



Original Research

Implementation of blanket provider-initiated testing and counselling: Predictors of HIV seropositivity among infants, children and adolescents in Cameroon



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ABSTRACT

Objectives: The number needed to test (NNT) to identify a child infected with HIV remains high in the context of the implementation of the blanket provider-initiated testing and counselling (bPITC) strategy. This study assessed the predictors of HIV seropositivity among outpatient children/adolescents (6 weeks–19 years) in Cameroon. This information is needed to improve the yield of bPITC and reduce the current gap in pediatric and adolescent ART coverage in this country and beyond.

Study design: Cross-sectional study conducted in 3 hospitals in Cameroon.

Methods: Through biological parents and guardians we systematically invited children and adolescents visiting the outpatient departments for any reason to test for HIV (bPITC) in a 6-month period. Children and adolescents were tested for HIV following the national guidelines and the predictors of HIV seropositivity were assessed using multivariate logistic regression at 5% significant level.

Results: A total of 2729 eligible children/adolescents were enrolled. Among these, 90.3% (2465/2729) were tested for HIV. Out of these, 1.6% (40/2465) tested HIV-positive, corresponding to a NNT of 62. In multivariate analysis, HIV seropositivity was 2.5, 3.3, and 5 times more likely to be reported among children/adolescents of the female sex [aOR = 0.4 (0.2–0.8), $p = 0.008$]; whose fathers had no formal school education [aOR = 0.3 (0.1–0.6), $p = 0.004$] and those whose mothers had died [aOR = 0.2 (0.0–0.9), $p = 0.041$], respectively.

Conclusions: Focusing HIV testing among female children/adolescents, whose fathers had no education level and whose mothers had died could reduce the NNT, improve the yield of bPITC and increase the pediatric and adolescent ART coverage.

1. Introduction

From the first World Health Organization (WHO) guidelines on HIV testing and counselling published in 2007 to the latest released of 2015, the universal (routine) provider-initiated-testing and counselling (PITC) has been consistently recommended as a key strategy for HIV case finding and treatment among health care settings among infants, children and adolescents [1–4].

In this strategy also referred to as blanket PITC (bPITC) [5], it's the responsibility of the care provider to offer an HIV test to a client presenting in the health facility for any reason, but this with the possibility for the client to freely declined the test. Despite the consistency of this recommendation for more than a decade now, bPITC implementation has been inconsistent and fragmented [6,7]. Today, this implementation gap is still contributing to the delay in the expansion of antiretroviral therapy (ART), especially among infants, children and adolescents.

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In fact, with a global ART coverage of 52%, children (<15 years) are still lagging behind adults with 59% ART coverage [8]. This gap is even wider among adolescents (10–19 years) with a global coverage of 36% [9].

Cameroon, likewise other countries in West and Central Africa (WCAR) has a low pediatric ART coverage at 25% (compared to 51% in adults) [8]. This is a clear indication that bPITC is not achieving the desired results in this country despite the availability of a large body of evidence on the acceptability, feasibility, ethical safety and effectiveness of this strategy in increasing case detection and ART enrolment among children and adolescents [5,9–12]. Previous studies have reported that bPITC implementation gap is related to the parental, health facility, community and national policy levels barriers affecting the operationalization in the field [13]. Among these barriers are fear of stigma, lack of staff training, lack of HIV testing kits, poor commitment from health facility leadership, and missed parental consent to test children [6,7]. However, there is a paucity of evidence on children-level characteristics affecting the outcome of bPITC. More importantly, the lower yield of bPITC is a major deterrent to the uptake of this strategy, notably among children and adolescents depicting the lowest HIV prevalence. Actually, the number needed to test (NNT) to identify a case living with HIV/AIDS remains high in several sub-Saharan African countries. For example, among outpatient children and adolescents, this NNT is estimated at 330, 145 and 64 respectively in Kenya, Nigeria and DRC [14]. There is a need to reduce this NNT to improve the yield of HIV pediatric and adolescent case finding through bPITC. The objective of this study was to determine the predictors of HIV testing uptake and seropositivity among children and adolescents in bPITC implementation. This information could contribute in improving the yield of bPITC and therefore reducing the current gap in pediatric and adolescents ART coverage in Cameroon and beyond.

