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They are likely to be there: using a family-centered index testing approach to identify children living with HIV in Kenya

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Abstract

In Kenya, only half of children with a parent living with HIV have been tested for HIV. The effectiveness of family-centered index testing to identify children (0–14 years) living with HIV was examined. A retrospective record review was conducted among adult index patients newly enrolled in HIV care between May and July 2015; family testing, results, and linkage to treatment outcomes were followed through May 2016 at 60 high-volume clinics in Kenya. Chi square test compared yield (percentage of HIV tests positive) among children tested through family-centered index testing, outpatient and inpatient testing. Review of 1937 index client charts led to 3005 eligible children identified for testing. Of 2848 (94.8%) children tested through family-centered index testing, 127 (4.5%) had HIV diagnosed, 100 (78.7%) were linked to care, and 85 of those eligible (91.4%) initiated antiretroviral therapy (ART).Family testing resulted in higher yield compared to inpatient (1.8%, $p < 0.001$) or outpatient testing (1.6%, $p < 0.001$). The absolute number of children living with HIV identified was highest with outpatient testing. The relative contribution of testing approach to total children identified with HIV was outpatient testing (69%), family testing (26%), and inpatient testing (5%). The family testing approach demonstrated promise in achieving the first two “90s” (identification and ART initiation) of the 90–90–90 targets for children, with additional effort required to improve linkage from testing to treatment.

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Authors’ contribution

The author contributions include: study design: NO, JLK, KO, HM, JP; data analysis: MM; first manuscript draft preparation: NO, JLK, KO, MM, JP; reviewing and revision of the manuscript: all authors; approving the final manuscript draft: all authors.

Declaration of conflicting interests

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Keywords

HIV; Africa; screening; diagnosis; treatment

Introduction

In Kenya, despite national gains in reducing new HIV infections among children (0–14 years) from 18,000 in 2010 to 7600 in 2018, and drastically reducing HIV-related deaths from 16,000 in 2010 to 5200 in 2018,[1] a need to identify children living with HIV remains. A national survey in 2012 found that among children 18 months to 14 years old with a parent living with HIV, only 52.9% had been tested for HIV.[2]

Children with undiagnosed HIV often present with severe opportunistic infections and inadequate growth and have a higher mortality risk.[2–4] A delay in antiretroviral therapy (ART) initiation also increases the risk of morbidity and mortality among children.[5–8]

Although Prevention of Mother-to-Child Transmission (PMTCT) programs have been an effective setting to identify HIV-exposed and – infected infants, the success in finding undiagnosed children outside of PMTCT has been underwhelming.[3] Multiple approaches have been used to improve HIV detection among children, including Provider-Initiated Testing and Counselling (PITC), community and school-based approaches, and home-based testing.[3] A systematic review of HIV testing among children and adolescents in sub-Saharan Africa found PITC approaches with the highest yield (percent of children tested identified as HIV-positive) include inpatient (12%), outpatient (7%), and family testing (3%), whereas home-based, outreach, and school-based programs have lower yield at 2.3, 0.06, and 0.1%, respectively.[9] Additionally, implementation of routine testing of pediatric inpatients has resulted in increased identification of children living with HIV and higher rates of subsequent ART initiation for those identified.[10,11]

Strengthening case finding is critical to the achievement of the 90–90–90 targets.[12] Family testing, a focused PITC approach that targets a high-risk population by testing the children and partners of index patients in HIV care, may be an important approach for efficient and early case detection.[13–15] A study in Malawi found that 81% of the children of adults living with HIV had not been tested; however, 33% of these children ended up being positive once tested, illustrating the potential for case finding through family testing.[13] Recent efforts to utilize a family testing strategy have also shown positive results for identification and linkage to care.[15,16] One study in Kenya identified 2.5 family members at risk per index patient, two-thirds of which were children, with more than 80% of children identified living with HIV successfully enrolled into care.[15] Despite improvements in child HIV testing uptake in Kenya, HIV identification remains a challenge. HIV testing yield among children declined nationally from 2.7% in 2015 to 0.5% in 2017, illustrating the need for more efficient testing strategies (routine program data from the U.S. President's Emergency Plan for AIDS Relief [PEPFAR] HIV reporting database; Data for Accountability, Transparency and Impact Monitoring [DATIM]). In this study, we examined the effectiveness of a routinely implemented family testing approach at identifying children living with HIV (0–14

years of age) in comparison to other HIV testing approaches. Onward linkage to care and ART initiation after family testing were also assessed.

