

# Knowledge and perception of COVID-19 vaccine among offshore oil and gas workers in Nigeria

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## Abstract

**Background:** Offshore oil-and-gas installations are high-risk, high-mobility environments where infectious-disease outbreaks can rapidly disrupt operations. Effective COVID-19 vaccination depends not only on vaccine availability but also on workers' knowledge of the vaccine and their perceptions of its safety and value.

**Objective:** To assess the level of factual knowledge about, and attitudinal perceptions toward, the COVID-19 vaccine among offshore oil-and-gas workers in Nigeria.

**Methods:** A facility-based cross-sectional survey was conducted among 295 offshore oil and gas workers. Data on knowledge and perception of the COVID-19 vaccine were obtained from modifying the World Health Organization (WHO) Strategic Advisory Group of Experts (SAGE) tool on vaccine hesitancy. Knowledge of the COVID-19 vaccine was assessed using seven structured items. A composite knowledge score ranging from 0 to 7 was calculated for each respondent, with scores of 4 or higher indicating good knowledge. The perception of the COVID-19 vaccine was measured using eight statements, each rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), with higher scores indicating more favorable perceptions. Respondents with mean scores of 3.0 or higher were classified as having a *positive perception*. Descriptive statistics were used to summarize the data.

**Results:** The mean knowledge score was  $4.6 \pm 1.6$ ; 55.6 % of respondents met the threshold for good knowledge. The highest mean scores were recorded for items related to antibody production (0.76) and WHO approval (0.73), whereas the route of administration was the least understood (0.45). The mean perception score was  $2.89 \pm 0.71$ ; 47.1 % of workers held a positive perception.

**Conclusion:** Offshore personnel demonstrated moderate knowledge of COVID-19 vaccines, yet fewer than half expressed positive perceptions. Targeted, work-site-specific education that clarifies vaccine administration and safety evidence is warranted to bridge this knowledge-perception gap and support sustained immunization uptake in the sector.

**Keywords:** COVID-19 Vaccine; Offshore Personnel; Knowledge; Perception; Nigeria

## 1. Introduction

Vaccination is one of the most significant public health achievements, having significantly reduced mortality and morbidity from infectious diseases. It has led to the elimination of poliomyelitis in the Americas, the worldwide eradication of smallpox (CDC, 1999), and the recent defeat of wild-type poliovirus in Nigeria

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(Adebisi, Prisno and Nuga, 2020). Vaccination programs rely on high uptake to provide direct protection to individuals and indirect protection, herd immunity, to the broader community, slowing the transmission of vaccine-preventable diseases and protecting those who remain susceptible (Fine, Eames and Heymann, 2011).

Vaccines contain a weakened or inactivated part of a pathogen (whole viral vaccine), protein subunits, nucleic acids, or toxins (Robinson et al., 2021). Because most viral diseases lack definitive cures, scientific prevention through vaccines remains paramount (Berekaa, 2020). On the African continent, effective childhood vaccination programs have significantly reduced mortality and morbidity, alleviating the financial burden of treating preventable diseases on households (Afolabi and Ilesanmi, 2021).

The emergence of COVID-19, a global pandemic first reported in Wuhan, China, on 31 December 2019, heightened the urgency for vaccine development (Dong and Gardner, 2020). The World Health Organization (WHO) declared COVID-19 a Public Health Emergency of International Concern on 30 January and a pandemic on 11 March 2020 (WHO, 2020). COVID-19 has since affected nearly every country. In Nigeria, the first case was reported on 26 February 2020, with over 243,450 cases documented by December 2021 (NCDC, 2021). Infection occurs through respiratory droplets, aerosols, and contaminated surfaces, with most individuals recovering without hospitalization; however, some experience severe illness (WHO, 2020).

