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Evaluation of Vaccination Coverage and Factors Associated with Non-Vaccination of Children Aged 9 Months to 5 Years: Experience of Ayilé Polyclinic in Port Gentil, Gabon

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Abstract

Introduction: *Vaccination represents one of the most popular and widely used approaches to prevention, a major pillar of public health. The main objective of our study was to assess vaccination coverage and determine the factors associated with non-vaccination among children aged 9 months to 5 years in the private sector in Gabon.*

Methodology: *This prospective and descriptive study was conducted from December 1, 2022 to November 30, 2023 (1 year) and targeted all children aged 9 months to 5 years seen in consultation at the pediatrics department of the Ayilé medical-surgical polyclinic in Port Gentil, Gabon.*

Results: *We identified 176 children. The lowest age of the patients was 3.3 years ± 1.5 years, with the 3-5-year age group being the most represented at 60.2%. 88.1% of the children were brought by their mothers, and 52.3% of the accompanying adults had a low level of education. Regarding Expanded Program on Immunization (EPI) vaccination coverage, children with zero doses represented 3.4%, while the proportion of children who had received at least 3 doses of Penta and Polio was 92% and 77.8%, respectively. For BCG, measles, and yellow fever, the proportion of children who had received at least one dose was 96.6%, 82.4%, and 77.8%, respectively. The significant factors of non-vaccination were: lack of information with 56.3% (P = 0.001), forgetting appointments, i.e. 31.8% (P= 0.001) and low level of education of accompanying persons, 52.3% (P = 0.001).*

Conclusion: *The significant factors of non-vaccination identified were lack of information, missed appointments, and low level of education of accompanying persons.*

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Introduction

Vaccination is a major component of primary healthcare for children, as highlighted by the 1978 Alma-Ata Conference [1]. This was also reiterated by the 1987 Bamako Initiative and by the 1994 International Conference on Population and Development held in Cairo, Egypt [2,3]. Consequently, vaccination occupies a prominent place in current health policies [4]. Vaccination and the prevention of infectious diseases are public health issues [5]. In children under 5 years of age, 30% of deaths are due to vaccine-preventable causes [6,7]. Vaccination coverage indicates the proportion of the target population that has received the required doses of a vaccine against a vaccine-preventable disease [8]. It is an important indicator of population health and accurately reflects the degree of susceptibility to vaccine-preventable diseases [9,10].

It is estimated that approximately 3 million deaths are prevented each year worldwide thanks to vaccination. Furthermore, vaccination prevents nearly 750,000 children annually from developing serious physical, mental, or neurological disabilities. According to estimates from the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), approximately 19.5 million infants worldwide still do not receive basic or life-saving vaccines [11].

Vaccines are administered according to vaccination schedules developed and recommended by national and international organizations such as the World Health Organization and adopted nationally through dedicated programs like the Expanded Program on Immunization (EPI). Like many sub-Saharan African countries, Gabon has an Expanded Program on Immunization (EPI). Launched in 1978, Gabon's EPI has only been fully operational since 1990.

GAVI (Global Alliance for Vaccines and Immunization) is an international public-private partnership created in 2000, which works to improve access to vaccines in low and middle-income countries.

GAVI supports eligible countries through: Funding for the purchase of essential vaccines, such as those against measles, polio, HPV, etc.

Technical support to strengthen health systems, including cold chains and vaccine data management.

Rapid response in the event of epidemics or health crises (e.g., COVID-19 via COVAX) [12]. Not being eligible through the GAVI Alliance, Gabon was able to deploy and support its EPI (Expanded Programmed on Immunization) within its territory. There are currently 119 operational fixed vaccination centers, equipped and integrated into health facilities in Gabon. They provide routine vaccinations for tuberculosis (BCG), polio (oral and injectable forms, OPV and IPV), diphtheria, tetanus, and pertussis (DTP), hepatitis B, and Haemophilus influenzae type b), measles (MRV), and yellow fever (AF). These vaccines are administered according to a schedule of 10 appointments associated with the child's age at birth, 6 weeks, 10 weeks, 14 weeks, and 9 months [13]. Few studies have been reported in Gabon on assessing children's vaccination status and the factors contributing to incomplete vaccination schedules in the private sector. This was a key reason for conducting this study. The main objective was to evaluate vaccination coverage and identify factors associated with non-vaccination among children aged 9 months to 5 years in the private sector.

