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Lessons learned from implementing the HIV infant tracking system (HITSsystem): A web-based intervention to improve early infant diagnosis in Kenya



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ABSTRACT

Objectives: Guided by the RE-AIM model, we describe preliminary data and lessons learned from multiple serial implementations of an eHealth intervention to improve early infant diagnosis (EID) of HIV in Kenya.

Methods: We describe the reach, effectiveness, adoption, implementation and maintenance of the HITSsystem, an eHealth intervention that links key stakeholders to improve retention and outcomes in EID. Our target community includes mother–infant pairs utilizing EID services and government health care providers and lab personnel. We also explore our own role as program and research personnel supporting the dissemination and scale up of the HITSsystem in Kenya.

Results: Key findings illustrate the importance of continual adaptation of the HITSsystem interface to accommodate varied stakeholders' workflows in different settings. Surprisingly, technology capacity and internet connectivity posed minimal short-term challenges. Early and sustained ownership of the HITSsystem among stakeholders proved critical to reach, effectiveness and successful adoption, implementation and maintenance.

Conclusions: Preliminary data support the ability of the HITSsystem to improve EID outcomes in Kenya. Strong and sustained collaborations with stakeholders improve the quality and reach of eHealth public health interventions.

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1. Introduction

Early infant diagnosis (EID) and prompt treatment of HIV-positive infants are critical program components of Prevention of Mother-to-Child Transmission (PMTCT) efforts.^{1,2} EID can facilitate early (before 12 weeks postnatal) initiation of antiretroviral therapy (ART) which can reduce mortality by 76% and slow the progression of HIV by 75%.³ Current challenges to quality EID include late infant testing, delayed or lost test results, passive systems for informing mothers, high loss -to-follow-up, and poor linkage to treatment for HIV-positive infants.^{4–6} Primary stakeholders include mothers, EID providers who collect and send samples for

HIV DNA PCR testing, courier services that deliver samples, laboratories technicians who conduct and report PCR testing, and community health workers who reach out to mothers of HIV-exposed infants.⁷ These stakeholders span clinical and community settings and vary widely in training and capacity. In an effort to improve communication and accountability between varied EID stakeholders, we developed the HIV Infant Tracking System (HITSsystem).

The HITSsystem is a web-based, automated intervention designed to overcome current EID barriers by providing efficient prospective tracking of HIV-exposed infants. The HITSsystem is accessed online via computer, using mobile broadband modems that respond to cellular signal rather than hardwired internet access, making this system feasible even in remote areas. The HITSsystem triggers electronic action 'alerts' for both EID providers and lab technicians when time-sensitive EID interventions are due

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Table 1
HITSytem targets: 8 time-sensitive EID interventions.

1. Initiation of OI prophylaxis at 6 weeks.
2. Collect dried blood spot (DBS) for PCR test by 6 weeks.
3. Receipt of DBS at lab within 10 days of collection.
4. Return of PCR results from lab within 2 weeks.
5. Notify mother within 2 weeks of the EID provider receiving results.
6. Initiate all HIV-infected infants on ART within 4 weeks of notifying the mother.
7. Retest all HIV-uninfected infants at 9 months, initiate ART w/in 4 weeks if applicable.
8. Retest all HIV-uninfected infants at 18 months, initiate ART w/in 4 weeks if applicable, complete EID.

* For more detail, refer to Fig. 1 illustrating the HITSytem process.⁸

(Table 1). These alerts facilitate infant tracking so that those who default from care can be easily identified and quickly targeted for outreach. A built-in text messaging system sends messages to mothers' mobile phones when test results are ready or follow up visits are needed. HITSytem data is de-identified and stored on a secure server, which facilitates reporting. A more detailed description of the HITSytem has been previously published.⁸ The primary goals of the HITSytem are to: (a) reduce turn-around time for the PCR testing cycle, (b) facilitate early ART initiation for infants identified as HIV+, and (c) improve EID retention.

After promising pilot testing of the HITSytem in two Kenyan health facilities, we partnered with key stakeholders (detailed below) to implement the HITSytem in other health facilities across Kenya. This paper highlights experiences and lessons learned from implementing the HITSytem at ten sites in Kenya. Guided by the RE-AIM model,⁹ we analyze and describe our efforts to disseminate the HITSytem.