Notably, offshore travel to oil and gas platforms has contributed to Nigeria's rising case numbers, despite preventive measures, adversely affecting industry demand, productivity, and disease burden (Okeh et al., 2022). The oil and gas sector is a cornerstone of Nigeria's economy, accounting for roughly 10% of GDP, 70% of government revenue, and over 83% of foreign exchange earnings. However, it endured a steep decline during the pandemic, contributing just 5.87% to real GDP in Q4 2020, a 19.81% drop from Q3 amid falling demand and declining prices (Aimee and Akaoma, 2021).

In response, the global vaccine race accelerated, culminating in the rollout of the Pfizer–BioNTech BNT162b2 vaccine in December 2020 under Emergency Use Authorization (EUA) by the U.S. FDA. The AstraZeneca/Oxford vaccine (produced by Serum Institute of India and SKBIO) followed on 15 February 2021, with the Janssen Ad26. The COV2.S and Moderna vaccines received EUA on April 30, 2021 (WHO, 2021).

In Nigeria, the National Primary Health Care Development Agency (NPHCDA) led the COVID-19 vaccine rollout, supported by global initiatives such as COVAX. Despite these efforts, misinformation, government mistrust, safety concerns, and poor risk perception have impeded full population coverage. These challenges are likely amplified among offshore workers due to limited access to health communication and constrained vaccine availability in their occupational environment.

This study aims to evaluate the knowledge of and perceptions toward COVID-19 vaccines among offshore oil and gas workers in Nigeria, using Port Harcourt City Airport as the recruitment site. By identifying gaps in understanding and attitudes, the research seeks to inform targeted interventions that build vaccine confidence and improve uptake among this high-risk group. The findings will guide governmental strategies and industry policies, directly benefiting offshore workers by enhancing their vaccine awareness, and serve as a baseline for future research on vaccine knowledge and perceptions in occupational contexts.

## 2. Methodology

### 2.1. Study Design and Setting

A descriptive cross-sectional survey was carried out at a central transit point for personnel embarking on offshore installations in the Niger Delta.

### 2.2. Study Population

The study population comprised all offshore oil-and-gas workers scheduled for helicopter or crew-boat transfer.

#### 2.2.1. Inclusion Criteria

- Active workers on offshore oil and gas platforms.
- Scheduled for crew transfer (helicopter or boat) during the study period.
- Minimum age of 18 years.
- Willing to provide informed consent and able to complete the study questionnaire in English.

### 2.2.2. Exclusion Criteria

- Workers who are on leave, vacation, or in training.
- Non-offshore support staff, such as office-based administrative personnel.

### 2.3. Sample size calculation and Sampling

Since the true proportion of vaccine knowledge among offshore workers was unknown, we used the conservative estimate of 50% to maximize statistical precision. With a 95% confidence level ( $\alpha = 0.05$ ) and a margin of error of  $\pm 5\%$ , Cochran's formula for infinite populations yields an initial sample size of 385. Applying a finite population correction resulted in a final sample size of 295, ensuring adequate precision and statistical power for the study.

Using systematic sampling, every fifth eligible worker in the pre-departure lounge was invited to participate after providing written informed consent, until the desired sample size was achieved.

### 2.4. Data Collection

Data were gathered using a structured, self-administered questionnaire modified from the World Health Organization (WHO) Strategic Advisory Group of Experts (SAGE) tool on vaccine hesitancy but restricted to domains of knowledge and perception (Domek et al., 2018).

The knowledge section comprised seven items with responses of yes/no/or do not know. Correct responses were scored 1; incorrect or 'do not know' responses scored 0. This yielded a maximum score of seven and a minimum score of zero. Respondents scoring four or more correct answers were classified as having *good knowledge*, while those with fewer than four correct answers were classified as having *poor knowledge*.

The perception section comprised eight items with responses graded on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Negatively worded statements were reverse-coded so that higher values uniformly signified more favorable attitudes. The perception composite score was determined based on the mean of eight Likert items after reverse coding. The mean score for each respondent ranged from 1 to 5. Mean score  $\geq 3.0$  indicated a *positive perception*, while scores  $< 3.0$  indicated a *negative perception*. Two occupational health specialists reviewed the draft instrument for content validity and pilot-tested it on 20 non-study offshore workers (Cronbach's  $\alpha = 0.78$  for perception items).

