

COVID-19 vaccination coverage survey in population 18 years and older, Bissau, Guinea-Bissau, January 2023

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ABSTRACT

Introduction: COVID-19 poses a serious problem to global public health. Despite vaccine availability, countries face difficulties in reaching the 70% coverage target. The objectives of this study were to estimate vaccination coverage for COVID-19 in the population aged 18 and older in Bissau, January 2023, and to assess factors associated with vaccination. **Methods:** A cross-sectional study was conducted using the WHO 30 by 7 cluster sampling technique. Based on this, a total of 210 interviews were estimated. Bissau's selection was by convenience. The selection of clusters, blocks, households, and individuals to be interviewed was by simple random drawing. A vaccinated individual was defined as an eligible who provided proof, through a vaccination card or certificate, of at least one dose of the COVID-19 vaccine. Descriptive statistics, Prevalence Ratio (PR), 95% Confidence Intervals (95%CI), and Design Effect (DE) were calculated. **Results:** A total of 209 individuals were interviewed. The mean age was 37 (SD 0.89) years old; 59.3% (124/209) were female, 50% (104/209) were married, and 50.7% (106/209) were Christians. The vaccination coverage was 49% (102/209) with 95%CI: 42.0-56.0%, and DE=1.001. In bivariate analysis, married people (PR=1.5; [95%CI: 1.12-2.01]; DE=1.001) and having comorbidity (PR=1.37; [95%CI: 1.04-1.81]; DE=1.001) were more likely to be vaccinated. **Conclusion:** COVID-19 vaccination coverage in Bissau remained below the 70% target. Being married and getting vaccinated was an unusual finding that needs further study. The findings highlight the need for intensified vaccination campaigns and personalised strategies to improve coverage, particularly among unmarried individuals and those without comorbidities.

KEYWORDS: COVID-19, vaccination coverage, cluster survey, Guiné-Bissau

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Introduction

In December 2019, a new infectious disease caused by a beta-coronavirus was identified in Wuhan province, China. These cases were related to a new strain, SARS-CoV-2, which had not previously been identified in humans. On March 11, 2020, the World Health Organization (WHO) characterized COVID-19 as a pandemic, recognizing its geographical spread in several countries and regions. Since then, the scientific community, healthcare systems and governments have been working tirelessly to understand the virus, develop effective treatments and implement prevention measures [1,2,3,4].

The disease has spread quickly around the world, affecting around 760 million people and causing almost seven million deaths. In the African region, there have been 9,497,673 cases and 175,295 deaths. As of February 26, 2023, Guiné-Bissau has recorded 8,979 cases and 176 deaths from COVID-19, the first case of which was reported on March 26, 2020. The COVID-19 pandemic characterized by the WHO has caused worldwide disruption in health systems, severe impacts on the economy and an increase in social inequality [5].

COVID-19 is an acute respiratory infection caused by SARS-CoV-2, which is potentially serious and highly transmissible. It can range from asymptomatic cases to clinical manifestations such as respiratory failure, shock and multiple organ dysfunction and is mainly transmitted by direct contact with people or surfaces contaminated by droplets transmitted by coughing and sneezing from an infected person. The main clinical manifestations are respiratory, including cough, sore throat and dyspnea. The entire population is vulnerable, especially the elderly, children and people with comorbidities [1].

To combat the spread of the virus and reduce the mortality associated with the disease, the global scientific and pharmaceutical community has mobilized quickly to develop effective vaccines. The development of vaccines in record time, in less than a year, represented a milestone in the history of medicine. Vaccination against COVID-19 is a more useful and cost-effective way of preventing the disease, and it's also kind of mandatory. Their main objective is to induce a robust immune response, preparing the immune system to recognize and fight the virus in the event of exposure, which has been a key strategy for generating immunity of significant relevance, improving health and life expectancy [2,6]. In addition to distribution, public acceptance

of vaccines varied, influenced by factors such as misinformation, vaccine hesitancy and cultural beliefs. Effective communication campaigns and transparent information about vaccine safety and efficacy were key to increasing vaccination uptake [7]. COVID-19 also has disproportionately affected low-resource settings, where vaccine access and uptake are often hindered by logistical, sociocultural, and infrastructural barriers [8,9].

