

Research Article

# Factors Associated with COVID-19 Vaccination Among Breastfeeding Women in Abidjan, in 2023

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## Abstract

**Background.** In 2022, the WHO recommended the vaccination of breastfeeding women against COVID-19. In the same year, the Minister of Health sent a referral to the National Committee of Independent Experts for Vaccination and Vaccines of Côte d'Ivoire (CNEIV-CI) for its opinion on the vaccination of breastfeeding women against COVID-19 in the country. The CNEIV-CI recommended the vaccination of breastfeeding women against COVID-19. **Objective.** To identify factors associated with COVID-19 vaccination among breastfeeding women. **Method.** We conducted a cross-sectional survey. The study population consisted of breastfeeding women. Data were collected, using a questionnaire, in health centers during a direct interview with breastfeeding women who came for their child's vaccination. The dependent variables were COVID-19 vaccination status and vaccination intention after weaning, and the independent variables were age, education level, religion, living with a partner, and district of residence. A multivariate analysis, by logistic regression, was performed to search for factors associated with COVID-19 vaccination status, on the one hand, and with vaccination intention after weaning, on the other hand. The measure of association was the adjusted Odds Ratio (ajOR) with a 95% confidence interval (95% CI) and a degree of significance  $p < 0.05$ . The data were analyzed using SPSS. **Results.** A total of 1009 breastfeeding women were surveyed. The respondents median age was 29 years; the minimum age was 16 years and the maximum age was 44 years. 49 % of respondents were vaccinated. Factors associated with COVID-19 vaccination status among breastfeeding women were education level (ajOR = 8.57; 95 % CI: 4.92 – 14.94), living with a partner (ajOR = 4.75; 95 % CI: 3.34 – 6.76), and age group (ajOR = 1.63; 95 % CI: 1.02 – 2.6). **Conclusion.** Awareness-raising among women on the acceptance of COVID-19 vaccination must continue. Factors associated with COVID-19 vaccination status were living with a partner, education level, and age group. Qualitative studies could be carried out to understand the underlying reasons behind non-vaccination among breastfeeding women.

## Keywords

COVID-19 Vaccine, Associated Factors, Breastfeeding Women, Côte d'Ivoire

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## 1. Introduction

COVID-19 is a respiratory disease which common clinical manifestations include fever, dry cough, fatigue, myalgia, and dyspnea. The first cases of this disease were detected in Wuhan, China, in December 2019 [1]. It spread rapidly and reached all continents in less than three months [2]. Thus, it was declared a public health emergency of international concern on January 30, 2020, by the World Health Organization (WHO) [3]. On March 11, 2020, with 121,000 confirmed cases including 4,583 deaths worldwide, the COVID-19 pandemic was declared by the Director-General of WHO [4].

The disease reached the African continent on February 14, 2020, via Egypt [5] and Côte d'Ivoire reported its first case on March 11, 2020 [4]. Therefore, the country developed a strategic response plan including eight (08) intervention axes [6].

With the development of vaccines, Côte d'Ivoire joined the COVAX initiative to protect its population against COVID-19 through vaccination [7] and developed a COVID-19 National Deployment and Vaccination Plan [8]. Vaccination against COVID-19 began in Côte d'Ivoire, in the city of Abidjan, on March 1, 2021 and has gradually been extended to all cities in the country [7].

In 2022, the WHO recommended the vaccination of breastfeeding women against COVID-19 [9, 10]. In the same year, the Minister of Health sent a referral to the National Committee of Independent Experts for Vaccination and Vaccines of Côte d'Ivoire (CNEIV-CI), also known as National Immunization Technical Advisory Group (NITAG), for its opinion on the vaccination of breastfeeding women against COVID-19 in the country [11]. The CNEIV-CI recommended the vaccination of breastfeeding women against COVID-19 [12]. Thus, in January 2023, the Ministry of Health decided to extend COVID-19 vaccination to breastfeeding women in Côte d'Ivoire [13]. Studies COVID-19 vaccination acceptability in the general population carried out in Côte d'Ivoire in 2021 [14] and 2022 [15] highlighted cases of hesitation and refusal. Faced with the decision of the Ministry of Health to extend vaccination to breastfeeding women, it seemed necessary to analyze the acceptability of COVID-19 vaccination in breastfeeding women in order to guide the Ivorian health authorities and vaccination programs managers in the development and implementation of necessary strategies to achieve the vaccination objective of this target. It is in this context that we carried out this work. The objectives of this study were to describe the socio-demographic characteristics of the respondents, to estimate the proportion of vaccinated breastfeeding women among those surveyed, to identify the reasons for non-vaccination, and to identify factors associated with COVID-19 vaccination among breastfeeding women.

