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SHORT REPORT

Determinants of vaccine uptake in HIV-affected families from West Bengal

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ABSTRACT

Children living with Human Immunodeficiency virus (HIV; CLH) have special vaccine needs. Determinants of household-level uptake of vaccines need to be examined in high-risk families with CLH. We previously conducted a study on the impact of *Haemophilus influenzae* type b conjugate vaccine and pneumococcal conjugate vaccine (PCV-13) in 125 HIV-affected families and 47 HIV-unaffected families in West Bengal. We then interviewed 99 of these 172 families who had participated in the study to understand the household-level factors that determine vaccine uptake. Sixty-four of the 99 families had one or more CLH. Within these 64 families, 30% of CLH had missed vaccines under the universal immunization program (UIP), compared to only 6% of HIV-uninfected children (HUC) (p = .001). Maternal HIV positivity in a family increased risk of missing UIP vaccines nearly five times (4.82, p = .001). Almost all families accessed UIP vaccines at local primary vaccination centers, but 14% of families experienced stigma due to HIV and avoided getting one or more vaccine doses. In contrast, in our study, 100% of HIV-affected families actively sought PCV-13 and HibCV, despite having to travel. Factors that influenced uptake included awareness generation and activation by an outreach worker and availability of vaccines on pick-up days for anti-retroviral therapy. Eighty-six percent of families strongly recommended PCV-13 to other families. To conclude, while we found that CLH have barriers to getting vaccinations, a program designed to take into consideration the obstacles that HIV-affected families face showed a high rate of vaccine uptake.

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Children living with HIV (CLH) and HIV-exposed uninfected children (HEU) are both at increased risk of disease from vaccine-preventable infections. They have special vaccine needs that need to be addressed in vaccination programs.

Although CLH regularly utilizes healthcare services, several studies from sub-Saharan Africa and India, have shown that CLH are at increased risk of missed or incomplete vaccinations compared to HIV-unexposed uninfected children (HUC).[1–4] Maternal HIV infection in a family increases the risk for under-vaccination in both CLH and HEU children. Barriers to vaccinations in these high-risk families need to be identified, especially with the adoption of the Immunization 2030 program, which aims for a world where "*everyone, everywhere, at every age, fully benefits from vaccines for good health and wellbeing.*"[5]

Acceptance of vaccination at the household-level is an important determinant of vaccine uptake. The determinants of vaccine acceptance include not only perception of the risk of vaccine-preventable disease versus potential adverse effects of the vaccine, but also trust in health systems, cost of vaccines, and sociocultural, historical, and political factors.[6] Vaccine hesitancy, which is defined as delay or refusal of vaccination by families despite availability, remains a major barrier in many countries for complete childhood vaccination.[7] Thomson identified five causes of suboptimal vaccination, which fall into the categories of access, affordability, awareness, acceptance, and activation, referred to as the "5A practical taxonomy on determinants of vaccine uptake."[8] This taxonomy provides a framework to discuss and improve vaccine uptake with families.[9,10]

Not much is known about the perception of vaccines, especially acceptability of new vaccines in families affected by HIV in India. With the largest burden of pediatric HIV outside of sub-Saharan Africa, India has rapidly scaled up antiretroviral therapy (ART) services and programs for the prevention of parent-to-child transmissions of HIV. As a result, there is a growing population of HEU children in India. Vaccines are not part of government programs for CLH, HEU children, or adults with HIV.

India has recently introduced new vaccines in the Universal Immunization Program (UIP) that are particularly important for CLH and HEU children: the pentavalent vaccine which includes diphtheria, tetanus, pertussis, Hepatitis B, and *Haemophilus influenzae* type b (HibCV);[11] rotavirus vaccine;[12] the pneumococcal conjugate vaccine (PCV13);[13] and the measles/rubella vaccine.[14] There is as yet no specific schedule for CLH or HEU children and no catch-up schedule for children who are still at risk because of HIV but have aged out of the standard vaccination schedule.