2. Methods

Design and setting: This was a cross-sectional study conducted in Cameroon, as a part of the “Active Search for Pediatric HIV/AIDS” (ASPAs), a larger study which compared the acceptability, feasibility and effectiveness of targeted provider initiated testing and counselling (tPITC) versus bPITC in Cameroon [5]. The ASPA study was implemented at three public health facilities: Limbe Regional Hospital (LRH) in the South-West, Ndop District Hospital (NDH) in the North-West and Abong-Mbang District Hospital (ADH) in the Eastern Region. These facilities provide comprehensive healthcare services, including HIV testing and treatment and were purposefully selected for inclusion of urban, semi-urban and rural populations.

Period and population: The study was implemented at LRH from July through December 2015, and from June through November 2016 at the two other sites. The eligible participants were: i) all caregivers (biological parents or guardians) accompanying children to the hospital and ii) children aged 6 weeks–19 years, of unknown HIV status, visiting the outpatient department (OPD) for any reason. Parents/guardians who refused to participate and critically sick children (i.e. emergencies) were excluded from the study.

Site preparation and study implementation: The site preparation included staff training on bPITC implementation, provision of HIV testing kits, data collection and monitoring tools, and additional human resources to support study implementation. Specifically, study staff was recruited to work collaboratively with hospital staff to support ASPA implementation and ensure compliance of the study protocol. It should be noted that prior to the study, the implementation of bPITC strategy in these health facilities was inconsistent as HIV testing was mainly offered to outpatients presenting with clinical manifestations of HIV/AIDS. During the study period, we systematically offered HIV testing and counselling to all eligible children/adolescents, thus ensuring the consistency of bPITC implementation.

Participant enrolment: The entry and enrolment point of participants

into the study was from the outpatient department (OPD) of the respective hospitals was the entry and enrolment point of participants into the study. Eligible caregivers (parents/guardians) were invited and counselled by a trained HIV counselor to enroll children in the study for HIV testing. Consenting caregivers, together with their children were enrolled in the study.

HIV testing, linkage and ART enrolment: For children <18 months old, blood specimens were collected on filter paper (dot blot spot) and shipped to reference laboratories for HIV DNA PCR testing. For children ≥18 months old, HIV testing was conducted using two rapid tests (RT). Rapid HIV testing was conducted at the respective hospital’s laboratory following the national HIV testing algorithm. Pre and post-test counselling, including results release to parents/children were conducted according to national guidelines on HIV management [15]. The WHO test and treat policy [16] was not yet established at study sites at study initiation, however implementation was subsequently scaled up. Thus, in some cases, children testing HIV-positive were assessed for ART eligibility using the WHO clinical staging and/or baseline laboratory analysis including CD4 count. Eligible children were initiated on ART following national guidelines [15] which was adapted from WHO’s 2013 HIV prevention and management guidelines [3]. In situations where the WHO test and treat policy was already effective in the hospital, ART was initiated irrespective of the availability of biological tests.

Data collection, management and analysis: Data on bPITC implementation and outcomes in the three hospitals were collected prospectively. For this purpose, a pre-tested structured questionnaire was used by a trained data clerk to collect socio-demographic information and HIV history of both parents/guardians and children enrolled in the study. In addition, for each child, we completed a follow-up form capturing HIV test results, plus clinical and biological assessment data for those found HIV-positive. Pseudonymized personal data were entered into a Microsoft Access (Redmond, WA, USA) database and analyzed using STATA 2013 (StataCorp, LLC, Texas, USA). The predictors of HIV testing uptake and seropositivity among children and adolescents were assessed using bivariate and multivariate logistic regression at 5% significant level. When indicated, the covariates associated in bivariate analysis with the outcome of variables (HIV testing uptake and HIV seropositivity) were entered into the multivariate logistic model to assess the independent predictors of HIV testing uptake, HIV seropositivity among children and adolescents.