## 2. Materials and Methods

### 2.1. Type, Location, Duration and Population of Survey

We conducted a cross-sectional survey in Abidjan, in the vaccination centers of the health districts of Yopougon East and West, predominantly urban areas. The survey took place from August to September 2023, i.e. a duration of 2 months. The study population included breastfeeding women.

Inclusion criteria:

- 1) To be present in the health center during data collection;
- 2) To have the child's vaccination record;
- 3) To be vaccinated or not against COVID-19.

Exclusion criteria:

- 1) To refuse to participate in the survey;
- 2) Having your child sick.

### 2.2. Sampling and Sample Size

The formula used to calculate the sample size is:

$$n = eg \times \frac{\varepsilon_{\alpha}^2}{i^2} \times p(1 - p)$$

with

eg: cluster effect = 1

$\varepsilon_{\alpha}$ : the reduced deviation from the normal law at the error threshold of  $\alpha = 1.96$

i: the precision of the estimate = 0.05

p: the expected acceptability percentage = 15%

Based on this formula, the minimum sample size is 294 breastfeeding women per district. This number was rounded to 300. The minimum sample size was therefore 600 breastfeeding women in the 2 health districts.

### 2.3. Data Collection

Data were collected in health centers during a direct interview with breastfeeding women who came for their child's vaccination. Data were collected using a paper questionnaire designed for this purpose. A pre-test of the questionnaire was carried out before data collection. This pre-test, including 10 participants, was used to estimate the duration of an interview, to assess the understanding of the questions and to make corrections to the questionnaire when needed.

Several types of variables were collected:

- 1) Sociodemographic variables (age, education level, religion, living with a partner, district of residence);
- 2) Vaccination-related variables (COVID-19 vaccination status, reason for non-vaccination, vaccination intention after weaning).

## 2.4. Data Analysis

No instance of missing data has been noticed, data collectors following instructions given during the training session.

Data analysis was carried out in two phases: a descriptive phase and an analytical phase. In the descriptive phase, qualitative variables were shown as proportions; quantitative variables were summarized by the mean  $\pm$  standard deviation, the median, the minimum and the maximum.

In the analytical phase, a Chi 2 test was performed between the dependent variables (COVID-19 vaccination status, vaccination intention after weaning) and the selected independent variables (age, education level, religion, living with a partner, district of residence). Then, a multivariate analysis, by logistic regression, was performed to search for factors associated with COVID-19 vaccination status, on the one hand, and with vaccination intention after weaning, on the other hand. The measure of association was the adjusted Odds Ratio (OR<sub>aj</sub>) with a 95% confidence interval (95% CI) and a degree of significance  $p$ -value  $< 0.05$ . The data were analyzed using PASW Statistics 18.

## 2.5. Ethical Considerations

Letters requesting authorization for the survey were sent to the health districts directors of Yopougon East and Yopougon West. Data collection began after obtaining agreement of these health districts directors.

The purpose of the survey was explained to all participants. Each participant was informed that her participation in the survey was voluntary, she was free to withdraw from the survey at any time without justification, and this withdrawal will have no consequences and will not affect her professional responsibilities. Verbal informed consent was obtained from the participants before the administration of the questionnaire, which was anonymous.

## 2.6. Risks and Benefits for Participants

The survey did not pose any risk to the respondents. The main benefit is indirect: the data collected will help guide efforts to protect breastfeeding women from COVID-19 through vaccination.

## 2.7. Confidentiality

Confidentiality of participants' information was maintained throughout the survey. Each participant was assigned a unique study-specific number by the survey team, which was used to identify her questionnaire. No data on the survey form could lead to the identification of the respondents.

## 3. Results

### 3.1. Descriptive Results

**Table 1.** Distribution of respondents according to socio-demographic and COVID-19 vaccine related variables, Abidjan, 2023.