In order to determine barriers to routine vaccinations and determinants of household-level uptake for new vaccines in families affected by HIV, we conducted a household-based study in a cohort of HIV-affected and -unaffected families in West Bengal. We used the 5A taxonomy to understand the most important determinants of vaccine uptake for these families.

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From February 2012 to October 2014, 172 families participated in a prospective cohort study looking at the impact of the monovalent *Haemophilus influenza type b* conjugate vaccine (HibCV, *Serum Institute of India*), and 13-valent pneumococcal conjugate vaccine (PCV-13, *Pfizer*), on nasopharyngeal carriage in vaccinated children and their unvaccinated parents in two districts of West Bengal.[15–18] The study included 125 HIV-affected children (2–14 years old) who represented nearly all families with CLH at the ART Center of the Midnapore Medical College, and a group of 47 HIV-unaffected families with children between ages 2–5 years. This 2–5 year unaffected group was age-matched with the children 2–5 years in the cohort with HIV. The original sample size was calculated to look at the impact of HibCV on nasopharyngeal carriage in vaccinated children. Children with no history of HibCV and PCV vaccination were eligible for the study and details have been published.[18] We systematically collected information on participation in the Universal Immunization Program in all 172 families in one-to-one interviews.

From December 2015 to February 2016, we invited all 172 families to participate in an in-depth interview on drivers of vaccine uptake. 99 families agreed to participate, 64 were HIV-affected, and 35 were not. A social worker conducted the interviews with one parent or guardian, face-to-face in Bengali for 30 minutes, at the ART center in Midnapore Medical College for HIV-affected families, and at the Hijli Rural Hospital-Kharagpur for HIV-unaffected families. The majority of interviews were with mothers (HIV-affected 64%; HIV-unaffected 88%). Interview responses were fully transcribed, translated into English, and entered into Epi-Info 7 (CDC, Atlanta).

Ethical clearance was obtained from the Ethics Committees of all participating institutions. Written informed consent was obtained from parents and guardians.

In HIV-affected families, children and parents had HIV. In the original pneumonia prevention study, prior to study enrollment, group discussions about pneumonia and pneumonia preventing vaccines were held at the antiretroviral treatment (ART) clinic, and in a community center run by a local NGO, working with HIV-affected families. A movie in Bengali featuring a familiar pediatric HIV physician explained the need for vaccines. An outreach worker from the HIV community worked as a resource person for HIV-affected families. The Hib and PCV-13 vaccinations were organized at the ART clinic for CLH on days when they would come for CD4 count checks and medicine pick-up. Families were compensated for travel.

In the HIV-negative cohort, the study was discussed with families at the primary health center (PHC) in the presence of auxiliary nurse midwives (ANM), Accredited Social Health Activist (ASHA) workers, and the Block Medical Officer of Health. The vaccines were given at the PHC where families regularly accessed UIP services.

To assess the determinants of vaccine uptake, we developed a survey, in Bengali, consisting of both multiple-choice questions with a visual analog scale to accommodate literacy levels and open-ended questions. The survey instrument was designed in an iterative manner by a team consisting of physicians, a psychologist, and a social worker. It was then pilot tested in the clinic and reformulated.

Questions on the survey included:

1. Was information about UIP given at the health center prior to vaccination?
2. Are your child's UIP vaccinations completed?
3. Did you miss or delay any UIP vaccines?
4. Did any geographical factors prevent you from getting UIP vaccines?
5. Were there any past events that discouraged you from getting UIP vaccines?

These and other survey questions were developed with the 5A framework in mind:

1. Access is the ability of individuals to reach vaccines. The survey asked questions about (a) location, (b) time to reach clinic, and (c) availability of vaccine cards.
2. Affordability is the ability to afford vaccination. Participants were asked about (a) travel expenses, (b) willingness-to-pay for Hib/PCV, and (c) the amount they could pay out-of-pocket. A payment card method was used to evaluate the maximum amount of parents would be willing-to-pay.[19]
3. Awareness is defined as individuals' knowledge of vaccines and their objective benefits and risks. Questions were asked to determine (a) parental knowledge of pneumonia and (b) what was most important for deciding participation?
4. Acceptance is the degree to which individuals accept, question, or refuse vaccines. Questions to gauge acceptance included:

- How likely will you consider Hib/PCV vaccination for your other child?
- How likely will you recommend Hib/PCV vaccine to friends and relatives?
- How strongly do you feel Hib/PCV has impacted your child's health?