Ethical considerations: Participation in the study was voluntary for both parents and children. Only parents who consented were enrolled and assent was requested from children above 11 years of age. Consent from parents was obtained via signed written consent form. Likewise, assent for children over the age of 11 years was obtained through a signed written assent form. The ASPA study received ethical approval from the Cameroon National Ethics Committee, the Ludwig-Maximilians-Universität, Munich (Germany) and the Albert Einstein College of Medicine (NY, U.S.). The ASPA study was also registered at clinicaltrials.gov (NCT03024762)⁵. The study was also approved by the Cameroon Ministry of Public Health.

3. Results

A total of 2459 caregivers (biological parents or guardians) were counselled and offered HIV testing opportunities for their children. Of those, 98.8% (2430/2459) accepted to be enrolled in the study and have their children tested for HIV. Through these caregivers, 2729 children/adolescents were enrolled in the study. Of these, 50.2% were female and the majority (63.8%) were enrolled via their mother. Children/adolescents were predominantly between 18 and 59 months (29.6%) and their median age was 4 years. The majority of children/adolescents had no school education (41.3%) and had never tested (80.0%) for HIV before the study. Among children/adolescents (n = 2729) enrolled, 90.3% (n = 2465) tested for HIV; and of those paternal orphans were significantly higher compared to maternal orphans: 6.1% (165/2729) vs 2.4% (65/

2729) ($p < 0.0001$). Factors associated with HIV testing uptake included: child's age and education level; mother's education level and occupation, father living status, school education level and occupation. In adjusted analysis, the independent predictors of HIV testing uptake were mother's occupation and father's education level: mothers in office work/student were 2 times more likely to test a child compared to farmers [aOR = 2.0 (1.4–2.8), $p < 0.001$], and fathers of primary education level were 2 times more likely to test a child compared to those with no formal education [aOR = 2.0 (1.2–3.5), $p = 0.008$] (Table 1).

Among children/adolescents who tested for HIV ($n = 2465$), 40 (1.6%) were found HIV-positive. In bivariate analysis, factors associated with HIV-positivity among children/adolescents were: sex, age, mother and father living status and education level. In adjusted analysis, the independent predictors of HIV-positivity were female children/adolescents, mother living status and father education level (Table 2). Among children/adolescents who tested HIV-positive, 21 (52.5%) were enrolled on ART [5]. ART enrolled children/adolescents were predominantly female (55.2%), of 10–14 years of age (100%) and of primary education level (66.8%). However, there was no association between children/adolescents characteristics and ART-enrolment.

4. Discussion

The parental, health facility, community and policy-level barriers affecting the uptake of bPITC have been widely studied [13]. However, little is known on children-level characteristics affecting the uptake and most importantly the yield of this strategy. This study provides new knowledge with regards to the profile of outpatient children/adolescents

most likely to be tested and diagnosed HIV positive in relatively low HIV prevalence contexts such as in Cameroon.

The large majority (80%) of enrolled children/adolescents had not previously been tested for HIV. This finding is consistent with data reported in Kenya [17] and Zimbabwe [18] and points out the need for innovative strategies in reaching children/adolescents with HIV testing services in the community. Our data show that paternal orphans were significantly higher compared to maternal orphans (6.1% vs 2.4%, $p < 0.0001$). This result is in line with the HIV/AIDS-related mortality pattern which is highest in men compared to women across countries [19–21].

Almost all (98.8%) parents/guardians that were counselled for enrolment in the study accepted to have their children tested for HIV. Moreover, 90.3% of enrolled children/adolescents were tested for HIV. These findings highlight the remarkable willingness of parents to test their children if offered the opportunity. They also indicate that the uptake of HIV testing among children/adolescents could be very high when bPITC is consistently implemented. This evidence suggests that the current low HIV testing coverage among children/adolescents could be attributed to health care providers' failure in offering testing opportunities to this sub-population group. A change of attitudes and practices of health care workers regarding the provision of HIV services is required to achieve optimum HIV testing coverage among the pediatric and adolescents population in our communities.

Mothers' occupation and fathers' educational level were independently associated with HIV testing uptake among children/adolescents. Actually, mothers in office work or students were 2 times more likely to test a child compared to farmers or traders (aOR = 2.0 (1.4–2.9), $p <$

Table 1
Predictors of HIV testing uptake among children and adolescents in three hospitals in Cameroon.