### 2.5. Data Management and Analysis

Completed questionnaires were checked for completeness, entered into SPSS version 25, and double-verified. Analysis was limited to descriptive statistics: means  $\pm$  standard deviations (SD) for continuous variables and frequencies with percentages for categorical variables. Being a baseline study, the analysis was restricted to descriptive statistics.

### 2.6. Ethical Considerations

Approval was obtained from the University of Port Harcourt Research Ethics Committee (Ref No. UPH-PH-SPH/2022/107). Written permission was secured from the Port Harcourt City Airport Base Manager. Participation was voluntary, and anonymity was assured by omitting personal identifiers. All field staff adhered to prevailing COVID-19 safety protocols during data collection.

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## 3. Results

### 3.1. Demographic characteristics

The mean age of the respondents was 37.45 years (SD = 8.95). Concerning employment status, 150 (50.8%) had permanent employment while 145 (49.2%) were contract staff.

### 3.2. Knowledge of the COVID-19 Vaccine

Respondents' knowledge of the COVID-19 vaccine was assessed using seven items with binary response options, coded as 1 for correct and 0 for incorrect or "don't know." The mean knowledge score was 4.6 (SD = 1.6) out of a maximum score of 7. This suggests a moderate level of knowledge among the offshore workers surveyed.

As shown in Table 1, the highest-scoring knowledge item was "The vaccine stimulates antibody production," with a mean score of 0.76 (SD = 0.43), indicating that most respondents correctly understood this fundamental function of the

vaccine. Similarly high scores were recorded for the item assessing knowledge of WHO approval of the vaccine (mean = 0.73, SD = 0.44), the statement that vaccines undergo rigorous testing before approval (mean = 0.70, SD = 0.46), and knowledge that two doses are generally required for protection (mean = 0.69, SD = 0.47).

In contrast, lower scores were recorded for items assessing understanding of the vaccine's composition and route of administration. For example, only 45% of respondents correctly indicated that COVID-19 vaccines are not administered orally, as reflected by a mean score of 0.45 (SD = 0.50), the lowest among all knowledge items.

Based on a cut-off of 4 or more correct responses, 164 respondents (55.6%) were classified as having *good knowledge* of the COVID-19 vaccine, while the remaining 131 (44.4%) were categorized as having *poor knowledge*.

**Table 1** Knowledge of the COVID-19 Vaccine among Offshore Oil-and-Gas Workers (N = 295)

Items	Mean	SD
The vaccine stimulates antibody production.	0.76	0.43
WHO has approved the vaccine.	0.73	0.44
Two doses are generally required for full protection.	0.69	0.47
Vaccines undergo rigorous testing before approval.	0.70	0.46
The vaccine contains an inactivated virus.	0.62	0.49
The vaccine provides long-term immunity.	0.60	0.49
COVID-19 vaccines are administered orally	0.45	0.50

### 3.3. Perception of the COVID-19 Vaccine

Respondents' perception of the COVID-19 vaccine was measured using eight Likert-type items, each scored on a 5-point scale from 1 (strongly disagree) to 5 (strongly agree). Negatively worded statements were reverse-coded so that higher scores uniformly reflected more positive perceptions.

**Table 2** Perception of the COVID-19 Vaccine

Item	Mean	SD
The vaccine protects against severe illness.	3.31	1.01
Everyone should get vaccinated.	3.25	1.06
I would recommend the vaccine to others.	3.10	1.08
The vaccine is safe for use.	3.11	1.09
The vaccine has long-term negative health effects*	2.76	1.14
The vaccine can cause COVID-19 infection*	2.62	1.17
The government is hiding the side-effects*	2.58	1.12
I trust information from the Ministry of Health.	2.89	1.03

\*reverse coding

The mean composite perception score was 2.89 (SD = 0.71). When categorized using a threshold of  $\geq 3.0$  to indicate positive perception, 139 respondents (47.1%) were classified as having a *positive perception* of the vaccine, while 156 respondents (52.9%) were classified as having a *negative perception*.