The first vaccination campaign against COVID-19 in Guiné-Bissau began on April 2, 2021, and in the period of one year five campaigns were carried out in which the country achieving coverage of 50% of the population aged 18 and over fully vaccinated and 76% of the same population with at least one dose. Despite the availability of vaccines by the government and its partners, adherence to vaccination has been poor, possibly for various reasons contrary to vaccination [10].

Understanding these factors is critical for designing targeted interventions. So, this study aimed to estimate COVID-19 vaccination coverage in the population aged 18 and over in the Sector Autónomo de Bissau (SAB) in January 2023, and assess sociodemographic and clinical-epidemiological factors associated with vaccination. By focusing on the capital city (home to almost 26% of the national population) the findings provide actionable insights to strengthen vaccination strategies in high-density urban settings.

Methods

Study design, location and period

A cross-sectional study was conducted using WHO 30 by 7 cluster sampling technique [11]. The study site was in the Sector Autónomo de Bissau (SAB), the seat of the country's capital, Guiné-Bissau's largest city, located on the Rio Geba estuary on the Atlantic coast and divided into four zones (districts) [12] and 46 neighborhoods. Bissau's neighborhoods were not yet geographically or census-designated, and the 46 neighborhoods were considered as clusters for the survey. The field study was conducted in January 2023.

According to the Instituto Nacional de Estatísticas (INE), 523,387 inhabitants lived in the city of Bissau, representing 25.7% of the country's total population, estimated at 1,905,516 inhabitants [8,13]. The country's official language is Portuguese, spoken by approximately 15% of the population. Most Bissau guineans communicate in the Portuguese-based Crioulo dialect, but they also adopt various dialects

spoken by more than 10 ethnic groups in the country [12].

Sampling and selection stages

The sample size was estimated using the WHO 30 by 7 cluster sampling technique, which inherently accounts for confidence intervals, precision, and margin of error. Based on this method, a total of 210 interviews were estimated [11]. Weights were applied during analysis to adjust for cluster size variations. The sample was selected in four successive stages, as described below, and the entire process of delimiting the clusters, blocks and households within each block was designed by the researchers, since the city did not yet have geographic-census planning.

Stage 1: cluster selection

Of the 46 neighbourhoods (called clusters for this study), the 40 most populous were randomly selected using a free draw application [14]. Following the order of the draw, the first 30 clusters were used to conduct the interviews and the 31st was used for the pilot test. The 32nd to 40th clusters made up a reserve list for replacements. In each cluster, the number of interviewees had to be seven and the minimum five. If a cluster didn't reach seven interviews, the weight should be adjusted by dividing the number of expected interviews by the number of interviewees (Number of expected interviews/Number of interviews carried out). If the number of interviewees was less than 5, the cluster would have to be replaced by another from the reserve list.

Stage 2: Block selection within the clusters

For the second stage of the selection, images of the selected clusters were captured using the Google Earth app [15], with the aim of delimiting the clusters. The boundaries were marked with vertical and horizontal lines spaced 1cm apart, drawn to delimit the blocks. A total of 2,586 blocks were diagrammed.

In each cluster, all the diagrammed blocks were listed and then nine blocks were drawn from each cluster, the first seven of which were for the interviews and the last two blocks of each cluster for possible replacements. In this way, a total of 360 blocks were drawn, 270 of them in the first 30 clusters (210 for the interviews and 60 reserves for possible substitutions). A further 90 blocks were

diagrammed and drawn in the remaining 10 clusters, which made up the pilot test and the reserves.

Stage 3: Household selection within the block

At this stage, all the households in the block drawn were identified and listed, and the draw was made in order from the first one drawn to the last one registered in the drawer app. The first household drawn was the one chosen for the interview. Each of the households drawn in the seven blocks of the cluster was visited in order to carry out the interviews. If there wasn't an eligible individual in the house drawn, or if it was empty or closed, the next house was moved on to, according to the order of the draw. Commercial establishments, uninhabited/closed houses, churches, schools and public or private institutions were excluded from the draw.