Characteristics	Total (N = 2729)	Total children tested for HIV (N = 2465)	Bivariate logistic regression		Multivariate logistic regression	
	N (column %)	N (row %)	OR (CI)	P	aOR (CI)	P
Sex				0.839		
Female (ref)	1369 (50.2)	1235 (90.2)	1			
Male	1360 (49.8)	1230 (90.4)	1.0 (0.8–1.3)			
Age (months)				0.01		0.069
0–17 (ref)	643 (23.6)	574 (89.3)	1		1	
18–59	779 (28.5)	728 (93.5)	1.7 (1.1–2.5)		1.6 (1.0–2.4)	
60–119	548 (20.1)	493 (90.0)	1.0 (0.7–1.5)		0.9 (0.5–1.7)	
120–179	405 (14.8)	360 (88.9)	0.9 (0.6–1.4)		1.3 (0.7–2.7)	
180–228	354 (13.0)	310 (87.6)	0.8 (0.5–1.2)		1.4 (0.7–3.2)	
Education level				0.001		0.071
None (ref)	1127 (41.3)	1025 (90.9)	1		1	
Primary	1013 (37.1)	931 (91.9)	1.1 (0.8–1.5)		1.2 (0.7–1.9)	
Secondary/higher level	589 (21.6)	509 (86.4)	0.6 (0.5–0.9)		0.6 (0.3–1.2)	
Child brought to hospital by				0.06		
Father (ref)	352 (12.9)	328 (93.2)	1			
Mother	1742 (63.8)	1575 (90.4)	0.7 (0.4–1.1)			
Others	635 (23.3)	562 (88.5)	0.6 (0.3–0.9)			
Child's mother alive				0.469		
No (ref)	65 (2.4)	57 (87.7)	1			
Yes	2664 (97.6)	2408 (90.4)	1.3 (0.6–2.8)			
Mother's Education level				0.002		0.002
Secondary/higher level (ref)	1845 (67.6)	1646 (89.2)	1		1	
Primary	736 (27.0)	689 (93.6)	1.8 (1.3–2.5)		2.0 (1.4–3.0)	
None	148 (5.4)	130 (87.8)	0.9 (0.5–1.5)		1.3 (0.7–2.3)	
Mother's Occupation				0.016		<0.001
Farming/trading (ref)	1165 (42.7)	1032 (88.6)	1		1	
Office Work/student	901 (33.0)	832 (92.3)	1.6 (1.1–2.1)		2.0 (1.4–2.9)	
Others	663 (24.3)	601 (90.6)	1.2 (0.9–1.7)		1.5 (1.1–2.1)	
Child's father alive				0.007		0.137
No (ref)	165 (6.0)	139 (84.2)	1		1	
Yes	2564 (94.0)	2326 (90.7)	1.8 (1.2–2.8)		1.5 (0.9–2.5)	
Father's education level				<0.001		0.027
None (ref)	328 (12.0)	282 (86.0)	1		1	
Primary	571 (20.9)	538 (94.2)	2.7 (1.7–4.3)		2.0 (1.2–3.4)	
Secondary/higher level	1830 (67.1)	1645 (89.9)	1.5 (1.0–2.1)		1.2 (0.8–1.8)	
Father's Occupation				0.049		0.55
Farming/trading (ref)	1401 (51.4)	1270 (90.6)	1			
Office Work/student	1000 (36.6)	911 (91.1)	1.1 (0.8–1.4)		1.1 (0.8–1.6)	
Others	328 (12.0)	284 (86.6)	0.7 (0.5–0.9)		0.9 (0.6–1.3)	

Table 2
Predictors of HIV seropositivity in bPITC among children and adolescents in three hospitals, Cameroon.

