A Model to Evaluate the Cost-Effectiveness of a Highly-Sensitive Rapid Diagnostic Test for Malaria in a Community Setting in Uganda

Caputo J. [1], Eggleston A. [2], Tai R. [1],

[1]Vista Health Pte Ltd., Singapore, [2]Andrew Eggleston Consulting

BACKGROUND

- Malaria remains a major cause of morbidity in Uganda, despite the presence of effective and low-cost interventions such as artemisinin-based-combination therapy (ACT) and sulfadoxine-pyrimethamine (SP).
- This is largely attributed to the prevalence of asymptomatic low-density infections that often go undetected by conventional rapid diagnostic test (c-RDT) and hence untreated.
- A novel highly-sensitive Malaria rapid diagnostic test (HS-RDT) has been recently developed that has been shown to detect asymptomatic low-density infections (80 pg/mL) compared to c-RDTs (800 pg/mL) to *Plasmodium falciparum* HRP2.[1]
- 20-50% of human-to-mosquito transmissions go undetected with c-RDTs, highlighting the need and adoption of HS-RDTs.[2]

OBJECTIVE

- The objective of this study is to estimate the cost-effectiveness of HS-RDT compared to current clinical practice in 3 different patient settings, active case detection using c-RDT in febrile children (age less than or equal to 5 years), Intermittent Presumptive Treatment (IPTP) in pregnant women and reactive case detection in Mpigi, Uganda.

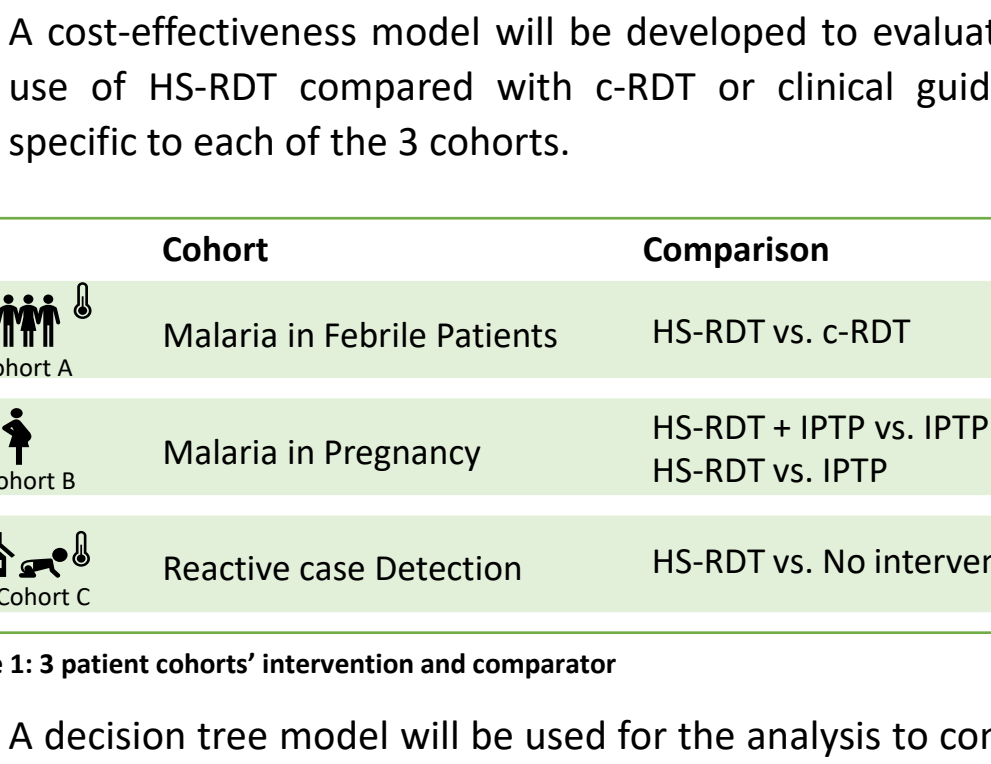
METHODS

- A cost-effectiveness model will be developed to evaluate the use of HS-RDT compared with c-RDT or clinical guidelines specific to each of the 3 cohorts.

	Cohort	Comparison
Cohort A	Malaria in Febrile Patients	HS-RDT vs. c-RDT
Cohort B	Malaria in Pregnancy	HS-RDT + IPTP vs. IPTP HS-RDT vs. IPTP
Cohort C	Reactive case Detection	HS-RDT vs. No intervention

Table 1: 3 patient cohorts' intervention and comparator

- A decision tree model will be used for the analysis to compare clinical (DALY) and cost outcomes, with patients entering the model at diagnosis stage.



+ Positive malaria result - Negative malaria result

Figure 1: Proposed decision tree model of the patient treatment journey

- Clinical inputs, direct and indirect costs inputs are sourced from local publications. Prevalence, RDT sensitivity and false positive rates will be based from a community based observational study in Mpigi, Uganda.

Observational study	Clinical	Cost
• Prevalence of malaria • HS-RDT & c-RDT sensitivity • False positive rates	• Malaria infection causing febrility • Effect of IPTP prophylaxis • Treatment with ACT • Low-birth weight risk • Disutility and life years lost due to disability	• Price of HS-RDT & c-RDT • Drugs (IPTP, AL) • Febrile malaria • Loss wages • End of life

Table 2: Key study, clinical and cost inputs for modelling

DISCUSSION

- Results from the observational study and model outputs, will be used to test the following hypotheses:

Cohort	Hypothesis
Malaria in Febrile Patients	• As all patients are febrile, every additional malaria detection that is asymptomatic will result in cost-savings
Malaria in Pregnancy	• Detecting malaria in pregnant women translates into fewer mortality events in unborn children & women and avoided complications in born children
Reactive Case Detection	• Reactive testing of children's household members leads to reduction in asymptomatic reservoir and long-term benefit beyond the household

Table 3: Hypothesis derived from inputs and assumptions from literature

- The results will determine the impact of HS-RDTs in reducing the asymptomatic malaria reservoir and how it can decrease overall costs of malaria treatment and management.
- The increase in malaria detection can lead to earlier treatment and contribute towards Malaria elimination.
- Results from this study can help shape the next Ugandan Malaria Reduction Strategy developed by the Ministry of Health.
- One way sensitivity analysis will be conducted to test model sensitivity to key inputs. A limitation of this approach is that the model is not a dynamic transmission model and does not therefore model long-term consequences and seasonal effects.

References

1. Das, et al. Performance of a High-Sensitivity Rapid Diagnostic Test for Plasmodium falciparum Malaria in Asymptomatic Individuals from Uganda and Myanmar and Naive Human Challenge Infections. Am. J. Trop. Med. Hyg., 97(5), 2017, pp. 1540–1550
2. Slater HC, Ross A, Ouedraogo AL, White LJ, Nguon C, Walker PGT, et al. Assessing the impact of next-generation rapid diagnostic tests on Plasmodium falciparum malaria elimination strategies. Nature. 2015;528:S94–101.

Acknowledgements

The authors acknowledge Abbott Rapid Diagnostics (Pty) Ltd for their sponsorship and editorial assistance.

Contact Information: admin@vistahealthconsulting.com