Variables	N	n	%
Education level	1009		
None		85	09
Primary		102	10
Secondary		376	37
Superior		446	44
Religion	1009		
Christian		513	51
Muslim woman		413	41
No religion		83	08
Living with a partner	1009		
Yes		630	62
No		379	38
Age range	1009		
16-25 years		331	33
26-35 years		477	47
36-44 years		201	20
Vaccination status against COVID-19	1009		
Vaccinated		494	49
Unvaccinated		515	51
Reasons for non-vaccination	509		
Fear of side effects		283	55
Ignorance of vaccination for pregnant women		69	14
Lack of time		67	13
No confidence in the vaccine		49	10
Lack of information		41	08
Intention to be vaccinated after weaning	1009		
Yes		444	44
No		565	56

A total of 1009 breastfeeding women were surveyed, in-

cluding 33% in Yopougon West and 64% in Yopougon East. The mean and median age of respondents were 28.88 years

and 29 years respectively. The minimum and maximum age were 16 and 44 years respectively.

### 3.2. Analytical Results

**Table 2.** Chi-square of COVID-19 vaccination status according to sociodemographic variables, Yopougon, 2023.

Independent variables	COVID-19 Vaccination			X <sup>2</sup>	p-value
	Total	Yes n (%)	No n (%)		
Health district					
Yopougon West	1009	156 (43)	208 (57)	8.48	0.004
Yopougon East		338 (52)	307 (48)		
Age group					
16 – 25 years	1009	85 (26)	246 (74)	107.46	0.0001
26 – 35 years		283 (59)	194 (41)		
36 – 44 years		126 (63)	75 (37)		
Education level					
None	1009	24 (28)	61 (72)	192.16	0.0001
Primary		20 (20)	82 (80)		
Secondary		124 (33)	252 (67)		
Superior		326 (73)	120 (27)		
Religion					
Christian	1009	277 (54)	236 (46)	10.90	0.004
Muslim		183 (44)	230 (56)		
Animist		34 (41)	49 (59)		
Living with a partner					
Yes	1009	400 (64)	230 (36)	141.75	0.0001
No		94 (25)	285 (75)		

There was a relationship between COVID-19 vaccination status and health district, age group, education level, religion and living with a partner.

**Table 3.** Chi-square of COVID-19 vaccination intention after weaning according to sociodemographic variables, Yopougon, 2023.

Independent variables	COVID-19 vaccination intention after weaning			X <sup>2</sup>	p-value
	Total	Yes n (%)	No n (%)		
Health district					
Yopougon West	1009	187 (51)	177 (49)	12.55	0.0001
Yopougon East		257 (40)	388 (60)		
Age group					

COVID-19 vaccination intention after weaning					
Independent variables	Total	Yes n (%)	No n (%)	X <sup>2</sup>	p-value
16 – 25 years	1009	177 (54)	154 (46)	19.39	0.0001
26 – 35 years		195 (41)	282 (59)		
36 – 44 years		72 (36)	129 (64)		
Education level	1009			14.14	0.003
None		34 (40)	51 (60)		
Primary		47 (46)	55 (54)		
Secondary		192 (51)	184 (49)		
Superior	1009	171 (38)	275 (62)	4.20	0.12
Religion					
Christian		215 (42)	298 (58)		
Muslim		197 (48)	216 (52)		
Animist	1009	32 (39)	51 (61)	0.30	0.58
Living with a partner					
Yes		273 (43)	357 (57)		
No		171 (45)	208 (55)		

There was a relationship between COVID-19 vaccination intention after weaning and health district, age group, and education level.

**Table 4.** Adjusted Odds Ratio of COVID-19 vaccination status in breastfeeding women, Yopougon, 2023.

COVID-19 Vaccination			
Independent variables	ajOR	95% CI	P-value
Education level			
None	8.57	4.92 - 14.94	0.0001**
Primary	12.85	7.29 - 22.66	0.0001
Secondary	4.34	3.10 - 6.07	0.0001
Superior	1		
Living with a partner			
Yes	1		
No	4.75	3.34 - 6.76	0.0001**
Age group			
16 – 25 years	1.63	1.02 - 2.60	0.04*
26 – 35 years	1.15	0.77 - 1.70	0.5
36 – 44 years	1		

\*p < 0.05, \*\*p < 0.0001

Factors associated with COVID-19 vaccination status among breastfeeding women were education level, living with a partner, and age group.