Patients and Methods

Type and Period of Study

This was a prospective, descriptive, single-center study of 1 year from December 1, 2022 to November 30, 2023.

Population and Study Framework

It concerned all children aged 9 months to 5 years seen in consultation at the Pediatrics department of the Ayilé medical-surgical polyclinic in Port-Gentil, Gabon.

Inclusion Criteria

all children aged 9 months to 5 years with a vaccination record were included.

Exclusion Criteria

We excluded all patients aged less than 9 months and more than 5 years, as well as children who did not have a vaccination record.

Data Collection and Variables Studied

Data were collected from children's vaccination records and by interviewing accompanying adults. We analyzed sociodemographic parameters, the content of the vaccination record, and the information provided by the accompanying adult.

Data Entry and Statistical Analysis

The collected data were entered into a database, which was then transferred to Excel (version 2016) and analyzed using SPSS (version 27.0). Quantitative variables were presented as means with their ranges. Qualitative variables were expressed as percentages. The relationships between qualitative variables were assessed using Pearson's chi-squared test and Fisher's exact test. A test was considered significant if the p-value was less than 0.05.

Results

We identified 176 children. The lowest age of the patients was 3.3 years ± 1.5 years, ranging from 9 months to 5 years. The 3-5-year age group was the most represented, at 60.2%, and the male-to-female ratio was 0.98. Sociodemographically, the majority of children were brought by their mothers (88.1%), and more than half of the accompanying adults had a low level of education (52.3%). This low level of education was identified as a factor associated with low vaccination coverage ($P < 0.025$) (summarized in Tables I and III).

Table I: Distribution of Accompanying Persons According to Level of Study

Level of education	Staff	Percentages
Not enrolled in school	11	6.3
Low level	92	52.3
Top level	73	41.5
Total	176	100

Table III: Distribution of Vaccine Doses According to School Level

Vaccine N=176	Doses (%)	Not enrolled in school (%)	Weak (%)	Superior	P
Penta	1 dose 2 doses ≥ 3 doses No dose 1 dose	1 (9,1) 1 (9,1) 5 (45.5) 4 (36.4) 2 (18,2)	1 (1,1) 2 (2,2) 86 (93.5) 3 (3,3) 2 (2,2)	1 (1,4) 1 (1,4) 71 (97.3) 0 (0) 1 (1,4)	0.0001
Polio	2 doses ≥ 3 doses No dose 1 dose	1 (9,1) 5 (45.5) 3 (27.3) 9 (81.8)	2 (2,2) 74 (80.4) 14 (15.2) 89 (96.7)	0 (0) 58 (79.5) 14 (19,2) 71 (97.3)	0.02
BCG	2 doses No dose 1 dose	1 (9,1) 1 (9,1) 4 (36.4)	0 (0) 3 (3,3) 58 (63.0)	0 (0) 2 (2.7) 28 (38.4)	0.003 0.0001
Measles	2 doses No dose	2 (18,2) 5 (45.5)	14 (15.2) 20 (21.7)	39 (53.9) 6 (8,2)	0.0001
Yellow fever	1 dose No dose	3 (27.3) 8 (72.7)	66 (71.7) 26 (28.3)	64 (87.7) 9 (12.3)	

Regarding vaccination coverage, the proportion of children who had not received any vaccine doses was 4%. Almost all patients (92%) had received at least three doses of the Penta vaccine.

In our study, 78.8% of children received at least three doses of the polio vaccine. The measles and yellow fever vaccines were administered at least once to 82.4% and 77.8% of children in our series, respectively. Almost all children (96.6%) had received at least one dose of the BCG vaccine. In our study, vaccination coverage for non- EPI vaccines is lower compared to EPI vaccines, based on the results obtained in our study (Table II).

