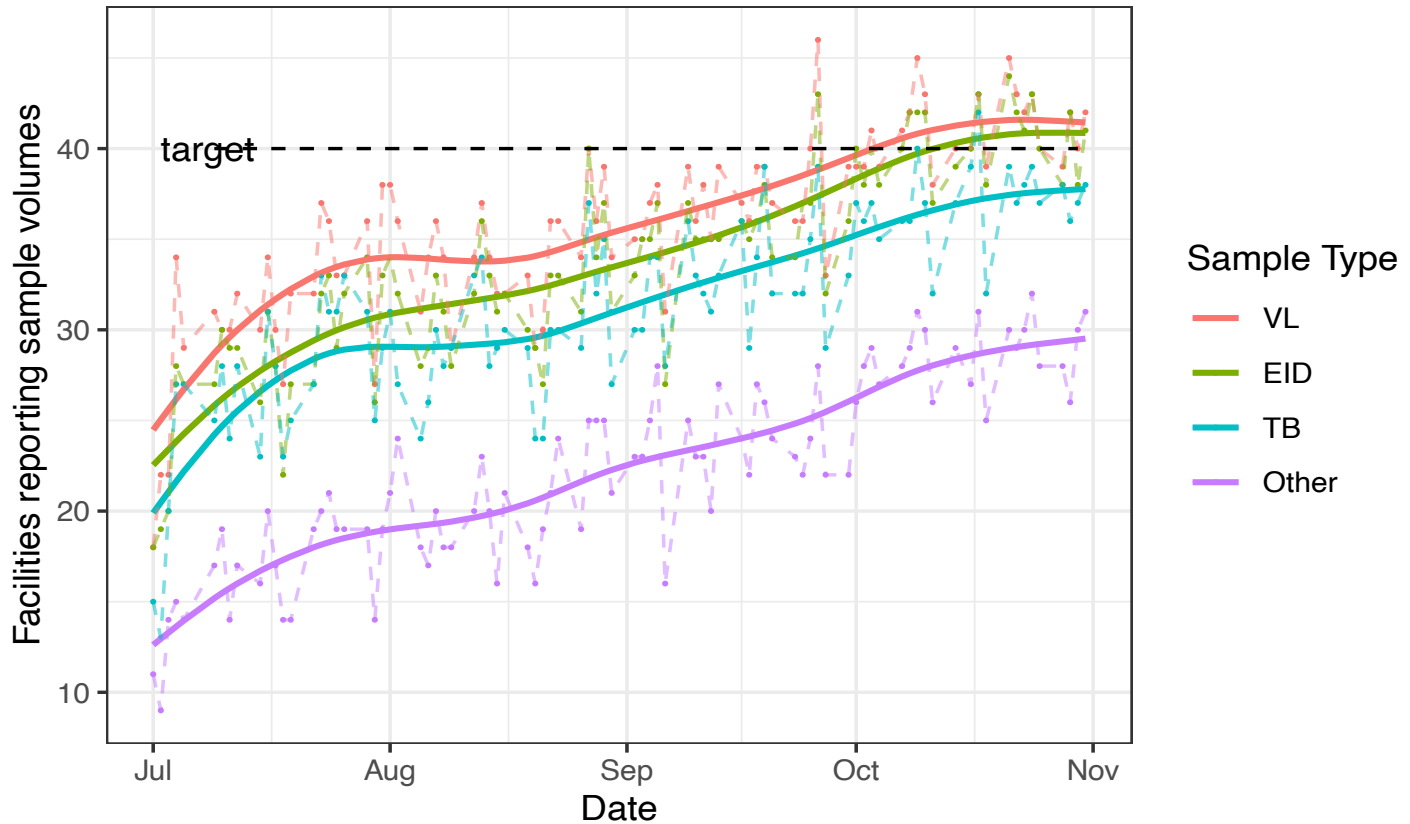
- One training session per district
- 1-hour presentation + 1-hour demonstration/practice
- 2-4 representatives from each healthcare facility
- Informational posters for each facility

Challenges:

- Network/technical issues
- Assigning responsibility (contact person for each facility)
- Use of personal phones
- No incentives/payment

USSD participation

Sample reporting participation, July – October 2019



USSD participation: lessons learned

- Network / phone issues affect only 5-10% of facilities
- Poor participation is almost always due to lack of interest/effort from facility staff
 - Important to **identify the right contact person** to be responsible for reporting
 - **In-person visits** from RAs are an effective way to encourage participation, along with district **WhatsApp groups**
 - Maintaining participation is easier once facilities are in the **habit** of reporting

Logistical challenges

- Couriers
 - Demand-based schedules result in longer routes
 - Daily data entry requirements
 - Lack of routine/predictability
- District labs
 - Staff shortages and technical issues
 - Changes due to hub automation
 - Adjustment to more frequent/less predictable trips to molecular labs
- Molecular labs
 - Backlogs in sample testing

Courier routes summary

During the initial implementation phase, couriers covered over **40 000 kilometers** and transported over **12 000 samples** and **11 000 results**. Routes included **1060 visits to healthcare facilities** and **62 trips to molecular laboratories**.

Weekly route statistics

	Facility visits		Lab trips		Distance* (km)	
	Fixed schedule	Opt. schedule	Fixed schedule	Opt. schedule	Fixed schedule	Opt. schedule
Rumphi	25	29	1	1.58	1197	1363
Salima	34	31	1	1.62	1015	1088
Phalombe	28	30	2	2.2	896	988
Total	87	90	4	5.4	3108	3439

*Distance estimates are based on assigned routes. Detours and other travel are not included.

Conclusion

Conclusion

- Sample transport optimization has the potential to reduce ST delays and improve efficiency within the diagnostic network.
- Real-time information sharing is essential, and low-cost, low-tech data platforms are a key challenge.
- Diagnostic systems are constantly evolving. Sustainable interventions must be adaptable and robust to change.