Characteristics	Children/adolescents who tested for HIV with a conclusive ^a result (N = 2456) N (column %)	Children/adolescents who tested HIV+ (N = 40) N (row %)	Bivariate logistic regression		Multivariate logistic regression	
			OR (CI)	P	aOR (CI)	P
Sex				0.006		0.008
Female (ref)	1229 (50.1)	29 (2.4)				
Male	1227 (49.9)	11 (0.9)	0.4 (0.2–0.8)		0.4 (0.2–0.8)	
Age				0.038		0.229
0–17 months (ref)	571 (23.3)	6 (1.1)				
18–59 months	726 (29.6)	11 (1.5)	1.4 (0.5–3.9)		1.3 (0.5–3.7)	
5–9 years	492 (20.0)	10 (2.0)	2.0 (0.7–5.4)		1.8 (0.6–5.0)	
10–14 years	357 (14.5)	2 (0.6)	0.5 (0.1–2.6)		0.4 (0.1–1.9)	
15–19 years	310 (12.6)	11 (3.5)	3.5 (1.3–9.5)		1.9 (0.6–5.7)	
Education level				0.567		NA
None (ref)	1022 (41.6)	18 (1.8)				
Primary	928 (37.8)	12 (1.3)	0.7 (0.4–1.5)			
Secondary/higher level	506 (20.6)	10 (2.0)	1.1 (0.5–2.5)			
Child's mother alive				<0.001		0.041
No (ref)	57 (2.3)	5 (8.8)				
Yes	2399 (97.7)	35 (1.5)	0.2 (0.1–0.4)		0.3 (0.1–1.2)	
Mother's Educational level				0.004		0.599
Secondary/higher level (ref)	1638 (66.7)	19 (1.2)				
Primary	688 (28.0)	14 (2.0)	1.8 (0.9–3.6)		1.4 (0.6–3.2)	
None	130 (5.3)	7 (5.4)	4.8 (2.0–11.8)		1.5 (0.5–4.9)	
Child's father alive				0.002		0.808
No (ref)	139 (5.7)	7 (5.0)				
Yes	2317 (94.3)	33 (1.4)	0.3 (0.1–0.6)		0.9 (0.3–2.5)	
Father's education level				<0.001		0.016
None (ref)	279 (11.4)	13 (4.7)				
Primary	536 (21.8)	10 (1.9)	0.4(0.2–0.9)		0.4 (0.2–1.0)	
Secondary/higher level	1641 (66.8)	17 (1.0)	0.2(0.1–0.4)		0.3 (0.1–0.7)	

^a Conclusive result = positive or negative HIV test result. We excluded 9 indeterminate cases from the analysis.

0.001). On the other hand, fathers of primary education level were 2 times more likely to test a child compared to those with no formal education (aOR = 2.0 (1.2–3.4), $p = 0.027$) (Table 1). These findings demonstrate the positive association between parents' education and HIV testing uptake among children. They are consistent with previous studies in sub-Saharan Africa countries (including Cameroon) showing a positive relationship between population educational attainment and the uptake of HIV services [22–24]. This indicates the need for enhanced counselling of parents/guardians with lower or no education level so as to improve the uptake of HIV testing of their children during outpatient consultations.

Female gender, mother's living status and father's educational level were independent factors to HIV seropositivity among children/adolescents (Table 2). Actually, female children/adolescents were 2.5 times more likely to be tested HIV-positive compared to males (aOR = 0.4 (0.2–0.8), $p = 0.008$). This finding is in line with available evidence indicating a higher rate of peri-natal HIV infection among female infants [25–27].

Children/adolescents whose mothers were not alive were 5 times more likely to be tested HIV-positive compared to those whose mothers were alive (aOR = 0.3 (0.1–1.2), $p = 0.041$). It's established that more than 90% of pediatric HIV infection is from mother to child transmission [28]. Thus, the above result could be explained by the fact that children had acquired HIV infection predominantly from their mothers some of

whom may have died of AIDS.

Children/adolescents whose fathers had no formal education were 3.3 times more likely to be tested HIV positive compared to those whose parents had secondary/higher education level (aOR = 0.3 (0.1–0.6), $p = 0.004$). This result could be explained by the positive association between educational attainment and lower risk of HIV infection as reported by previous studies [29,30].