Table 2 displays the mean responses for each perception item. The highest-rated item was "The vaccine protects against severe illness," with a mean score of 3.31 (SD = 1.01), followed closely by "Everyone should get vaccinated" (mean = 3.25, SD = 1.06) and "I am willing to recommend the vaccine to others" (mean = 3.10, SD = 1.08). These responses suggest that nearly half of the respondents acknowledged the public health value of the vaccine and were open to promoting it.

Perceptions related to safety and trust showed more variability and lower scores. For example, the item “The vaccine has long-term negative health effects” (reverse-coded) had a mean score of 2.76 (SD = 1.14), and “The vaccine can cause COVID-19 infection” (reverse-coded) had a mean score of 2.62 (SD = 1.17). Notably, trust in the Ministry of Health was modest, with a mean score of 2.89 (SD = 1.03), while the reverse-coded item “The government is hiding the side effects of the vaccine” scored lowest among perception items at 2.58 (SD = 1.12).

## 4. Discussion

This study aimed to quantify factual knowledge of, and attitudinal perceptions toward, the COVID-19 vaccine among offshore oil-and-gas workers in Nigeria. This critical workforce operates in confined, high-mobility settings where outbreaks can rapidly compromise worker safety and national petroleum output. Three principal findings emerged. First, the average respondent answered roughly two-thirds of the knowledge items correctly, yielding a composite mean of  $4.6 \pm 1.6$  out of 7. Second, fewer than half of the respondents (47.1 %) displayed an unequivocally positive perception of the vaccine, with a composite mean of  $2.89 \pm 0.71$  on a 5-point scale. Third, marked discrepancies were evident between relatively sound knowledge in some domains (e.g., immunologic function and WHO approval) and persistent misconceptions in others (e.g., administration route), as well as between knowledge and perception more generally.

### 4.1. Knowledge in Comparative Context

The overall knowledge score (66 % correct) aligns with ranges reported in recent Nigerian surveys of healthcare providers (62–74 %; Amuzie et al., 2021) and community members (64 %; Adedeji-Adenola et al., 2022). Comparable levels have been documented among healthcare workers across sub-Saharan Africa (Ackah et al., 2022) and globally (Dzieciolowska et al., 2021). High accuracy on items relating to antibody production and WHO approval suggests that mass-media messaging has been effective in conveying the broad vaccine purpose and regulatory status. Conversely, the lowest-scoring item, the belief that the vaccine is administered orally, mirrors route-of-administration myths identified in community samples throughout West Africa (Olu-Abiodun et al., 2022). Notably, injection-related anxieties have historically hampered uptake of other vaccines in Nigeria (Paterson et al., 2016); correcting this specific misconception is imperative.

### 4.2. Perception, Safety Concerns, and Trust Deficits

Despite moderate knowledge, the attitudinal profile was predominantly cautious, if not overtly hostile. Approximately half of the cohort expressed reservations about long-term adverse effects and the possibility of contracting COVID-19 from vaccination. Similar safety-centric hesitancy has been flagged in meta-analyses of African healthcare workers (Ackah et al., 2022) and Nigerian community polls (Olu-Abiodun et al., 2022). Mistrust of government transparency scored lowest among perception items, echoing broader Nigerian data where distrust in public institutions predicts hesitancy more strongly than misinformation exposure alone (King et al., 2021). This pattern is consistent with the “confidence” dimension of vaccine hesitancy (MacDonald, 2015) and underscores findings that institutional trust is a critical determinant of vaccine acceptance worldwide (Dubé et al., 2014; Larson et al., 2016).

