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Vaccination coverage and immune response among children and adolescents living with HIV/AIDS in a tertiary hospital in Southern Brazil

Abstract

Introduction: Children and adolescents living with HIV/AIDS are more vulnerable to vaccine-preventable diseases due to immunological impairment. Adequate vaccination coverage and immune response are essential to reduce morbidity and improve quality of life in this population.

Objective: To describe adherence to the vaccination schedule among children and adolescents living with HIV/AIDS in a tertiary healthcare service in southern Brazil, as well as the immune response to selected vaccines.

Methods: This was an observational, cross-sectional study with retrospective data collection, evaluating the vaccination profile of patients followed at a pediatric infectious diseases outpatient clinic in a tertiary care center in Paraná, Brazil, during the year 2022.

Results: A total of 49 patients participated in the study. The median age at diagnosis was 4.0 years (0–10), and the current median age was 10.0 years (1–17). Females accounted for 53.1% of the sample, and 67.3% of participants were under the care of parents or extended family members. Vaccination coverage for the routine immunization schedule was 83.7%, whereas coverage for complementary vaccines was 76.2%, ranging from 42.9% to 98.0%. No statistically significant association was observed between complete hepatitis vaccination schedules and the presence of antibodies.

Conclusion: Vaccination coverage rates among children and adolescents living with HIV/AIDS were below desirable levels, and low rates of detectable antibodies against hepatitis A and B were observed.

Keywords: HIV, child, hepatitis B, hepatitis A, vaccination schedule

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Introduction

Human immunodeficiency virus (HIV) infection remains a major global public health challenge. One important aspect of the HIV epidemic is its impact on children and adolescents, which may occur through both horizontal transmission (sexual or parenteral) and vertical transmission (from an HIV-positive mother to the newborn). Vertical transmission remains the main source of infection, and despite global targets for its eradication, approximately 180,000 children continue to acquire HIV each year worldwide, while nearly 1.8 million children are currently living with the virus.[1] These rates are a direct consequence of the fact that only 85% of pregnant women living with HIV worldwide have access to antiretroviral therapy (ART) during pregnancy.[2] Although vertical transmission rates have significantly decreased, from a peak of 43.1 per 100,000 live births in 1992 to 0.8 per 100,000 live births in 2019,[3] the current prevalence still demonstrates that children continue to be affected by HIV. In addition to the intrinsic social and cognitive vulnerability of this population, there is also a biological component to this vulnerability. Compared with adults, the pediatric population presents higher AIDS-related mortality rates, with approximately 110,000 deaths reported in 2017.[1]

Despite the potential severity of the disease, the availability of effective treatments has transformed HIV into a chronic condition due to improved survival rates. In Brazil, access to ART has changed the epidemiological profile of patients, resulting in fewer children being born with HIV and a greater number of adolescents reaching adulthood.[4] In Brazil, this population receives specialized care, including recommendations for a specific vaccination schedule. Given the current increase in vaccine hesitancy, an important point of discussion is understanding vaccination coverage within this group. Therefore, this study was designed to describe adherence to the vaccination schedule among children and adolescents living with HIV/AIDS in a tertiary healthcare service in southern Brazil, as well as the immune response to selected vaccines. These data may support public health strategies aimed at providing high-quality follow-up care while considering the specific characteristics of HIV-positive children and adolescents.

Methods

This was a descriptive, analytical, observational, cross-sectional study with retrospective data collection. All children and adolescents living with HIV/AIDS who were followed at the secondary immunodeficiency outpatient clinic of the Pediatric Infectious Diseases Service at the Hospital de Clínicas of the Federal University of Paraná (UFPR) during the year 2022 were included. Patients without documented medical records were excluded. Data were collected between July and August 2023. Written informed consent and assent forms were obtained from participants in accordance with the requirements of the Human Research Ethics Committee of CHC-UFPR. The study was approved under CAAE number 69036123.9.0000.0096.

Demographic data, adherence to both the standard and HIV-specific vaccination schedules, and post-vaccination serology results

(hepatitis A and hepatitis B) were collected.

The HIV-specific vaccination schedule evaluated in this study was based on the Clinical Protocol and Therapeutic Guidelines for the Management of HIV Infection in Children and Adolescents issued by the Brazilian Ministry of Health.[5]

After collection, the data were entered into Microsoft Excel® spreadsheets and analyzed using Stata/SE 12.0®. Variables were summarized using frequencies, means, and medians, as appropriate, comparisons of proportions were performed using Fisher's exact test. Statistical significance was defined as $p < 0.05$ or a 95% confidence interval.

Results

During the study period, 53 patients were followed at the service. Four patients were excluded due to the absence of adequately documented vaccination records, resulting in a final sample of 49 patients.

Among the 49 patients analyzed, 26 (53.1%) were female, with a median age of 10.0 years (1–17 years; 95% CI 8.65–11.43). Of these children, 24 (49.0%) were residents of Curitiba, 18 (36.7%) came from the Metropolitan Region of Curitiba, and 7 (14.3%) were from other municipalities in the state of Paraná. Regarding legal guardianship, 27 (55.1%) were under the care of their biological parents, 6 (12.2%) had adoptive parents, and 16 (32.7%) were under the care of other family members. The median age at diagnosis was 4 years (0–10 years; 95% CI 2.99–4.93), and the median follow-up time was 6.6 years (1–13 years; 95% CI 5.77–7.33). Regarding regularity of follow-up, 34 (69.4%) patients attended regular follow-up appointments.

The evaluation of the vaccination schedule, according to the recommendations for the child's or adolescent's age, is described in Table 1. Coverage of the basic vaccination schedule was 83.7%, whereas coverage for complementary vaccines was 76.2%, ranging from 42.9% to 98.0%. For the COVID-19 vaccine, information was available for only 22 children (44.9%), all of whom had been adequately vaccinated.