Among children/adolescents who tested for HIV ($n = 2465$), 40 (1.6%) were diagnosed with HIV infection. Thus, the number of children/adolescents needed to be tested (NNT) to identify a case living with HIV/AIDS was 62 (2465/40). This number is 6 times higher compared to the NNT reported by Bandason et al. in a study validating an HIV screening tool to identify older children (6–15 years) living with HIV in primary care facilities in Zimbabwe [31]. This finding suggests that using a screening tool to better target children/adolescents more likely infected with HIV could be useful in optimizing the efficiency of bPITC implementation in Cameroon and other West and Central Africa countries with low HIV prevalence. That notwithstanding, data from Nigeria suggest that the use of the Bandason screening tool is not achieving the desired results. Actually, the NNT in this country among outpatients children is still high at 14,2¹⁴. This could be due to the fact that the Bandason tool was validated in Zimbabwe, a very high HIV prevalence (12.7%) country compared to Nigeria (1.5%)[32]. Therefore, there is a need for further research to re-assess the effectiveness of this screening tool in low HIV

prevalence contexts. The predictors of HIV seropositivity reported by this study could guide the development of a robust screening tool more appropriate for Cameroon and other low HIV prevalence countries, especially in West and Central Africa Region.

4.1. Strengths and limitations

The strength of our study lies in the assessment of children-level characteristics that could influence HIV testing uptake and seropositivity for infants, children and adolescents across a large age range (6 weeks-19 years). Specifically, the determination of children-level predictors of HIV seropositivity could open the door for the development of a more robust HIV screening tool for children and adolescents at the facility level. This new evidence could contribute in optimizing the yield and efficiency bPITC strategy in low HIV prevalence contexts.

The study is limited by the fact that the sites were not randomly selected and did not include the Northern regions of Cameroon, and thus the results may not be generalizable nationwide. That notwithstanding, the external validity of our study is stronger as it was conducted in 3 hospitals from three different geographic locations covering urban, semi-urban and rural populations in Cameroon. Our study has provided new data that could guide further research in the area of pediatric and adolescent HIV case finding.

5. Conclusions and recommendations

In the context of limited resources, the implementation of efficient interventions is of paramount priority. With HIV testing being the gateway towards accessing HIV prevention and care services, the prioritization of efficient HIV case finding strategy is instrumental in achieving the 90-90-90 targets among pediatric and adolescents. Our study has provided new knowledge that children/adolescents: of the female sex, having lost their mother and whose father had no education are more likely to be tested HIV positive at outpatient consultations. This new knowledge could guide health care workers in optimizing the yield of pediatric HIV testing at the facility level, but also further research aiming at reducing the current high NNT in Cameroon and other countries in West and Central Africa Region with similar low HIV prevalence.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhip.2020.100025>.

Ethical considerations

Participation in the study was voluntary for both parents and children. Only caregivers who consented were enrolled and assent was requested from children above 11 years of age. Written informed consent was obtained from participating parents. Likewise, assent for children over the age of 11 years was obtained through a signed written assent form. The ASPA study received ethical approval from the Cameroon National Ethics Committee, the Ludwig-Maximilians-Universität, Munich (Germany), and the Albert Einstein College of Medicine (NY, U.S.). The ASPA study was registered at [ClinicalTrials.gov](https://clinicaltrials.gov) (NCT03024762) and received an administrative authorization from the Cameroon Ministry of Public Health.

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Competing interests

The authors declared that they have no competing interests.

Authors' contributions

HAY: conceived, conceptualized and designed the study, drafted the study protocol, fundraised for the study, recruited and trained study staff, supervised data acquisition, analyzed data, interpreted the results and drafted the manuscript.

DNN: co-supervised data acquisition and reviewed the manuscript.

MBN: co-supervised data acquisition, interpreted the results and reviewed the manuscript.

PBK: co-supervised data acquisition, interpreted the results and reviewed the manuscript.

IS: co-supervised data acquisition, interpreted the results and reviewed the manuscript.

JJNN: collected data, supported data analysis, reviewed the manuscript.

GT: Interpreted the results and reviewed the manuscript.

PM: Supported data analysis and reviewed the manuscript.

CK: Reviewed the study protocol, interpreted the results and reviewed the manuscript.

MB: Reviewed the study protocol, interpreted the results and reviewed the manuscript.

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