### 4.3. The Knowledge–Perception Disconnect

The coexistence of moderate knowledge and skeptical perception illustrates a well-documented knowledge–attitude gap in vaccination behavior (Machingaidze and Wiysonge, 2021). Health Behavior theories, such as the Health Belief Model, posit that accurate knowledge is necessary but insufficient; perceived susceptibility, perceived benefits, and confidence in safety must converge to drive uptake (Fine et al., 2011). In the present study, although respondents recognized the vaccine’s protective value (mean = 3.31 for “protects against severe illness”), concerns over side-effects (mean = 2.76) and infection risk from the vaccine (mean = 2.62) depressed overall perception scores, suggesting that risk–benefit calculations remain unfavorable for many workers.

### 4.4. Occupational Nuances in an Offshore Environment

Offshore installations introduce distinct contextual factors that likely amplify safety concerns. Isolation limits real-time access to professional health counsel, and rotational schedules impede timely vaccination opportunities. Moreover, the sector’s history of labor disputes may generalize mistrust of government-led health initiatives, reinforcing skepticism. Peer-to-peer communication, dominant in such settings, can accelerate the spread of unverified rumors, consistent with social-network analyses of misinformation diffusion in other essential-worker groups (Kricorian et al., 2022).

#### 4.5. Strengths and Limitations

A chief strength of this study is its focus on an under-researched occupational cohort using a validated, SAGE-adapted instrument with acceptable internal consistency (Cronbach's  $\alpha = .78$ ). Systematic sampling at a significant transit hub enhances internal validity. Nevertheless, several limitations merit acknowledgment. The cross-sectional design precludes causal inference, while reliance on self-report introduces potential social-desirability and recall biases. The single-site sampling frame may limit generalizability to all Nigerian offshore platforms or other countries' offshore sectors. Finally, the exclusive use of descriptive statistics restrains exploration of determinants; future inferential analyses could elucidate socio-demographic or psychosocial predictors of knowledge and perception.

#### 4.6. Implications for Practice and Policy

Findings argue for multifaceted, worksite-adapted interventions. Peer-led educational briefings should directly tackle knowledge gaps about vaccine composition and administration, using pictorial aids and rig-crew vernacular to enhance salience. Transparent communication of post-marketing safety data, delivered through credible intermediaries such as occupational physicians, may improve confidence. Partnerships between industry and the Ministry of Health to host interactive, recorded town-hall sessions could normalize two-way dialogue and build institutional trust. Finally, aligning vaccination opportunities with routine offshore medicals or mid-tour health checks could mitigate logistical barriers.

#### 4.7. Future Research

Longitudinal designs are needed to track shifts in knowledge and perception as targeted interventions are rolled out and new variants or booster recommendations emerge. Qualitative studies could explore the psychosocial mechanisms underpinning mistrust and identify leverage points for communication strategies tailored to offshore subcultures.

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### 5. Conclusion

This study provides valuable baseline data on the level of COVID-19 vaccine knowledge and perception among Nigerian offshore oil-and-gas workers, a critical but underrepresented occupational group in public health research. While the majority of respondents demonstrated moderate to good factual knowledge about the vaccine, particularly regarding its immunologic function and global approval, key misunderstandings persisted about its administration route and formulation. These knowledge gaps are significant given their potential to undermine confidence in the vaccine.

Perceptions were more varied, with less than half of the respondents expressing positive attitudes toward the vaccine. Concerns centered around long-term health effects, mistrust of government transparency, and misinformation about vaccine safety. These findings reveal a notable disconnect between what workers know and how they feel about the vaccine, underscoring the need for more than just factual education.

To bridge this gap, targeted, worksite-specific communication strategies are urgently needed, beyond general awareness, to address occupational realities, safety concerns, and trust deficits. Incorporating peer-led education, accessible safety information, and two-way engagement with credible health authorities could help foster more favorable perceptions and support sustained uptake. Future research should evaluate the effectiveness of such interventions and track changes over time to inform responsive and inclusive public health strategies for offshore populations.

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### Compliance with ethical standards

#### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

#### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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