**Table 5.** Adjusted Odds Ratio of COVID-19 vaccination intention after weaning, Yopougon, 2023.

Independent variables	COVID-19 vaccination intention after weaning		
	ajOR	95% CI	P-value
Age group			
16 – 25 years	1		
26 – 35 years	1.75	1.25 - 2.45	0.01*
36 – 44 years	2.29	1.50 - 3.49	0.0001**
Health district			
Yopougon West	1		
Yopougon East	1.6	1.23 - 2.09	0.0001**
Living with a partner			
Yes	1		
No	1.47	1.08 - 2.02	0.01*
Education level			
None	1		
Primary	0.80	0.44 - 1.45	0.45
Secondary	0.64	0.39 - 1.05	0.08
Superior	0.93	0.57 - 1.52	0.76

\*p < 0.05, \*\*p < 0.0001

Factors associated with COVID-19 vaccination intention after weaning were age group, health district, and living with a partner.

## 4. Discussion

In this work, we analyze the factors associated with COVID-19 vaccination in breastfeeding women.

Regarding sociodemographic characteristics of respondents, our comments will focus on the age, religion and education level.

The mean and median age were 28.88 years and 29 years, respectively. The 26-35 age group represented about half (47%) of the respondents. This finding could be explained by the evolution of female fertility. Indeed, female fertility is at its peak around the age of 25 years. It begins dropping progressively beyond this age and collapses around the age of 38 years. The chances of pregnancy are minimal between the ages of 42 and 44 years and spontaneous pregnancies are exceptional at the age of 45 years [16].

With regard to religion, the data collected show that the majority of respondents were Christians (51%), followed by Muslims (41%). Population census carried out in Côte d'Ivoire in 2021 [17] and other surveys conducted in Yopougon also found the predominance of these religions [18, 19].

As for the level of education, 44% of the breastfeeding women surveyed had a high level of education. This observation could be explained by two reasons: the predominant age group among the respondents and the place of the survey. Indeed, according to the results of the demographic and health survey (DHS) carried out in Côte d'Ivoire in 2021, the proportions of high level of education among women were higher in the age groups of 20 to 24 years (8.3%), 25 to 29 years (8%) and 30 to 34 years (6.7%) [20]. In our study, the predominant age group was 26 to 35 years. In addition, according to the DHS, the vast majority of women with a high education level (12.6%) lived in Abidjan [20]. Our survey took place in Yopougon (the most populated municipality in the city of Abidjan) where could reside a large number of women with a high education level.

Concerning vaccination status and reasons for



non-vaccination, the majority of respondents (51%) were not vaccinated against COVID-19 and 56% did not intend to be vaccinated after weaning. The reasons for not being vaccinated against COVID-19 were fear of side effects, ignorance of the possibility of vaccinating pregnant women, lack of time, lack of confidence in the vaccine and lack of information. In 2021 and 2022, the COVID-19 vaccination acceptability surveys carried out in the general population in Côte d'Ivoire highlighted that the main reasons for not being vaccinated were lack of confidence in the vaccine, fear of side effects and lack of time [14, 15]. Studies on COVID-19 vaccine hesitancy conducted in Africa found similar reasons [21, 22]. The COVID-19 vaccination acceptability survey conducted in five West African countries (Benin, Liberia, Niger, Senegal and Togo) found that vaccine hesitancy or refusal was closely linked to doubts about the ability of governments to guarantee the safety of COVID-19 vaccines before offering them to citizens [23]. Social networks played a major role in the emergence of these doubts by spreading misinformation messages and conspiracy theories [24, 25].

With regard to factors associated with COVID-19 vaccination in breastfeeding women, our study showed that several factors such as living with a partner, educational level, and age group are associated with COVID-19 vaccination among breastfeeding women. According to Joshi et al, COVID-19 vaccination decision-making is influenced by different groups of factors such as socio-demographic characteristics, communication about COVID-19 and vaccination, COVID-19 vaccines, and disease [26]. Social support [27], in general, and particularly intimate support [28], increases the likelihood of COVID-19 vaccine uptake. In contrast to our study, a research conducted in Uganda found an association between not living with a partner and intention to receive COVID-19 vaccine [29]. Likewise, in 2022, a survey conducted in Côte d'Ivoire among the general population (3611 participants) found that not living with a partner was associated with COVID-19 vaccination [unpublished data].