Stage 4: Selection of the individual in the house

In the fourth and final stage of selection, all the eligible individuals in the household were identified and listed. Using the draw app, the first person drawn was the only one eligible to be interviewed. If there was only one eligible person in the household, they were interviewed. In both situations, the person drawn was only interviewed if they spontaneously agreed to take part and signed the Free Informed Consent Form.

Sources and data collection

Data was collected by applying a structured questionnaire both on tablets and in printed form, as this was the first time the interviewers had used tablets. The questionnaires contained sociodemographic, clinical, epidemiological and COVID-19 vaccination variables. Data on vaccination was collected directly from the vaccination card or other official proof. The interviews were carried out by professionals in training at the Intermediate FETP in Guiné-Bissau, under the supervision of the mentors and training coordinators.

Operational definitions used in the study

For the purposes of this study, the following operational definitions were considered:

Eligible person: every person ≥ 18 years of age, resident for at least six months in the SAB.

Ineligible person: every person ≤ 18 years of age, people ≥ 18 years of age residing in other regions or who did not prove their age in an official document or who presented communication barriers before or during the interview.

Vaccinated: a person who has received at least one dose of the COVID-19 vaccine and has provided proof, such as a COVID-19 vaccination card or vaccination certificate.

Not vaccinated: person who has not presented any proof such as a COVID-19 vaccination card or vaccination certificate.

Refusal: a person who did not agree to take part in the interview.

Clusters: neighbourhoods of the capital, Bissau.

Block: all the houses delimited by the intersection of the horizontal and vertical lines that divide the clusters.

Household: all the people who share the same living space and financial resources.

Statistical analysis

The data was analysed using Epi Info 7.2.5.0 and Microsoft Office Excel 2019. The Design Effect (DE) and weights were taken into account when calculating the 95% Confidence Intervals (95%CI) for vaccination coverage. Accuracy was considered satisfactory when the DE was less than 2.0 and the amplitude of the 95%CI was less than 10%, in the values used to determine the sample size.

In the descriptive statistical analysis, absolute and relative frequency measures were calculated, as well as measures of central tendency (mean and median) and dispersion (standard deviation and range). To estimate possible associations, the Prevalence Ratio (PR) and its 95%CI were calculated, considering that this interval does not include the null value (PR=1). Vaccination coverage was calculated as the total number of vaccinated people divided by the total number of interviewees, and multiplied by 100.

Ethical considerations

This study was approved by the Comité Nacional de Ética em Pesquisa na Saúde (No. ref. 010 CNES/INASA/2023). The interviewees agreed to take part in the study on a voluntary basis by signing the Free Informed Consent Form, and the confidentiality of the information provided was ensured. In the interview questionnaire, the individuals were identified using three-digit numerical codes. Individuals who refused to sign the Free and Informed Consent Form or those who were

unable to answer the questionnaire, either of their own volition or due to a reported or observed communication barrier, were excluded. From the point of view of biosafety, the professionals followed the health measures recommended by the health surveillance system for the prevention of COVID-19.

Results

In this study, 209 people living in the 30 clusters drawn in the SAB were interviewed (figure 1). There was a refusal in one cluster, which resulted in it having six interviewees. The weight adjustment was applied in this cluster, resulting in 1.167. This values was given to each interviewee to adjust this cluster to other ones.

Sociodemographic characteristics of the study population

Of the 209 interviewees, 97.1% (203/209) were Bissau Guineans. The median number of people per household was 7 (range: 1-38), and the mean age was 37 (SD 0.89) years old. Females accounted for 59.0% (123/209) of those interviewed; 92.3% (193/209) had some level of education, with 31.6% (66/209) having completed pre-university; 49.8% (104/209) were married and 50.7% (106/209) were of the Christian religion and in second place the Muslim religion (Table 1).