Table II: Distribution of Vaccines According to the Number of Doses Received

Vaccine	Dose	Staff	Percentages
Penta	1 dose 2 doses ≥ 3 doses No dose	3 4 162 7	1.7 2.3 92 4
Polio	1 dose 2 doses ≥ 3 doses No dose	5 3 137 31	2.8 1.7 77.8 17.6
Measles	1 dose 2 doses No dose 1 Dose	90 55 31 133	51.1 31.3 17.6 75.6
Yellow fever	No dose 1 dose 2 doses	43 13 4	24.4 7.4 2.3
Pneumo	≥ 3 doses	8	4.5
	No dose	151	85.8
Meningo	1 dose 2 doses	20 3	11.4 1.7

	No dose	153	86.9
Typhoid fever	1 dose 2 doses No dose	20 1 155	11.4 0.6 88.1
BCG	1 dose 2 doses No dose	169 1 6	96 0.6 3.4
Rotavirus	1 dose 2 doses No dose	7 4 165	4 2.3 93.8
Rubella	1 dose 2 doses No dose	43 11 122	24.4 6.3 69.3

Regarding vaccinations outside the Expanded Program on Immunization (EPI), almost all children received no doses of pneumococcal or meningococcal vaccine, with figures of 85.8% and 86.9% respectively. 88.1% of children received no doses of the typhoid vaccine. Almost all children in our study received no doses of the rotavirus vaccine. Only 30.7% of children received at least one dose of the rubella vaccine. (Table II)

Among the factors contributing to children's non-vaccination, the most significant was lack of information: this was the most frequent reason at 56.3% (P 0.001), followed by missed appointments at 31.8% of cases (P 0.001) (Table IV). Among the caregivers of our patients, 93.8% were in favor of vaccination.

Table IV: Distribution of Vaccine Doses According to Non-Vaccination Factors

Vaccine	Factors contributing to non-vaccination	Dose of (%)				
		1 dose	2 doses	≥ 3 doses	No dose	P
Penta	Disease	0 (0)	0 (0)	1 (0.6)	0 (0)	1,000
	Forget	3 (100)	3 (75.0)	45 (27.8)	5 (71.4)	0.001
	Journey	0 (0)	0 (0)	3 (1.9)	0 (0)	1,000
	Lack of information	0 (0)	1 (25.0)	99 (61.1)	7 (100)	0.001
	Lack of resources	0 (0)	0 (0)	15 (9.3)	0 (0)	0.806
Polio	Disease	0 (0)	0 (0)	1 (0.7)	0 (0)	1,000
	Forget	2 (60)	3 (100)	34 (24.8)	16 (51.6)	0.001
	Journey	0 (0)	0 (0)	3 (2,2)	0 (0)	0.677
	Lack of information	0 (0)	0 (0)	88 (64.2)	12 (38.7)	0.001
	Lack of resources	0 (0)	0 (0)	12 (8.8)	3 (9.7)	1,000
	Disease	0 (0)	1 (1.8)	-	0 (0)	0.408
Measles	Forget	35 (38.9)	7 (12.7)	-	14 (42.2)	0.001
	Journey	2 (2,2)	1 (1.8)	-	0 (0)	0.71
	Lack of information	8 (8,9)	3 (5.5)	4 (12.9)	4 (12.9)	0.517
	Lack of resources	0 (0)	0 (0)	15 (9.3)	0 (0)	0.806

BCG	Disease Forget Journey Lack of information Lack of resources	1 (0.6) 54 (32.0) 2 (1,2) 98 (58) 13 (7.7)	0 (0) 1 (100) 0 (0) 0 (0) 0 (0)	- - - - -	0 (0) 1 (16.7) 1 (16.7) 2 (33.3) 2 (33.3)	1,000 0.334 0.115 0.224 0.162
Yellow fever	Disease Forget Journey Lack of information Lack of resources	0 (0) 34 (25.6) 3 (2,3) 83 (62.4) 14 (10.5)	- - - - -	- - - - -	1 (2,3) 22 (51.2) 0 (0) 17 (39.5) 1 (2,1)	0.244 0.002 0.321 0.007 0.121