Methods

Family approach

The family approach supported by Family AIDS Care and Education Services (FACES) at Ministry of Health (MOH) HIV clinics is based on the connection between index clients and their family members at risk. A 'family' in this context is defined as an adult index client (≥15 years old and accessing HIV care), their sexual partner/s, and children under 15 years of age. The family approach is designed to identify, engage, and treat all family members and partners living with HIV; prevent new infections among family members at risk; and raise family support and awareness.[15] Within the health facility Comprehensive Care Center (CCC) and Maternal Child Health (MCH) departments, during HIV care enrollment and follow-up, counselors discuss the importance of family testing with the index client. 'Contacts' refer to family members or sexual partners identified by index clients. This study is focused on contacts who were biological children (0–14 years of age).

At enrollment, index clients' family member information is documented in the Family Information Table (FIT) that was pioneered by FACES[15] and later incorporated into the MOH patient medical record (Figure 1). The extent of disclosure between index clients and their contacts is assessed. Information is shared about the benefits and potential risks of disclosure, and the index client is guided through an assisted disclosure process (although disclosure is not mandatory). The index client can bring their contacts to the clinic for HIV testing during subsequent visits or have targeted home-based testing. Testing follows the Kenya national HIV testing algorithms using rapid HIV test kits. Once HIV testing is conducted, HIV-positive contacts are enrolled into care and assessed for ART initiation. HIV-negative contacts are linked to prevention services and scheduled for future testing. The index client is re-engaged about disclosure and contact testing if eligible contacts are not tested during subsequent clinic visits.

Evaluation approach

This retrospective study assessed the effectiveness of the family testing approach that had been implemented as standard of care at all FACES-supported health facilities. Data collection was performed by review of clinical records among all adult clients newly enrolled in HIV care at 60 high-volume MOH health facilities. The facilities were chosen as a convenience sample based on feasibility across three high-burden counties in western Kenya (Kisumu, Homabay, and Migori). This included all index clients who enrolled in HIV care between May and July 2015 and were followed for a minimum of ten months through May 2016. Index clients' and contacts' patient medical record data were abstracted, including testing eligibility of children contacts (known positives were not eligible; those with previously negative test results were eligible if due for retesting per national guidelines), testing status, HIV identification, enrollment into care for those identified with HIV, and ART initiation for those eligible for ART according to the national guidelines at the time (ART was recommended for all children ten years and below; however, it was based

on CD4 cell count and clinical staging for those above ten years; the national guidelines did not adopt WHO's 2015 recommendation of 'test and treat' for all children until 2016).[17]

To compare the family testing approach to PITC for children in outpatient and inpatient departments, family testing data were compared to abstracted aggregate data on HIV testing and identification of children from routine MOH outpatient and inpatient reports at the same health facilities during the same enrollment period as the family testing cohort period: May 2015–July 2015. The family testing data in the CCC and MCH were captured separately from outpatient and inpatient testing data reports to prevent overlap in approach comparison. The PITC performed in the outpatient and inpatient PITC during the study period consisted of routine testing of all patients accessing services those departments. No risk screening tools were used to determine who should receive outpatient or inpatient PITC. Abstracted aggregate data using MOH-designated facility level of testing sites: level 4 (county and sub-county hospitals), level 3 (health centers), and level 2 (dispensaries) were also compared.[18]

Descriptive statistics were generated and Chi square test was conducted to compare the HIV testing yield between the family testing, outpatient and inpatient testing approaches. Statistical analysis was performed with STATA version 12.0 (StataCorp, College Station, TX).