5. Activation is the nudge toward vaccine uptake. Questions to assess activation were:

- How did you come to know about this study?
- How difficult was it to decide to participate?
- Was the audiovisual discussion understandable?
- Did you have an opportunity to ask questions?

Outcome measures were vaccination status of children as per the Expanded Program on Immunization (EPI) recommendations.[20] Complete vaccination status was defined as children receiving one dose of Bacillus Calmette–Guérin, BCG vaccine (birth); three doses of oral polio vaccine, OPV (6, 10, 14 weeks); three doses of diphtheria, pertussis, and tetanus vaccine, DPT (6, 10, 14 weeks); and one dose of measles vaccine (9–12 months) by 12 months of age. Incomplete immunization was defined as children who received at least one but not all recommended vaccines by 12 months of age. Un-immunization was defined as children who did not receive any recommended vaccines by 12 months of age. Individual and socio-economic factors that

often present barriers to vaccination coverage were chosen as variables for analysis. These included HIV status of child and mother, geography, gender, religion, single-parent household, more than one child in a family, maternal age and education, socioeconomic status, and absence of vaccination card.[9,21–23]

Data were analyzed using STATA 13 (Stata Corp). Descriptive statistics were calculated and comparisons were made using chi-square or Fisher's exact test for categorical data, and rank-sum test for continuous data. The risk factors for incomplete or un-immunization were determined by relative risk estimation.

The demographics of the 172 families that participated in the vaccination study are shown in Table 1. Ninety-four percent lived in rural households. Sixty-one percent of CLH, and 47% of HUC were male. More HIV-affected households were single-parent households; 37% of fathers and 7% of mothers had died in the HIV-affected group. Both parents were alive in all HIV-unaffected households. The median family income in the groups was INR 9478/month. Ninety percent of HIV-affected and 96% of HUC were Hindus, 10% of HIV-affected, and 2% of HIV-unaffected followed Islam.

Nearly 95% of CLH and 100% of HUC depended on government programs for routine vaccination. Twenty-two percent of CLH had no vaccination card, while all HUC had cards. It took a median of 4 hours for HIV-affected families to travel the 65 km to the ART center.

UIP vaccination coverage is described in Table 2. Out of 172 children, 30% of CLH missed UIP vaccines. Of these 14% of CLH were incompletely immunized and 16% were un-immunized, while all HUC were up-to-date (p = .001). This included 83% BCG, 77% OPV (1–3), 80% DPT (1–3), and 77% Measles-1 coverage in CLH. CLH also missed booster vaccines (only 9% got OPV-4, 14% DPT-4, and <1% got two doses of measles). In HUC 79% got OPV-4, 87% DPT-4, and 2.5% Measles-2 (p < .001 each). Only 35% of CLH ages of 2–5 had 3 doses of Hepatitis B vaccine compared to 85% in the 2–5 year HUC cohort. In the whole cohort of CLH from 2 to 14 years, 27/125 (22%) had gotten three doses of Hepatitis B.

Barriers to coverage in the universal immunization program were investigated (Table 3). Loss of vaccination card in CLH strongly increased their risk of missing UIP vaccines (Risk ratio RR 5.4; 3.4–8.69; p < .001). Maternal HIV (RR 4.8, 1.5–14.9; p = .001) and HIV infection status of child (RR 4.6; 95% CI 1.5–14.3; p = .0013) were major risk factors for incomplete immunizations. Muslims had 2 times increased risk of missing the UIP vaccines (RR 2.15; 1.1–4.6; p = .042). Families where the mother had not been to school had nearly two times increased risk of incomplete child immunization (RR 1.8; p = .042).