Clinical-epidemiological characteristics

Of the total number of people interviewed, 31.3% (65/209) reported having some comorbidity (Table 2).

Arterial hypertension was the most frequently mentioned with 55.4% (39/65), while bronchial asthma was mentioned less frequently with 13.8% (9/65) and diabetes with 12.3% (8/65) and cardiovascular pathies with 9.2% (6/65) – data not included in the table.

Vaccination coverage

Of the 209 participants, 102 attested to having received at least one dose of the COVID-19 vaccine, showing vaccination coverage of 48.8% (95%CI: 42.0-56.0%; DE: 1.001) (Table 1). Among those vaccinated, 57.8% (59/102) received a single dose of the vaccine, 21.6% (22/102) received the first dose, and 20.6% (21/102) received two or more doses. Among those with comorbidities, 60.0% (39/65) reported having received at least one dose of the vaccine – data not included in the table.

Bivariate analysis

Table 2 shows the results of the bivariate analysis, in which married people (PR=1.5; [95%CI: 1.12-2.01]; ED=1.001) and those with comorbidities (PR=1.37; [95%CI: 1.04-1.81]; DE=1.001) were more likely to be vaccinated against COVID-19 than the unmarried and those without comorbidities, respectively. Among the factors not statistically significantly associated with COVID-19 vaccination in Bissau were gender (PR=1.02; [95%CI: 0.77-1.36]; DE=1.001); age group (PR=0.75; [95%CI: 0.56-1.00]; DE=0.99); schooling (PR=1.12; [95%CI: 0.63-1.99]; DE=0.99); nationality (PR=1.34; [95%CI: 0.72-2.49]; DE=0.99); and religion (PR=1.04; [95%CI: 0.63-1.74]; DE=0.99).

Discussion

Vaccines are one of the most effective and cost-effective ways of preventing infectious diseases worldwide [7]. The emergence of the COVID-19 pandemic has also prompted the production of vaccines that can prevent the disease or reduce its severity. About nine months after the first cases of COVID-19, which generated the largest pandemic on record, the first dose of the vaccine was administered to a person in the United Kingdom on August 12, 2020 [16]. Adherence to the COVID-19 vaccine is critical for decision-makers, especially in countries with scarce financial resources and a vulnerable population to numerous infectious agents, as it depends on key factors like vaccine safety and confidence in its effectiveness [17].

In recent decades, anti-vaccine movements have posed constant challenges and it was no different when it came to the COVID-19 vaccine adherence. These movements have amplified debates surrounding the risks and benefits of vaccination, transforming what were once discussions confined to expert circles into generalized public discourse [18]. The scenario of the biggest pandemic of all time has shaken the structures of health services and brought to the debate questions about the individual and the collective, as well as having significant social impacts in the face of imposed measures. In this context, adherence to vaccination against COVID-19 has required governments to mobilize resources in communication area in order to achieve the recommended vaccination coverage to avoid further damage to the population [19].

The findings of our study, which estimated COVID-19 vaccination coverage in the population of the country's capital, revealed that most the interviewees were female, young adults, with pre-university education, followed by university and of Christian and Muslim religion.

With regard to COVID-19 vaccination coverage, the results of the survey showed coverage below the 70% target recommended by Direção de Serviço de Imunização e Vigilância Epidemiológica (DSIVE). In the findings of Plácido Cardoso *et al*, on vaccination against SARS-CoV-2 in Guiné-Bissau, it was found that despite the major challenges in getting the population vaccinated in the period corresponding to one year of vaccination activities (April 2021 – April 2022), the country achieved 50% coverage for those fully vaccinated, also lower than the target set by the DSIVE of the Ministério de Saúde Pública da Guiné-Bissau (MINSAP), a similar challenge when compared to the Sidat and Capitine study carried out in Moçambique, which failed to reach the target even with the introduction of National Vaccination Programs against COVID-19 throughout the country [10,19].

Also, according to the study on sharing experiences in designing vaccination strategies, Guiné-Bissau is among the economically disadvantaged countries with low vaccination coverage for COVID-19 [16]. It should be noted that the vaccination coverage estimated in this study may have been influenced by the definition of vaccinated adopted, which required proof of vaccination.