In our study, the association between education level and COVID-19 vaccination was statistically significant. This result is in line with previous research that identified education level as a factor with a statistically significant association with COVID-19 vaccine acceptance [26, 29, 30]. Indeed, education is a powerful strategy for disseminating information related to individuals' health. Education level promotes general understanding and influences decision-making regarding the adoption of health interventions including vaccination [29]. A survey conducted in Côte d'Ivoire, in 2022, including 3611 participants, showed that education was associated with COVID-19 vaccination [unpublished data].

Age was significantly associated with COVID-19 vaccination in our study. Indeed, women aged 16 to 25 years had a high tendency to be vaccinated compared to those aged 36 to 44 years. Previous studies have also identified age as a socio-demographic factor associated with the acceptance of COVID-19 vaccination [29, 32]. It should be noted that the

results are heterogeneous from one study to another. Indeed, while some studies indicate a higher proportion of younger people to be vaccinated against COVID-19, others show that older people are more likely to accept this vaccination [29, 32]. In 2022, a survey conducted in Côte d'Ivoire among the general population found that people aged 18 years and more were less likely to be vaccinated against COVID-19 [unpublished data].

The results of our study should be used taking into account its limitations.

Firstly, the representativeness of breastfeeding women. Since the data was collected in vaccination centres, the survey does not take into account the vaccination status of breastfeeding women who do not visit vaccination centers; women who visit vaccination center may differ systematically from those who do not.

Secondly, the generalization of the results. The survey took place in the health districts of Yopougon which are not representative of the districts of Abidjan. In fact, population Yopougon includes inhabitants coming from different parts of Côte d'Ivoire but the vast majority comes from the West part of the country. In addition, the proportion of non-Ivorians living in Yopougon is much lower than that of Abidjan city. Therefore, the results could not be generalized to the city of Abidjan and to Côte d'Ivoire.

Public health implications:

- a) The vast majority of respondents being from secondary and superior education level, it is important to take into account the education level when developing awareness messages on COVID-19 vaccination;
- b) Religion playing an important role in individuals' life and almost all respondents are Christians and Muslims, it is crucial to involve Christian and Muslim religious leaders in raising awareness among breastfeeding women to get vaccinated;
- c) Almost half of respondents being unvaccinated, it is important to continue raising awareness among the population, particularly women of reproductive age, to get vaccinated against COVID-19.

## 5. Conclusion

Our study shows that about half of the breastfeeding women surveyed were not vaccinated against COVID-19. Also, less than half did not intend to be vaccinated after weaning. Awareness-raising among the population in general, and especially among breastfeeding women, on the acceptance of COVID-19 vaccination must continue so that vaccination coverage against this disease is optimal when the vaccine is introduced into routine immunization. Awareness-raising must take into account the recurring reasons for non-vaccination which are fear of side effects and lack of confidence in the vaccine. Factors associated with COVID-19 vaccination status were living with a partner, education level, and age group. Awareness-raising and communication strategies on the acceptance of the COVID-19 vaccine must also take these factors

into account. Our study being a quantitative study, qualitative surveys could be carried out to understand the underlying reasons behind non-vaccination among breastfeeding women.

## Abbreviation

ajOR	Adjusted Odds Ratio
CI	Confidence Interval
CNEIV-CI	National Committee of Independent Experts for Vaccination and Vaccines of Côte d'Ivoire
DHS	Demographic and Health Survey
NITAG	National Immunization Technical Advisory Group
WHO	World Health Organization
X <sup>2</sup>	Chi-square test

## Author Contributions

**Alfred Douba:** Conceptualization, Methodology, Formal Analysis, Writing – original draft

**Nicaise Bernadin Lépri Aka:** Conceptualization, Methodology, Writing – review & editing

**Eric martial Kouakou Ahoussou:** Methodology, Writing – review & editing

**Christian Bangaman Akani:** Data curation, Writing – review & editing

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**Marie Noelle Ano:** Supervision, Writing – review & editing

**Daniel Kouadio Ekra:** Validation, Writing – review & editing

**Tiembre Issaka:** Validation, Writing – review & editing

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## Data Availability Statement

The data is available from the corresponding author upon reasonable request.

## Conflicts of Interest

The authors declare no conflicts of interest.

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