Introduction of an innovative system to assist malaria rapid diagnostic testing and reporting in the private sector in Wakiso District, Uganda

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Background

- Rapid diagnostic tests (RDTs) allow healthcare providers to offer accurate diagnostic services at the point of care.
- RDT effectiveness is reduced when used incorrectly or followed up with inappropriate treatment.
- There is a need to promote and monitor proper use of RDTs and capture reliable surveillance data - especially in the private sector, where 40-60% of people in endemic countries seek malaria care.
- Technology can incentivise the private sector to incorporate quality control and reporting mechanisms into case management.

Objectives

- To assess the acceptability of the Fionet™ system among private healthcare providers in Uganda over six months.
- To observe the impact of the introduction of the Fionet™ system on malaria case management and reporting.

Methods

- The Fionet™ system works with a mobile diagnostic device called the Deki™ Reader, to provide step-by-step guidance through their routine activities and transmit information to a secure web portal (Figure 1).
- The Deki™ Reader automates the analysis of RDTs, detecting and correcting errors so case management decisions and records are based on accurate diagnostic results.
- The Fionet™ system was implemented in Wakiso District, Uganda from December 12th, 2014 to June 12th, 2015.
- 13 health workers (one clinical officer, two laboratory technicians and 10 nurses) from five sites were trained over 2 days to use the Deki™ Reader in the management and documentation of suspected malaria cases.
- Health workers visually interpreted the RDT results and were blinded to the Deki™ Reader's automated reading.
- The Deki™ Readers sent the test result records to the Fionet™ web portal, along with a post-test image of each RDT, demographic and case management data.
- Comparison was made of post-test image, health worker's visual reading and automated test result by an experienced technician in Toronto.
- Implementing partners were trained to monitor data from the Fionet™ system, including such aspects as:
  - Total number of tests performed on a daily, weekly and monthly basis
  - Number of tests performed by facility and by health workers
  - Quantity of positive, negative and invalid RDT results
  - Record upload speed
  - Accuracy of health workers' readings of RDTs and prescription habits

Results

- A total of 1,194 records were uploaded to the Fionet™ web portal
- Each record included:
  - Health worker and patient identity
  - Date, time and location of interaction
  - Patient age, sex and pregnancy status
  - High-resolution pre- and post-test images of malaria RDT, including barcode
  - Health worker's visual interpretation of test results and Deki™ Reader's automated analysis of test results
  - Completed symptom and treatment forms
- 91 percent of completed records were available within 24 hours and 98 percent within a week.
- Of the 1,194 images analysed, the Deki™ Reader detected an error in 209 instances (see Table 1);
- The most common error was "CL (Control Line) absent or line intensity too low" (142/209, 67.9%). As confirmed by the technician in Toronto, 81 of these 142 images were unused or blank RDTs that the health worker had recorded with either a positive or negative malaria test result.
- Test result data was automatically segmented by pre-defined populations (see Table 2).
- Cross-analysis of test result and treatment data revealed that 6 percent of cases were left untreated despite a positive RDT result and 2 percent of negative cases were treated with antimalarials (see Figures 2-3).
- Health workers provided the following feedback when surveyed:
  - The Deki™ Reader made it easier to manage patients and record RDT results, demographic and case data.
  - Client satisfaction and confidence in test results improved with the Deki™ Reader.
  - The Deki™ Reader was beneficial to business efficiency and in some cases helped to attract more clients.
  - 9 out of 11 healthcare providers said they would pay to use the Deki™ Reader in their facility.

Figure 1: The Fionet™ system (developed by Fio Corporation) provides real-time access to reliable data captured during healthcare delivery.

Table 1: Total errors detected by the Deki™ Reader

Error conditions (total)	209
Faint or no control line	142
Un-processed RDT	81
True invalid (No CL)	61
RDT not supported	29
Too much blood	20
Too much blood in blood well	4
Blood in buffer well	6
Smeared, unreadable	4
Unexpected line	2
Incorrect RDT position	2

Table 2: Test result records by key populations

Patients		# Tests	Positive	Negative	Invalid
Under 5	Males	241	12 (5.0%)	222 (92.1%)	7 (2.9%)
	Females	216	14 (6.5%)	197 (91.2%)	5 (2.3%)
Over 5	Males	304	26 (8.6%)	270 (88.8%)	8 (2.6%)
	Females (non-pregnant)	407	38 (9.3%)	355 (87.2%)	14 (3.4%)
	Females (pregnant)	26	4 (15.4%)	22 (84.6%)	0 (0.0%)
Total		1194	94 (7.9%)	1066 (89.3%)	34 (2.8%)

Figure 2: Malaria diagnostic results (interpreted by health worker)

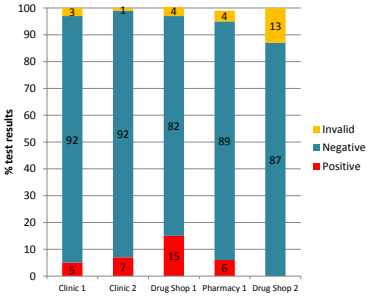
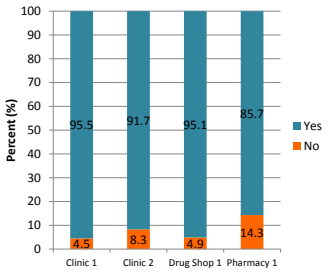


Figure 3: Antimalarial treatment following positive test results



Conclusion

- Implementing the Fionet™ system to assist with RDT-based case management and reporting in the private sector is feasible.
- Acceptability and perceived direct and indirect benefits of the Deki™ Reader were reflected in health worker survey results.
- Public health authorities at all levels would greatly benefit from accurate and timely records of suspected malaria cases managed by private healthcare providers.
- RDT quality control and provider competency indicators can be captured by the Deki™ Reader during the RDT procedure and transmitted to the Fionet™ web portal to be used as a remote supervision tool.

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Acknowledgement
The UNITAID Private Sector RDT Project is a partnership between FIND, JHSPH, MC, PSI and the WHO funded by UNITAID