This survey was carried out in a period when prevention guidelines and restriction measures were no longer as intense, and it is possible that adherence to the COVID-19 vaccine as a disease prevention measure is more fragile, since the vaccination coverage found is below the target recommended for the eligible population [10].

In the bivariate analysis, being married and having a comorbidity were associated with being vaccinated against COVID-19. Being married was an unusual finding that needs to be studied further. However, in Guiné-Bissau, a member of the couple who adheres to vaccination can directly influence their spouse. Regarding the association of comorbidity with being vaccinated since the beginning of the pandemic, health authorities prioritized the vaccination of people with comorbidities and the elderly, and the media emphasized the importance of these groups seeking the vaccine against COVID-19 [10].

This study had some limitations. One aspect to consider is the influence of methodological choices on the results. For example, requiring proof of vaccination as part of the eligibility criteria may have distorted coverage estimates, since some people who were vaccinated but had no documentary evidence were classified as unvaccinated hence lowering the reported vaccination coverage due to this misclassification bias. In addition, interviewer bias may have occurred as a limitation too: although pilot testing and training were carried out as a way of minimizing bias, there is still a slight probability that the questions may have been understood and asked in different ways by the interviewers due to the different forms of communication that each of one uses to pass on information.

Conclusion

In conclusion, the COVID-19 vaccination coverage estimated in the study was below the 70% recommended goal. The fact that being married was associated with being vaccinated was an unusual finding that needs to be studied further. Based on the findings, the Ministério da Saúde Pública da Guiné-Bissau and its competent areas were recommended to intensify vaccination campaigns and personalized strategies and approaches to improve COVID-19 vaccination coverage, particularly among single individuals and those without comorbidities.

It is hoped that these results will collaborate in the elaboration of actions that increase COVID-19 vaccination coverage in the city of Bissau and throughout the country.

What is already known about the topic

- COVID-19 is a disease caused by SARS-CoV-2 that affects the general population without any distinction.
- Several countries, including Guiné-Bissau, are struggling to reach 70% COVID-19 vaccination coverage.
- Although Guiné-Bissau has carried out vaccination campaigns against COVID-19, adherence has been low.

What this study adds

- COVID-19 vaccination coverage was estimated in Bissau, the country's most populous area.

- It allowed a comparison of the vaccination coverage obtained from the administrative data of the SAB, serving to subsidize strategies to achieve the recommended targets.
- This has opened the way for further studies, especially to investigate why couples are more likely to be vaccinated against COVID-19.

Competing Interest

The authors of this work declare no competing interest

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Authors' contributions

The authors have been listed by the initials of their initials. Conceptualisation of the article: GAM, EDS, MC, MHPD, NTNG. Data curation: GAM, MOH, IBS, NTNG, MC, JC, BJS, CMCSGC, MM, SFG, SGV, TVGS, VS, VI, ANL, ALP, DBC, MHPD and DAS. Methodology: GAM, MOH, EDS, IBS, NTNG, MC, JC, BJS, CMCSGC, MM, SFG, SGV, TVGS, VS, VI, ANL, MHPD, DBC, ALP and DAS. Investigation: GAM, MOH, MC, JC, BJS, CMCSGC, MM, SFG, SGV, TVGS, VS, VI, ANL. Data analysis: GAM, MOH, IBS, JC, BJS, CMCSGC, MC, MM, SFG, SGV, TVGS, VS, VI, NTNG, DAS, MHPD, ALP, DBC and EDS. Software: GAM, MOH, IBS, NTNG. Supervision: EDS, IBS, MHPD, DBC, ALP, DAS. Validation and writing original draft: GAM, MOH, MC, JC, BJS, CMCSGC, MM, SFG, SGV, TVGS, VS, VI, ANL, IBS, DAS,

MHPD, ALP, DBC, NTNG and EDS. Review and editing: GAM, MOH, EDS, IBS, MC, NTNG. All the authors have read and approved the final document after reviewing it and providing written suggestions to improve the overall presentation of the results.

