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

Elizabeth Streat1, Geoffrey Ssevumuna2, Robert Mugerwa3, Grace Nakawaggi - Sekabira4, Ebenezer Baba5, Zahra Hirji6, Max Schiff7, Ferro Santiago8

1Malaria Consortium Regional Office for Africa; 2Malaria Consortium, Uganda; 3Fio Corporation, Canada; 4Fio East Africa, Kenya

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 visually interpreted the post-test image, health worker’s visual reading and automated test result by an experienced technician in Toronto.
• The Deki™ Reader was beneficial to business efficiency and client satisfaction and confidence in test results improved with the Deki™ Reader.
  - The Deki™ Reader was 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.

Conclusions

• 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.

Table 1: Error conditions detected by the Deki™ Reader

<table>
<thead>
<tr>
<th>Error Conditions</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faint or no control line</td>
<td>142</td>
</tr>
<tr>
<td>Un-processed RDT</td>
<td>81</td>
</tr>
<tr>
<td>True invalid (No CL)</td>
<td>61</td>
</tr>
<tr>
<td>Too much blood</td>
<td>20</td>
</tr>
<tr>
<td>Too much blood in blood well</td>
<td>4</td>
</tr>
<tr>
<td>Blood in buffer well</td>
<td>6</td>
</tr>
<tr>
<td>Unreadable</td>
<td>4</td>
</tr>
<tr>
<td>Incorrect RDT position</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 2: Test result records by key populations

<table>
<thead>
<tr>
<th>Patients</th>
<th>Under 5</th>
<th>Over 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>Under 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>241</td>
<td>12</td>
</tr>
<tr>
<td>Females</td>
<td>216</td>
<td>14</td>
</tr>
<tr>
<td>Over 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>304</td>
<td>26</td>
</tr>
<tr>
<td>Females</td>
<td>407</td>
<td>38</td>
</tr>
<tr>
<td>Pregnant</td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>1194</td>
<td>94</td>
</tr>
</tbody>
</table>

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

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

Figure 3: Antimalarial treatment following positive test results.

For more information:
Elizabeth Streat, e.streat@malariaconsortium.org
Santiago Ferro, sferro@fio.com
Fio Corporation
111 Queen Street East, Suite 500
Toronto, ON, M5C 1S2, CANADA

Copyright 2015
All Rights Reserved Fio Corporation.
Fio is a registered trademark.
Deki and Fionet are trademarks.

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