Discussion

The average age of our children was 3.3 years ± 1.5 years, with a range from 9 months to 5 years. The 3-5-year age group was the most represented, at 60.2%. The sex ratio (M/F) was 0.98. This result is consistent with that of Tounkara M et al., who found a female predominance of 61%, but differs from those of Doumbia P et al. and Coulibaly F et al., who reported sex ratios (M/F) of 1.06 and 1.6, respectively [14,15]. The proportion of children who received no vaccine ("zero dose") was 3.4% in our series [16]. This result is consistent with that of Traoré SA, but differs from that of Félicitée N et al., who reported 4.3% and 8.1% of children receiving "zero doses," respectively. Diallo MD et al. found 22% of children receiving "zero doses" in their series [17]. In our study, 92% of patients received Penta 3 [18]. This result is consistent with that of Doumbia et al., who reported 94.8% of patients receiving Penta 3. But differs from that of Tounkara M. et al., who had a lower rate of 80% [14,15].

It should be noted that our rate is higher than the national Penta3 vaccination coverage rate and that of the WHO, which were respectively 70% and 84% in 2023 [19,20]. Almost all children had received at least one dose of the BCG vaccine, i.e., 96.6%. In the series by Doumbia P et al and Tounkara M et al, the rate of patients vaccinated with BCG was 93% and 72.9% respectively [14,15]. National vaccination coverage for BCG is 98% [21]. In our study, 78.8% of children received at least 3 doses of the polio vaccine, lower than that found in the series by Doumbia P, which found 94.8% of children vaccinated against polio [15]. In our study, 82.5% of patients received at least one dose of the measles vaccine (MRV). This rate is lower than that of Traoré SA et al. and Sunguliya M et al., who had 79% and 80.5%, respectively [17]. Similar to the proportion of children worldwide who received a first dose of measles vaccine, which was 83% in 2023 [22,23]. According to the WHO, measles vaccination coverage in Gabon was 66%, which is lower than what we reported in our study. We reported 77.8% vaccination coverage for the yellow fever vaccine in our study [23]. Our results are consistent with those of Traoré SA et al., who found 79% of children vaccinated against yellow fever [17]. These results are close to the WHO recommendation of 80%, but higher than the reality found in at-risk countries like Gabon, with a rate of 50% [23]. In our study, vaccination coverage for vaccines not included in the Expanded Program on Immunization (EPI) was very low, specifically for pneumococcal vaccine (9.7%), meningococcal vaccine (13.1%), rotavirus vaccine (6.3%), and typhoid fever vaccine (11.3%). This result can be explained by the prohibitive cost and unavailability of these vaccines outside the EPI.

Among the factors contributing to children's non-vaccination, lack of information was the most frequent at 56.3%, followed by missed appointments at 31.8% of cases. In the study by Ndeye NM et al., the factors identified for non-vaccination were parental lack of time (40.3%) followed by missed appointments (33.2%) [24]. In the series by Nacoulma EW et al., the major causes of non-vaccination were ignorance and the prohibitive

cost of these vaccines when the information was available [25]. Meanwhile, in the series by Sunguliya MM et al., the reasons for children's non-vaccination were: rumors circulating about vaccines (35.27%), failure to adhere to vaccination dates and times (8.7%), and lack of knowledge of vaccination locations (8.2%) [22]. 93.8% of those accompanying our patients were in favour of vaccination.

Conclusion

The vaccination coverage of children in our study was higher than the national vaccination coverage, but lower than targets. The factors influencing vaccination completion were primarily the education level of accompanying adults and gender. Factors contributing to non-vaccination identified were: lack of information, missed appointments, and lack of financial resources.

Conflict of Interest

The authors declare that they have no conflict of interest related to this article.

Ethical Approval

This study was conducted in accordance with the Declaration of Helsinki. To ensure confidentiality, each patient was assigned an identification code.

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