Open-ended questions on the survey revealed further reasons for missing vaccines that fit within the 5A framework. One mother from the HIV-affected group reported that "*after finding out that my child has HIV, I was busy seeing the doctor so I couldn't take the child for vaccination services*." This suggests she couldn't **afford** it due to time constraints, and though she was regularly accessing care, vaccines were not available. Another mother stated that the distance (**access**) to the vaccination center prevented her from getting vaccines. Nearly 14% (9/64) of HIV-affected families encountered unpleasant experiences at their local UIP vaccination centers, which discouraged

Table 1. Demographics and family organization of families who participated in the immunization study (N = 172).

	HIV infected children	HIV uninfected children	P value
N	125	47	
Rural, n (%)	114 (91.2%)	46 (97.8%)	.126
Vaccination card, n (%)			
No	27 (21.7%)	0	-
Religion, n (%)			
Hindu	112 (89.6%)	45 (95.7%)	.2
Muslim	12 (9.6%)	1 (2.1%)	.099
Buddhist	1 (0.8%)	1 (2.1%)	.469
Male child, n (%)	77 (61%)	22 (46.8%)	.08
Where immunized, n (%)			
Government	119 (95.2%)	47 (100%)	.162
Private	2 (1.6%)	0	-
NGO	2 (1.6%)	0	-
Hospital based government clinic	1 (0.8%)	0	-
Proximity to ART center, km median (IQR)	65 (52, 79)	NA	-
Time to ART center, hour median (IQR)	4 (4, 4)	NA	-
Father HIV, n (%)	65 (83%)	0	-
Mother HIV, n (%)	104 (89%)	0	-
Parent data			
Mother living, n (%)	116 (92.8%)	47 (100%)	.059
Father living, n (%)	78 (62.4%)	47 (100%)	<.0001
Mother's education (yrs) median, IQR	7 (4, 9)	9 (5, 10)	**.0028**
House			
Brick/cement	44 (35.2%)	31 (66%)	.0002
Mud	78 (62%)	16 (34%)	.0008
Temporary hut	2 (1.6%)	0	-
Asbestos	1 (0.8%)	0	-
Family income, median (IQR25, IQR75) (INR)	9478 (9478, 11362)	9478 (7594, 9478)	.0001
Kuppuswamy socioeconomic index, n (%)			
Upper-middle	49 (39.2%)	4 (8.5%)	.0001
Middle	68 (54%)	31 (66%)	.17
Upper-lower	7 (5.6%)	11 (23.4%)	.006
Lower	1 (0.8%)	1 (2.1%)	.47

Table 2. Immunization coverage in children living with and without HIV.

	HIV infected children (2–14 years)	HIV uninfected children (2–5 years)	HIV infected children (2–5 years)	P[!]	P[#]
N	125	47	31		
Fully immunized*	88 (70%)	47 (100%)	26 (84%)	**<.0001**	**.008**
Incompletely immunized**	17 (13.6%)	0	4 (13%)	**.008**	**.022**
Unimmunized***	20 (16%)	0	1 (3%)	**.004**	.397
Incompletely or unimmunized	37 (29.6%)	0	5 (16%)	**.001**	**.008**
Overall Immunization coverage, n (%)					
Vaccines in first 12 months of life					
BCG	104 (83.2%)	47 (100%)	30 (97%)	**.01**	.397
OPV 1–3	96 (76.8%)	47 (100%)	29 (93%)	**.001**	.15
DPT 1–3	100 (80%)	47 (100%)	28 (90%)	**.004**	.059
Measles 1	97 (77.6%)	47 (100%)	27 (87%)	**.002**	**.022**
Hepatitis B 1–3	27 (21.6%)	40 (85%)	11 (35%)	**<.0001**	**<.0001**
Vaccines in 12–24 months of life					
OPV Booster	11 (8.8%)	37 (78.7%)	5 (16%)	**<.0001**	**<.0001**
DPT Booster-1	18 (14.4%)	41 (87.2%)	5 (16%)	**<.0001**	**<.0001**
Measles 2	1 (0.8%)	26 (55%)	1 (3%)	**<.0001**	**<.0001**