This evaluation was approved by the Kenya Medical Research Institute Ethical Review Committee and University of California San Francisco Human Research Protection Program. It was also reviewed in accordance with the Centers for Disease Control and Prevention (CDC) human research protection procedures and was determined to be research, but CDC investigators did not interact with human subjects or have access to identifiable data or specimens for research purposes. Data were captured as part of routinely gathered medical information and reviewed retrospectively for program evaluation, and therefore informed consent was not obtained.

Results

A total of 1937 adult index clients were identified as newly enrolled in care at the 60 study sites resulting in identification of 3005 children as contacts. Among child contacts, 2848 (94.8%) were tested for HIV through the family testing approach and 127 (4.5%) were HIV-positive. Applying the positivity rate of 4.5% for the entire cohort at risk (including the 157 children not tested), this approach identified 94.1% of all children living with HIV in the cohort (127 children identified out of 135 children expected to be HIV-positive). Of the children with diagnosed HIV infection, 100 (78.7%) were successfully linked to HIV care. Ninety-three children were eligible to initiate ART according to the national guidelines, out of whom 85 (91.4%) were initiated on ART during the study period.

At the same 60 study sites, 27,402 children were tested through PITC in outpatient departments identifying 338 children living with HIV for a yield of 1.2%. In inpatient departments, 1459 children were tested through PITC, identifying 23 children living with HIV for a yield of 1.6% (Table 1). Family testing had higher yield ($p < 0.001$) compared to

testing in both outpatient and inpatient departments and was consistent across all health facility levels (Table 1).

Discussion

The family testing approach using index clients newly enrolled in care resulted in high HIV identification yield among children (4.5%), comparable to other studies evaluating the efficacy of utilizing index patients to increase HIV case finding in children.[19,20] In the study by Ahmed et al.[19] assessing a similar model for identification and linkage to care in Malawi, 64.7% of HIV-positive index patients who agreed to testing of household members had an untested child or young person at home, of which 4.0% were found to be living with HIV. In the study by Yumo et al.,[20] when parents living with HIV in Cameroon were invited to have their children tested for HIV, they found a 3.5% HIV identification yield. A study in Kenya by Wagner et al.[21] demonstrated 42% of patients living with HIV with children had an untested child, with an HIV prevalence of 7.4% among those children once tested. The higher HIV identification yield found by Wagner et al. could be explained by several factors: their data were collected two years earlier than ours, and there is a general temporal decrease in testing yield as the population of children with unknown HIV status decreases; their study population was drawn for people accessing services at the national referral hospital in Nairobi, compared to our study sites in urban, periurban, and rural areas, and their study population was younger (≤12 years, compared to our study population of ≤14 years).

This study found that the HIV case identification rate for children using the family testing strategy with newly enrolled index clients was almost four-fold greater than outpatient testing and almost three-fold greater than inpatient testing strategies among children. Yumo et al.[20] also found a higher testing yield among children tested through index parents compared to outpatient testing (3.5% and 1.6%, respectively), although this was only a two-fold difference compared to the almost four-fold difference in our study. These comparisons at the same health facilities during the same periods are unique and provide a more valid comparison between strategies, accounting for temporal and geographic differences in HIV trends. Although several studies found high HIV case identification rates among outpatient clinics and inpatient wards,[9,22] more recent studies corroborate our finding of decreased yield in pediatric outpatient clinics and inpatient wards. A study in Malawi found an HIV yield of only 1.0%, among children newly tested within inpatient wards,[23] and another study across six African countries identified a reduction in HIV yield among children in just a year's time, from 2.2% in 2015 to 0.9% in 2016.[24] National data show a decline in HIV positivity among children tested in Kenya from 2.7% in 2015 to 0.5% in 2017 (routine program data from DATIM).

It is important to note that although the HIV case identification rate was significantly higher with the family testing strategy, the absolute number of children living with HIV identified was higher with universal outpatient testing. Family testing, outpatient testing, and inpatient testing contribution to the total case load of children living with HIV identified was 26%, 69%, and 5%, respectively. This indicates that despite a lower yield, outpatient testing is still an important strategy for identifying children living with HIV. Systems that better identify

HIV exposure risk among children in outpatient settings may allow for more efficient targeted testing.

