IMMUNE RESPONSE TO CHILDHOOD VACCINATION IN VERTICALLY INFECTED PEOPLE LIVING WITH HIV: A LONG-TERM EVALUATION

1067

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BACKGROUND

- Despite successful antiretroviral therapy (ART), people living with HIV (**PLHIV**) are at risk of **suboptimal vaccine response**, exposing this vulnerable population to common vaccine-preventable diseases.
- Our study aims to **describe the vaccine response** in vertically infected PLHIV by assessing seroprotection rates after primary vaccination, their **durability over time**, and the **clinical** and **immunological** factors associated with a stronger and more sustained immune response.

METHODS

- **Cross-sectional observational study**
- Seroprotection rate for **diphtheria, tetanus, measles, mumps, rubella, varicella, and hepatitis B (HBV)** was analyzed at specific time points since primary immunization, and at the most recent analysis for each person up to 31.10.2023, by reviewing the serological analysis and medical records available for each subject.
- Associations between vaccine outcome and predictive factors were analyzed.

RESULTS

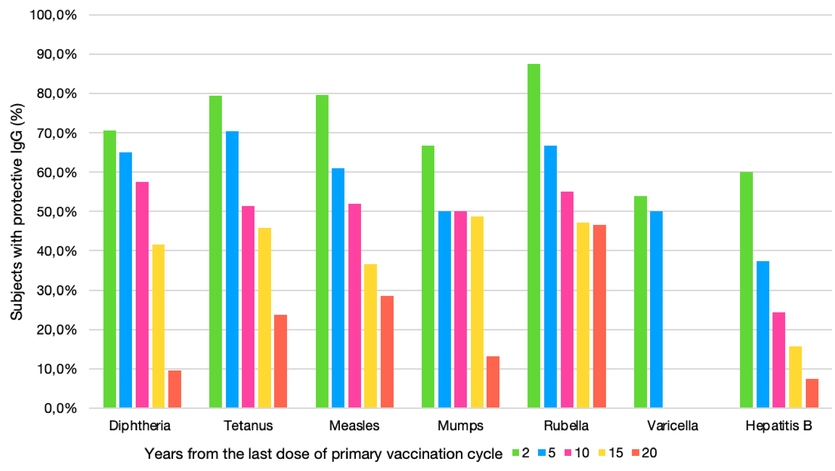
- **85 people** followed in the Pediatric Infection Disease Unit for vertically acquired HIV infection.

The characteristics of the population are summarized in **Table 1**.

Demographic Characteristics	HIV-positive subjects (n= 85)
Gender	47 F (55%); 38 M (45%)
Age (years), median (IQR)	24 (16, 31)
Country of birth, n (%)	
Italy	41 (48%)
Africa	28 (33%)
Others	16 (19%)
HIV infection stage before starting ART, n (%)	
CDC 1	32 (38%)
CDC 2	21 (24%)
CDC 3	32 (38%)
HIV infection stage at 2023, n (%)	
CDC 1	30 (36%)
CDC 2	21 (24%)
CDC 3	34 (40%)
Undetectable VL, n (%)	78 (92%)
VL (cp/ml) among subjects with unsuppressed VL in 2023, median (IQR)	6410 (59, 133000)
CD4+ cell/mm^3 in 2023, median (IQR)	793 (614, 1026)
CD4+ percentage in 2023, median (IQR)	36.5 (30.5, 41,8)
Subjects in ART at 2023, n (%)	85 (100%)
ART duration in 2023 (years), median (IQR)	21 (14, 24)
Age at ART initiation (months), median (IQR)	53 (12, 118)
Initiation of ART within the first 12 months of life, n (%)	
Yes	23 (27%)
No	58 (68%)
Not available	4 (5%)

Despite early ART initiation, PLHIV who have vertically transmitted infections exhibit lower antibody levels against vaccine-preventable diseases compared to non-infected individuals

- **Two years post-vaccination**, seroprotection rates were **71% for diphtheria**, **79% for tetanus** and **measles**, **67% for mumps**, **87% for rubella**, and **54% for varicella**.
- Protection declined to 50-70% at five years and 50-58% at ten years.
- **At twenty years**, seroprotection **dropped below 30%** for all vaccines except **rubella (47%).**