[!]P-value comparing HIV-infected children (under 15 years) and HIV-uninfected children; [#]P value comparing HIV-infected children (under 5 years) and HIV-uninfected children; *Fully immunized is defined as the children who received one dose of BCG, three doses of DPT, three doses of OPV(excluding the 0 dose of OPV) and one dose of measles vaccine by 12 months of age; **Incomplete immunization is defined as the children who received at least one but not all recommended vaccines (excluding the 0 dose of OPC) by 12 months of age;***Unimmunized is defined as the children who did not receive any of the recommended vaccines by 12 months of age.

Table 3. Factors influencing the risk for incomplete or un-immunization in study children (n = 172).

	Risk Ratio (RR)	95% CI	P*
Child's HIV	**4.637**	1.5, 14.3	**.0013**
Maternal HIV	**4.82**	1.5, 14.9	**.001**
Child's male gender	0.814	.47, 1.4	.46
Child's female gender	1.227	.71, 2.1	.46
Rural	1.425	.39, 5.2	.575
Urban	0.701	.19, 2.56	.575
Hindu religion	**0.45**	.24,.83	**.0247**
Islam religion	**2.15**	1.1, 4.16	**.042**
Buddhism religion	2.179	.53, 8.95	.368
Single parent	1.418	.81, 2.47	.224
Single mother	1.42	.79, 2.54	.244
Single father	1.258	.37, 4.2	.71
>1 child in family	1.295	.66, 2.51	.434
Maternal age			
<18 years	0.886	.40, 1.9	.76
19–25 years	1.21	.67, 2.19	.522
26–35 years	0.564	.28, 1.12	**.085**
Maternal schooling			
High school & above (> or = 9 years)	0.709	.37, 1.33	.28
Middle school (6–8 yr)	0.743	.36, 1.5	.398
Primary school (1–5 years)	1.15	.53, 2.4	.723
No schooling	**1.859**	1.03, 3.35	**.048**
Socioeconomic status, n			
Upper-middle	1.081	.60, 1.92	.792
Middle	1.106	.63, 1.92	.721
Upper-lower	0.693	.237, 2.02	.484
Absence of vaccine card	**5.428**	3.4, 8.69	**<.0001**

them from getting vaccines. All these incidents were of vaccine refusal by a health-care worker after HIV-positive status or thalassemia was detected. Three respondents from the Muslim community reported not having any knowledge or **awareness** of the vaccines and said religious beliefs prevented them from getting immunized.

In contrast to UIP vaccines, 100% of HIV-affected families actively sought the study vaccines. Awareness generation and **activation** by the outreach worker from the HIV community was cited as critical by 81% (52/64) of families affected by HIV. For each clinic, families were contacted by the outreach worker by phone or in person, providing a regular nudge. In further discussions of what promoted families to participate, 83% of HIV-unaffected families said activation by PHC staff was key. Thirty-two percent (32/99) felt the audiovisual discussions were essential in deciding to participate. 60% of families said they felt that the vaccines would keep their child healthy, and HIV-affected families cited the availability of vaccines on days of routine ART pick-up as key. Ninety-six percent of families were happy with the quality of service.

Out of 99 respondents, 89% (88/99) were strongly willing to recommend PCV and HibCV to others (Table 4). 90% of families considered pneumonia as an important childhood problem, and 69% felt that the vaccines had strongly impacted their child's health. Despite being aware that 2–3 doses may be needed, 87% (88/99) were willing-to-pay for PCV if not available through the government. The median amount of families were willing-to-pay for three doses of PCV was INR 750 (IQR 500–1500).