Despite many known caregiver barriers to HIV testing of children, related to fear and stigma, denial, and structural barriers, such as transportation to the clinic,[25–29] we found a very high uptake of testing children (94.8%) using the family approach. In comparison, studies in Malawi and Cameroon only achieved uptakes of 62.6% and 56.7%, respectively.[19,20] The high testing uptake we achieved could be due to several reasons: targeted and longitudinal follow-up with index parents and eligible contacts, where a healthcare worker was prompted by the FIT in the index parent's chart, as a reminder to ask about any remaining untested children at every visit; home-based testing options, where an index parent could opt to having a healthcare worker visit their home to conduct the HIV testing for their children instead incurring the extra costs and inconvenience of bringing their children to the health facility for testing; and the patient–provider relationship established with the index client as they receive their HIV care and ART over time, allowing for the establishment of trust and for multiple opportunities to discuss the importance of child testing. No incentives were provided to parents to have their children tested.

The family testing approach resulted in identification of 94.1% of the children expected to be positive in the cohort, surpassing the first "90" in the 90–90–90 targets. However, linkage to care was only 78.7%. ART initiation was 91.4% of the linked patients who were eligible for ART. Based on other studies, the family approach may boost linkage over routine approaches; a program in Lesotho using family testing found 90% linkage among children identified with HIV whereas a retrospective review of baseline routine testing and linkage among children in Uganda reported 58% linkage.[30,31] The ART initiation findings in our study are corroborated by previous studies using the family approach, in which ART was initiated in over 85% of children living with HIV.[15,16,31]

This study had several limitations to consider. This study was conducted in an HIV high-burden region of Kenya that may have different societal stressors and cultural norms related to HIV testing and treatment compared to other countries. Therefore, our results may not be generalizable to other populations. There may also be a degree of participation bias, as the clinics participating in the study were selected as a convenience sample. Data on linkage and ART initiation were collected only for the family testing strategy, so a direct comparison with linkage and ART initiation with outpatient and inpatient HIV testing strategies could not be made.

Conclusion

The family HIV testing approach resulted in a high HIV identification yield for children and demonstrates promise in achieving the first two "90s" of the 90–90–90 targets for children, with additional efforts required to improve linkage. Implementing family testing in populations with similar epidemics may help to increase diagnosis of children living with HIV. Despite the decreasing and relatively low yield for inpatient and outpatient testing approaches, outpatient testing still provided the highest contribution to children living with

HIV identified. More efficient models of finding undiagnosed children in outpatient and inpatient settings should be explored.

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	Family Testing	Relationship to index client	Baseline HIV status	HIV testing date	CCC Referral
	Name		Date	Results	CCC Number

Figure 1.

Family Information Table (FIT) from the Kenya Ministry of Health Patient Medical Record ‘Blue Card’.

Table 1.

HIV testing yield (proportion of children who tested positive) using three different testing approaches in a retrospective study in Kenya, May–July 2015.

	Testing approach and yield							
	Provider-initiated family testing		Provider-initiated outpatient testing		Provider-initiated inpatient testing		Total tested	
Facility (N)	Tested (N)	HIV-positive N (%)	Tested (N)	HIV-positive N (%)	Tested (N)	HIV-positive N (%)	Tested (N)	HIV-positive N (%)
Level 2 facilities (dispensaries) (50)	1305	61 (4.6)	15,231	158 (1.0)	75	0 (0)	16,611	219 (1.3)
Level 3 facilities (health centers) (6)	288	19 (6.6)	4369	62 (1.4)	50	0 (0)	4707	81 (1.7)
Level 4 facilities (county and sub-county hospitals) (4)	1255	47 (3.7)	7802	118 (1.5)	1334	23 (1.7)	10,391	188 (1.8)
All levels (60)	2848	127 (4.5)	27,402	338 (1.2)	1459	23 (1.6)	31,709	488 (1.5)
Chi square test	Family testing yield to inpatient and outpatient testing yield: $p<0.001$							

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