Tables & Figures

Table 1: Sociodemographic characteristics of participants in the COVID-19 vaccination coverage survey in Bissau, January 2023 (N=209)

Table 2: Factors associated with COVID-19 vaccination in Bissau, January 2023 (N=209)

Figure 1: Spatial distribution of 209 interviewees in the 30 clusters of Bissau city, January 2023

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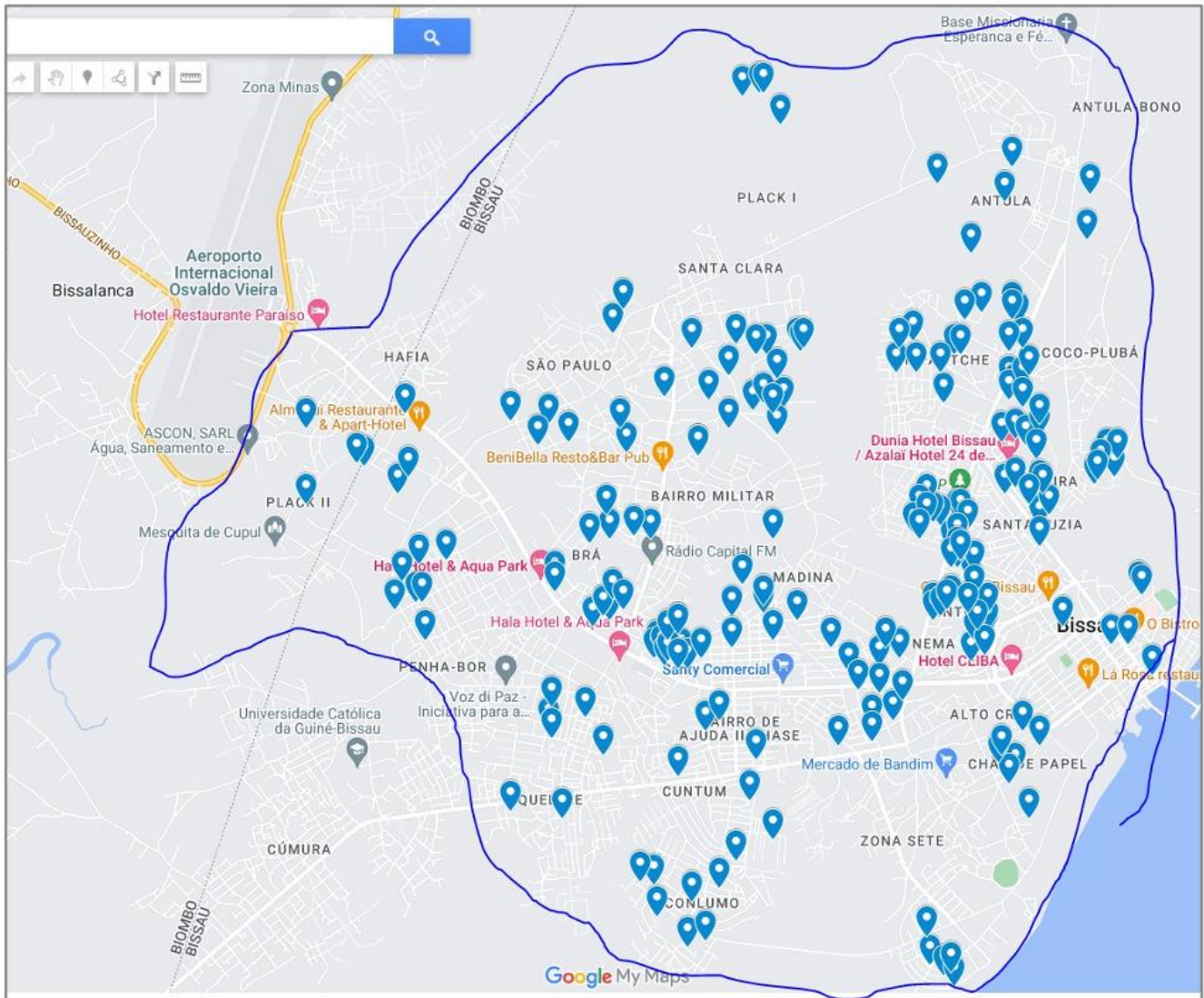
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Table 1: Sociodemographic characteristics of participants in the COVID-19 vaccination coverage survey in Bissau, January 2023 (N=209)