In summary, we looked at household-level determinants for uptake of new vaccines in high-risk families affected by HIV in West Bengal and the barriers to uptake of UIP vaccines. We found that maternal HIV infection, HIV infection in the child, maternal education, Muslim religion, were all associated with increased risk for a child being incompletely immunized or unimmunized, with UIP vaccines. Interestingly, all families regardless of maternal HIV status, child HIV status, religion, or their previous experience with UIP vaccines, actively sought the HibCV and PCV vaccines.

Again, interpreting the data through the 5A framework, we found high levels of *acceptance* for HibCV and PCVs; the majority of families would recommend these vaccines to friends and families. Effort was made to engage and communicate with families about the role of vaccines. The outreach worker from the community was instrumental in raising *awareness* and *activating* families. Families could *access* vaccines at a place and time where children routinely got follow-up. By making the vaccines free and compensating travel, vaccine access was made *affordable*.

Table 4. Responses of HIV-affected families and HIV-unaffected families on the reasons for uptake of study vaccines (HibCV and PCV13).

	HIV affected	HIV unaffected
N	64	35
Access		
Vaccination card available, n (%)	58 (90.6%)	35 (100%)
Time to travel to ART/Immunization center, hours (Median)	3 h	0.27 h (16 min)
Geographical factors prevented from taking UIP vaccines? n (%)	1 (1.5%)	
Affordability		
Travel expenses to visit treatment center, (Median) (INR)	120	
Ready to pay for three doses of study vaccines, n (%)	57 (89%)	32 (91.4%)
Ready to pay for HibCV and PCV13, n (%)	57 (89%)	32 (91.4%)
The amount you can pay for HibCV (Median, IQR) (INR)	300 (50, 300)	300 (200, 300)
The amount you can pay for 3 doses of PCV(Median, IQR) (INR)	500 (300, 1000)	750 (500, 2000)
Awareness		
Were you aware of pneumonia before participating in the study, n (%)		
No	53 (83%)	32 (91%)
Do you think pneumonia is a potentially important health problem for children, n (%)		
Yes	56 (87.5%)	33 (94.3)
How did you come to know about this study, n (%)		
Medical officer	2 (3.12%)	0
Study staff	3 (4.7%)	0
Outreach worker/Health center staff	52 (81.2%)	29 (83%)
Study participants	2 (3.12%)	1 (2.8%)
Others	5 (7.8%)	5 (14.3%)
Who took decision to participate in the study, n (%)		
Own decision	59 (92%)	29 (83%)
How difficult was it for you to decide if you should participate in the study, n (%)		
Scale 1, Not at all difficult	49 (76%)	28 (80%)
Scale 2, Not difficult	5 (7.8%)	3 (8.5)
Scale 3, Neutral	4 (6.25%)	3 (8.5)
Scale 4, Difficult	4 (6.25%)	1 (2.8%)
Scale 5, Highly difficult	1 (1.5%)	0
What was most important for your decision to participate and continue the follow-up, n (%)		
Information through audiovisual and discussion	25 (39%)	7 (20%)
Given at ART center where we could attend other ART services due in that week along with study visit	1 (1.5%)	
Recommended by health care provider or friends	1 (1.5%)	1 (2.8%)
Other	37 (57.8%)	27 (77%)
For good health and wellbeing of my child	33 (89%)	26 (96%)
Acceptance		
How likely will you consider immunization with Hib/PCV to your unvaccinated child or other children in your family, if given free through government? You have to come to hospital 3 times for schedule, n (%).		
Scale 1, Strongly disagree	1 (1.5%)	-
Scale 2, Disagree	1 (1.5%)	-
Scale 3, Neutral	-	1 (3%)
Scale 4, Agree	7 (11%)	1(3%)
Scale 5, Strongly agree	55 (86%)	33(94%)
How likely will you recommend these vaccines to other friends or relatives, n (%)		
Scale 1, Strongly disagree	3 (4.6%)	1 (2.8%)
Scale 2, Disagree	1 (1.5%)	-
Scale 3, Neutral	3 (4.6%)	-
Scale 4, Agree	8 (12.5%)	-
Scale 5, Strongly agree	49 (77%)	34 (97%)
How strongly do you feel that the study vaccines has impacted on your child's health, n (%)		
Yes	44 (69%)	21 (60%)
Scale 1, Strongly disagree	2 (3.1%)	
Scale 2, Disagree		
Scale 3 Neutral	13 (26.6%)	14 (40%)
Scale 4, Agree	35 (55%)	16 (46%)
Scale 5, Strongly agree	9 (14%)	5 (14%)
Did you had concern of adverse events from the vaccine, before participating in the study, n (%)		
Yes	26 (40.6%)	12 (34.3%)
Scale 1, Strongly disagree		
Scale 2, Disagree		
Scale 3, Neutral	15 (57.7%)	5 (42%)
Scale 4, Agree	6 (23%)	6 (50%)
Scale 5, Strongly agree	5 (19%)	1 (8%)
Activation		
Was the audiovisual presentation and the discussion before consent process understandable to you?		
Yes	64 (100%)	35 (100%)
Scale 1, Strongly disagree	0	5 (14%)