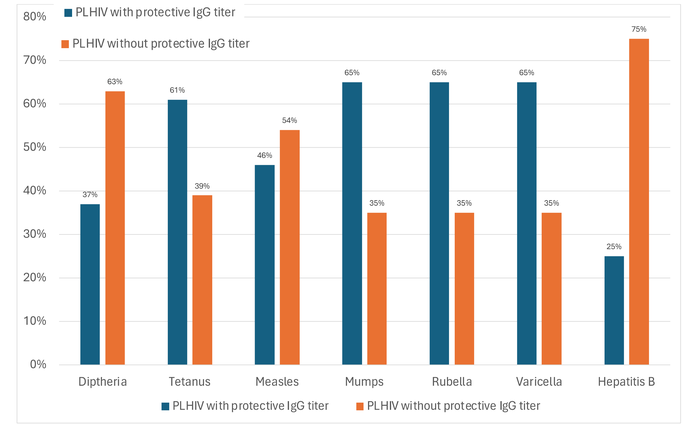


Years from the last dose of primary vaccination cycle

	2	5	10	15	20
Diphtheria	24/34 (71%)	28/43 (65%)	19/33 (58%)	10/24 (42%)	2/21 (9%)
Tetanus	27/34 (79%)	31/44 (70%)	19/37 (51%)	11/24 (46%)	5/21 (24%)
Measles	35/44 (79%)	25/41 (61%)	26/50 (52%)	15/41 (37%)	6/21 (28%)
Mumps	28/42 (67%)	20/40 (50%)	24/48 (50%)	18/37 (49%)	2/15 (13%)
Rubella	35/40 (87%)	28/42 (67%)	27/49 (55%)	17/36 (47%)	7/15 (47%)
Varicella	7/13 (54%)	4/8 (50%)	-	-	-
Hepatitis B	6/10 (60%)	9/24 (37%)	9/37 (24%)	6/38 (16%)	3/40 (8%)

Figure 1. Prevalence of HIV-positive subjects with protective IgG titres in different years since the last dose of primary vaccination cycle by antigen of interest

- **HBV** seroprotection was the **lowest**, with only **60%, 37%, 24%,** and **7.5%** maintaining protective IgG levels after 2, 5, 10, and 20 years post-vaccination.
- The most recent serologies showed seroprotection rates of **37%** for **diphtheria**, **61% for tetanus**, **46% for measles**, **65% for mumps, rubella**, and **varicella**, and **25**% for **HBV**.



	Diptheria	Tetanus	Measles	Mumps	Rubella	Varicella	Hepatitis B
IgG titer	31/84	52/85	35/76	46/71	47/72	13/20	19/77
:	53/84	33/85	41/76	25/71	25/72	7/20	57/77

Figure 2. Assessment of seroprotection rate in vaccinated person in 2023

- On multivariate analysis, only the **years from the last vaccination dose** correlated to the vaccine response for all the vaccinations.

DIPHTHERIA	OR (95%CI)	p value
Start ART before 12 months of age	1.03 (0.78-1.36)	0.855
Actual stage CDC3	0.88 (0.69-1.12)	0.302
CD4 at the last vaccination dose	1.00 (1.00-1.00)	0.130
Years from the last vaccination dose	**0.98 (0.97-0.99)**	**0.002**
Complete vaccination cycle	0.92 (0.71-1.19)	0.525
Male Gender	0.89 (0.71-1.12)	0.342

TETANUS	OR (95%CI)	p value
Start ART before 12 months of age	1.19 (0.84-1.45)	0.477
Actual stage CDC3	0.80 (0.63-1.01)	0.062
CD4 at the last vaccination dose	1.00 (1.00-1.00)	0.230
Years from the last vaccination dose	**0.98 (0.97-0.99)**	**0.003**
Complete vaccination cycle	1.06 (0.83-1.37)	0.632
Male Gender	1.14 (0.91-1.41)	0.261

MEASLES	OR (95%CI)	p value
Start ART before 12 months of age	1.22 (0.89-1.67)	0.230
Actual stage CDC3	1.09 (0.83-1.43)	0.521
CD4 at the last vaccination dose	1.00 (1.00-1.00)	0.055
Years from the last vaccination dose	**0.96 (0.95-0.98)**	**<0.001**
Complete vaccination cycle	0.77 (0.54-1.10)	0.156
Male Gender	1.02 (0.78-1.33)	0.895

MUMPS	OR (95%CI)	p value
Start ART before 12 months of age	1.04 (0.76-1.44)	0.807
Actual stage CDC3	1.07 (0.80-1.40)	0.685
CD4 at the last vaccination dose	**0.99 (0.99-0.99)**	**0.022**
Years from the last vaccination dose	**0.97 (0.95-0.99)**	**0.005**
Complete vaccination cycle	0.78 (0.54-1.12)	0.179
Male Gender	1.22 (0.92-1.62)	0.168

RUBELLA	OR (95%CI)	p value
Start ART before 12 months of age	1.07 (0.78-1.47)	0.681
Actual stage CDC3	1.03 (0.78-1.36)	0.838
CD4 at the last vaccination dose	1.00 (1.00-1.00)	0.896
Years from the last vaccination dose	**0.96 (0.94-0.98)**	**<0.001**
Complete vaccination cycle	0.86 (0.61-1.22)	0.409
Male Gender	0.98 (0.74-1.28)	0.861

HEPATITIS B	OR (95%CI)	p value
Start ART before 12 months of age	1.27 (0.90-1.80)	0.180
Actual stage CDC3	1.06 (0.79-1.42)	0.697
CD4 at the last vaccination dose	1.00 (1.00-1.00)	0.778
Years from the last vaccination dose	**0.98 (0.96-0.99)**	**0.031**
Complete vaccination cycle	0.67 (0.40-1.14)	0.148
Male Gender	0.83 (0.63-1.10)	0.198

Figure 3. Multivariate analysis of antibody titers related to childhood vaccinations

CONCLUSIONS

- Despite the initiation of ART, PLHIV who have vertically transmitted infections exhibit **lower antibody levels** against **vaccine-preventable diseases** compared to non-infected individuals.
- Strict **adherence** to the vaccination **schedule** and **regular serological testing** are **crucial** to ensure adequate protection