Characteristics	N	%	95% Confidence Interval	Design Effect
Sex				
Female	129	59.0	52.3 – 65.7	1.001
Male	84	41.0	34.3 – 47.7	1.001
Age group				
18–27	60	28.7	22.5 – 34.8	0.999
28–37	56	26.8	20.7 – 32.8	0.999
38–47	50	23.9	18.1 – 29.7	0.999
48–57	23	11.0	6.7 – 15.2	0.999
58 and above	20	9.6	5.7 – 13.9	0.999
Nationality				
Bissau guinean	203	97.1	94.7 – 99.4	1.024
Foreigners	6	2.9	0.6 – 5.3	1.024
Education				
Primary	33	15.8	11.7 – 22.4	0.995
Secondary	39	18.7	14.4 – 25.8	0.995
Pre-University	66	31.6	27.3 – 40.8	0.995
University	34	16.3	12.4 – 23.3	0.995
Professional technician	17	8.1	4.8 – 13	0.995
Non-formal	4	1.9	0.04 – 4.1	0.995
Did not study	16	7.7	4 – 11.2	0.995
Marital status				
Married	104	49.8	43 – 56.7	1.001
Separated	7	3.3	0.9 – 5.8	1.001
Undeclared	1	0.5	(-0.5) – 1.4	1.001
Single	91	43.5	36.7 – 50.2	1.001
Widowed	6	2.9	0.6 – 5.1	1.001
Religion				
Christian	106	50.7	43.9 – 57.5	0.996
Muslim	82	39.2	32.5 – 45.8	0.996
Animist	5	2.4	0.3 – 4.5	0.996
Other religion	2	1.0	(-0.4) – 2.3	0.996
No religion	14	6.7	3.3 – 10.3	0.996
Vaccination status				
Vaccinated	102	48.8	42.0 – 56.0	1.001
Not vaccinated	107	51.1	44.0 – 58.0	1.001

Table 2: Factors associated with COVID-19 vaccination in Bissau, January 2023 (N=209)

Characteristics	Vaccinated		Not Vaccinated		Total		Crude Prevalence Ratio	95% Confidence Interval	Design Effect
	n	%	n	%	n	%			
Marital status									
Married	61	59.9	43	40.2	104	49.8	1.5	1.12 – 2.01	1.001
Single	41	40.1	64	59.8	105	50.2	Ref		
Comorbidity									
Yes	39	38.6	26	24.4	65	31.3	1.37	1.04 – 1.81	1.001
No	63	61.4	81	75.6	144	68.7	Ref		
Sex									
Female	61	59.7	63	58.9	124	59	1.02	0.77 – 1.36	1.001
Male	41	40.3	44	41.2	85	41	Ref		
Age									
18–47	76	74.2	90	84.2	166	79.4	0.75	0.56 – 1.00	1.001
48 and more	26	25.8	17	15.8	43	20.6	Ref		
Education									
Studied	95	93.1	98	91.6	193	92.3	1.12	0.63 – 1.99	1.001
Did not study	7	6.9	9	8.4	16	7.7	Ref		
Nationality									
National	98	96.1	105	98	203	97.1	1.34	0.72 – 2.49	1.001
Foreigners	4	3.9	2	2	6	2.9	Ref		
Religion*									
Religious	93	91.1	95	90.4	188	90	1.04	0.63 – 1.74	1.001
No religion	9	8.9	10	9.7	19	9.1	Ref		
* One person did not state his religion									



Legend

- 📍 Interviews points
- Delimitation of cluster areas

Figure 1: Spatial distribution of 209 interviewees in the 30 clusters of Bissau city, January 2023