(*Continued*)

Table 4. (Continued).

	HIV affected	HIV unaffected
Scale 2, Disagree	9 (14)	1 (2.8%)
Scale 3, Neutral	25 (39%)	18 (51%)
Scale 4, Agree	13 (20%)	4 (11%)
Scale 5, Strongly agree	17 (26%)	7 (20%)
Did you have enough opportunity to ask questions before participating in the study?		
Yes	64 (100%)	35 (100%)

A systematic review of reasons for under immunization in low- and middle-income countries cite deficits in vaccination systems, family characteristics, parental attitudes, and problems with vaccination-related communication, as drivers of under immunization.[24] Sub-optimal coverage of vaccination in the CLH is a problem in health systems around the world, even though CLH regularly access health care.[1,2,25–27]

Discrimination due to HIV and negative experiences with the health system are barriers for accessing health services, specifically routine vaccinations, for CLH.[24,28,29] Interestingly, introduction of high-quality comprehensive HIV care has been shown to rapidly reduce stigma and increase uptake of HIV services.[30] Comprehensive HIV care for children includes vaccines.

We found that families with HIV valued vaccines and were willing-to-pay for three doses of PCV out-of-pocket. The amount they would pay represents nearly 19% of their monthly income.

The study was conducted more than four years ago, but is relevant because there is still no catch-up schedule or specific vaccine schedule for adults or children affected by HIV available in government programs, and no vaccination schedule for revaccination after immune reconstitution. The Indian Academy of Pediatrics recommends vaccinations for CLH following well-articulated international norms.[31,32]

Hepatitis B and HibCV vaccines are now in India's UIP, and PCV is being rolled out. Therefore, there is a need for a dedicated vaccination program with a catch-up schedule for CLH.[33] Hepatitis B was introduced into the UIP in 2011 and we found large numbers of CLH remained unimmunized because it is not available in HIV programs. Similarly, most CLH did not get two doses of measles vaccine. Comprehensive, high-quality HIV care requires integrating vaccination services for CLH as part of routine HIV care with community engagement, recognizing that these children have special vaccine needs.[34]

The study has limitations. The study was conducted in a limited number of families with more CLH than HUC. We had no HEU children, and the study was conducted more than four years ago. In this interval, however not much has been published about vaccine acceptance in high-risk families from India. Larger population-based studies are required to validate our cohort findings.[19]

In conclusion, we found that while CLH had increased risk of missing routine UIP vaccines, families affected by HIV actively sought the HibCV and PCV-13 vaccines due to the system in which awareness was generated, and vaccinations were made accessible and affordable. With improvement in HIV treatment services in India, developing a comprehensive program for inclusion of vaccination services for children and adults affected by HIV in government HIV programs is possible and required, especially now with the adoption of Immunization 2030 seeking to make the full benefits of vaccines available to everybody everywhere.

Disclosure of potential conflicts of interest

All authors do not have an association that might pose a conflict of interest.

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