2. Methods

Setting: Ninety-five percent of HIV+ Kenyans who seek care and treatment receive services through government hospitals.¹⁰ As such, we maximized the representativeness of facilities by targeting ten government hospitals at the referral, county, sub-county and health center levels; including three urban and seven peri-urban hospitals (Table 2). Consistent with the size and population density of their catchment areas, the average monthly volume of EID patients varied significantly between sites and

ranged from 6 to 26 mother–infant pairs. The HITSytem was implemented between April 2011 and November 2013 at these ten health facilities and the designated regional central laboratories (i.e., Kericho, Kisumu or Nairobi). Implementation and evaluation of sites was conducted between April 2011 and May 2014. Follow-up periods ranged between 6 and 38 months depending on month of initial implementation. The initial sites were selected based on perceived need, logistical feasibility, absence of other EID-related interventions, and approval from hospital administrators.

Partners: The implementation process of the HITSytem was undertaken by a multidisciplinary group of collaborating partners that included the following: the NGO that developed the HITSytem (Global Health Innovations), the national testing laboratories in Kenya that support PCR testing (Kenya Medical Research Institute), the internet marketing company that designed the interface for the HITSytem (OnTarget), and researchers from two academic medical centers that provided design and evaluation support (University of Kansas Medical Center and Children's Mercy Hospital Kansas City). The Walter Reed US Military HIV Research Program in Kenya also supported training and implementation at health facilities within their catchment area. While not a direct collaborator, Kenya's National AIDS & STI Control Programme has encouraged the evaluation of HITSytem implementation to inform feasibility of national scale up. Key members from each partnering organization worked collaboratively through in-person meetings and routine remote communication to develop effective strategies for approaching, introducing, training, implementing and evaluating the HITSytem.

Implementation: After gaining the appropriate facility level permissions, the team scheduled training with existing EID and laboratory staff who would utilize the HITSytem and worked with administrators to integrate these efforts as part of the routine workflow in an effort to foster ownership of the program and to reduce the perception of an increased burden. An overview of the HITSytem, which lasted approximately 2 h and included a question and answer session, was provided to key personnel from involved departments (Maternal and Child Health [MCH]/EID, internal laboratory, and pediatric provider from the Comprehensive Care Center [CCC] where ART is provided). We then provided tailored training with hands-on use of the system using practice scenarios similar to what staff would encounter in everyday use. Trainings lasted one day (6 h) for MCH/EID providers and a half

Table 2
Characteristics of hospitals implementing the HITSytem, including level of ownership and estimated time to program adoption.

	Region	Mo/Yr implemented	Setting	Total volume as of May,2014 (monthly avg)	Cell phone utilization	Model of support	Ownership level, range 1–5 (SD)	Time to adoption, months (SD)
1. Referral Hospital A	Nairobi	Apr 2011	Urban	745 (20)	(99.5)	Med	4.25 (.96)	4.8 (4.9)
2. Health Centre B	Nairobi	Nov 2011	Urban	514 (15)	(86.8)	High	3.25 (.5)	14.3 (9.6)
3. County Hospital C	Rift Valley	Nov 2012	P-urban	319 (12)	(76.2)	Med	4.75 (.5)	2.75(2.4)
4. County Hospital D	Rift Valley	Nov 2012	P-urban	558 (15)	(68.1)	High	3.25(.29)	10.5 (3.0)
5. Sub-County Hospital E	Western	Mar 2013	P-urban	104 (< 10)	(80.8)	Low	2.0 (1.15)	In progress
6. Sub-County Hospital F	Western	Mar 2013	P-urban	123 (< 10)	(74.8)	Low	3.37(.75)	4.0 (.81)
7. Sub-County Hospital G	Western	Mar 2013	P-urban	103 (< 10)	(67.0)	Med	1.37(.48)	In progress
8. Teach & Ref Hospital H	Nyanza	Sep 2013	Urban	306 (25)	(92.8)	Low	3.0(1.35)	7.8 (3.2)
9. Health Center I	Nairobi	Oct 2013	Urban	69 (< 10)	(97.1)	High	3.0 (1.41)	In progress
10. Health Center J	Nairobi	Feb 2014	Urban	15 (< 5)	(100)	High	2.87(1.31)	In progress

To increase the sense of anonymity, information regarding hospital level and geographic region has been provided rather than hospital name. "in progress" = not yet achieved full adoption/ownership of the HITSytem by health care providers but the process is ongoing.

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