Table 1 Adequacy of the recommended vaccination schedule according to age among children and adolescents living with HIV/AIDS followed at a referral center in southern Brazil, 2022

Vaccination schedule	Adequate		Inadequate	
	n	%	n	%
Basic Schedule	41	83.7	8	16.3
Pneumococcal 23-valent	40	81.6	9	18.4
Pneumococcal 13-valent	21	42.9	28	57.1
Meningococcal C	37	75.5	12	24.5
Meningococcal ACWY	36	73.5	13	26.5
Hepatitis A	42	85.7	7	14.3
HPV	48	98.0	1	2.0

When the adequacy of hepatitis B and hepatitis A vaccination schedules was compared with the presence of Anti-HBs and Anti-HAV IgG antibodies, respectively, no statistically significant association was observed between complete vaccination schedules and antibody positivity. Among patients with a complete hepatitis B vaccination schedule, 44.7% had non-reactive Anti-HBs and 55.6% had reactive Anti-HBs. Among those with a complete hepatitis A vaccination schedule, 41.7% had non-reactive Anti-HAV IgG, whereas 58.3% had reactive Anti-HAV IgG (Table 2). It is important to note that, at the time of the study, annual revaccination in cases of negative hepatitis B serology had not yet been recommended.

Table 2 Comparison between adherence to hepatitis B and hepatitis A vaccination schedules and seroconversion among children and adolescents living with HIV/AIDS followed at a referral center in southern Brazil, 2022

Serology	Adequate schedule		Inadequate schedule		Total		
	n	%	N	%	n	%	
Hepatitis B (N=46)							
Reactive Anti-HBs	21	84.0	4	16.0	25	54.3	*p*=1,00*
Non-reactive Anti-HBs	17	81.0	4	19.0	21	45.7	
Hepatitis A (N=43)							
Reactive Anti-HAV	21	87.5	3	12.5	24	55.8	*p=0,68**
Non-reactive Anti-HAV	15	79.0	4	21.0	19	44.2	

Note: *Fisher's exact test.

Discussion

Adherence to both the standard and the HIV-specific vaccination schedules in this population was higher than that reported in other populations described in the literature, although still far from ideal. A study conducted in China found adherence rates of 54.5% for the BCG vaccine, 84.5% for the hepatitis B vaccine, 54.5% for the poliomyelitis vaccine, and 59.5% for the DTP vaccine.[5] These vaccines are included in the standard childhood vaccination schedule in Brazil, and our study demonstrated higher adherence rates among children followed at the service. This finding also reflects the historical popularity of vaccination within the Brazilian population, despite the decline in vaccination coverage observed in recent years.

Before the COVID-19 pandemic, vaccination coverage rates in Brazil exceeded 90%; however, during 2020 and 2021, coverage rates for specific vaccines decreased to approximately 60–70%.[6] Since the study population had a relatively high median age and most vaccines included in the standard schedule are administered during the first two years of life, it is possible that vaccination coverage among the study population was lower than that of the general population at the time these children should have been vaccinated. This may be explained by several factors, including family concerns regarding vaccination of children with potentially immunosuppressive conditions, social vulnerability, or lack of interest in vaccination. Further studies specifically designed to investigate these factors are needed to better clarify these reasons.

The most concerning finding in the present study involves viral hepatitis, which remains an important cause of mortality, particularly among people living with HIV.[7] Vaccination has substantially

reduced infection rates since its implementation.[7,8] Therefore, vaccine effectiveness becomes a particularly important issue. However, in our population, no association was observed between vaccination status and the presence of antibodies for either hepatitis B or hepatitis A. Adherence to the standard vaccination schedule, which includes the complete hepatitis B vaccination series, was not statistically associated with the presence of anti-HBs antibodies. A similar finding was observed for anti-HAV antibodies, which appeared to be independent of adherence to the special two-dose hepatitis A schedule recommended for HIV-positive patients.

Taken together, these findings suggest that HIV-positive children may have greater difficulty achieving adequate post-vaccination antibody titers, although the standard interval between the last vaccine dose and serological testing was not evaluated in this study. This finding may be explained both by lower seroconversion rates after vaccination and by a more rapid decline in antibody titers among those who do seroconvert.[9]

Therefore, discussion is needed regarding the routine monitoring of antibody titers, even after documented seroconversion. Currently, in Brazil, annual hepatitis B serological testing is recommended for immunosuppressed populations, including both pediatric and adult patients.[10] This recommendation does not currently apply to hepatitis A, since hepatitis A vaccination is generally considered to produce high seroconversion rates in the general population.[11] However, serial monitoring may also be necessary in this context. Further studies are required to better understand antibody dynamics in these children and adolescents in order to optimize both vaccination schedules and serological monitoring strategies for this population.

This study has several strengths. It evaluated a well-characterized cohort of children and adolescents living with HIV/AIDS receiving specialized follow-up care in a tertiary referral center and assessed both vaccination coverage and post-vaccination serological response. However, some limitations should be acknowledged. The study was conducted at a single center and included a relatively small sample size, which may limit the generalizability of the findings. In addition, the retrospective design relied on the completeness of medical records and vaccination documentation. Furthermore, the interval between vaccine administration and serological testing was not available, which may have influenced the interpretation of antibody persistence.

Conclusion

Vaccination coverage among children and adolescents living with HIV/AIDS remained below recommended levels, and a substantial proportion of patients lacked detectable antibodies against hepatitis A and B despite documented vaccination. These findings demonstrate that HIV presents specific challenges within the pediatric population and highlight the need for careful and continuous follow-up in order to maintain adequate disease control and ensure that these children and adolescents are able to achieve a quality of life comparable to that of individuals not living with HIV.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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