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ORIGINAL STUDY

Health Workers' Knowledge, Attitudes, and Practices on Reporting Adverse Events Following Immunization (AEFI) in Nigeria: A Cross-sectional Study

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Abstract

Background: **Reporting of adverse events following immunization (AEFI) is not the sole responsibility of health workers providing routine immunization services, but also of health workers providing clinical treatments and working in other health units. This study aimed to assess health workers' level of knowledge as well as reporting attitudes and practices on AEFI in Ondo State, Nigeria.**

Methods: **A cross-sectional survey using a convenience sampling method was used to recruit Primary Health Care workers in four Local Government Areas (LGAs). A self-reported questionnaire was adapted from a previous study and used to assess knowledge, attitudes, and practices on AEFI.**

Results: **A total of 178 participants were recruited for this study. However, 158 respondents provided complete data and were included in the final statistical analysis. Overall, 64.6% (n = 102) respondents had good knowledge, 96.2% (n = 152) had positive attitudes, and 57.0% (n = 90) had good practices on AEFI. Respondents' age group, direct involvement in routine immunization, and duration of practice were significantly associated with knowledge ($p < 0.005$). There was a significant relationship between knowledge, gender, and AEFI practices ($p < 0.005$).**

Conclusions: **Although respondents in this study had good knowledge, positive attitudes, and good practices towards AEFI surveillance and reporting, this study also revealed some critical gaps in the categorization of serious AEFIs and in the timeliness of reporting of AEFI cases. Frequent training of health workers, supportive supervision, and on-the-job mentoring of health workers are recommended to ultimately improve the AEFI surveillance system.**

Keywords: Adverse events following immunization, Attitudes, Health care workers, Knowledge, Practices, Nigeria

1. Introduction

To improve public confidence in immunizations, appropriate reporting and management of cases of Adverse Events Following Immunization (AEFI) is important. Therefore, AEFI surveillance, which is the systematic and ongoing data collection on AEFIs, is needed for effective intervention [1,2]. The overall goal of the AEFI surveillance is to promptly detect and respond to adverse events, and to reduce any negative impacts on the immunization programme. It provides the justification for the restoration and maintenance of public confidence in the immunization programmes [1,3]. AEFI is defined as any untoward medical occurrence following immunization that does not necessarily have a causal relationship with the use of vaccines [1,4,5]. The World Health Organization (WHO) categorizes AEFIs into two broad categories: serious and non-serious AEFIs [6]. A serious AEFI is one

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that leads to death, is life threatening, requires a case to be hospitalized, or prolongs an existing hospitalization. An AEFI is considered non-serious if it occurs within few hours of immunization, which resolves after a short period of time and poses little danger [6].

Health workers are primarily the first contact with parents or caregivers of a patient that experiences an AEFI [7]. This is because immunization services are provided at health facilities and mainly in primary health care facilities. Incidents of AEFI are always possible. So it behoves health workers in these health facilities and those providing Routine Immunization (RI) services to provide adequate information on both the benefits of vaccines and possible adverse reactions of vaccines [7,8]. Good knowledge of AEFI and the prompt reporting becomes imperative, especially with the introduction of new vaccines into the immunization schedule and even during supplemental immunization activities.

AEFI reporting in Ondo State, Nigeria is very suboptimal, as well as across all LGAs in the State. This may be further demonstrated in the marked variations in AEFI reporting rates across the different states in Nigeria for the same vaccines [9]. In the last 3 years, AEFI reporting rates in the Ondo State have been consistently low; 38.4% in 2020, 54.6% in 2021 and 45.6% in 2022 (as of May 2022) [9]. Although AEFI surveillance is not new in this state and Nigeria as a whole, high attrition among health workers and employment of new health workers may result in declining knowledge, attitudes, and reporting practices regarding AEFI. These factors require investigation.

A study among health workers in Sokoto, Nigeria found only 64% of health workers had good knowledge on AEFI and 41% had never reported AEFI [8]. Another study in Lagos, Nigeria among primary health care workers showed that about 80% of respondents had good knowledge on AEFI, while 93% were aware of the reporting process [10]. Differences in levels of knowledge and practices between states in Nigeria might be explained by variations in socio-cultural, socio-demographic, religious, and geographical factors. However, it is difficult to reach conclusions. The northern part of Nigeria predominantly practices the Islamic religion, bearing semblance to the Arab states of the Middle East and northern Africa [11]. On the other hand, southern Nigeria is multi-ethnic; the Yorubas and Igbos are the largest ethnic groups. Christianity is the predominant religion in this region. Western education and culture are more largely embraced by southern Nigerians [11,12]. Taking all of the above factors into consideration, it is important to examine the differences in AEFI surveillance among different states in Nigeria in order to compare which AEFI practices are followed. These findings may guide future tailored and culturally informed interventions. Therefore, this study seeks to explore and evaluate the knowledge, attitudes, and practices of health care workers on AEFI in Ondo State, Nigeria.

2. Methodology

2.1. Study setting

This study was conducted between October to November 2021 in primary health care facilities in four LGAs in Ondo State, Nigeria. The Ondo State is situated in the southwestern geopolitical zone of Nigeria. The Ondo state has 18 LGAs. The state is divided into 3 senatorial districts namely the North, South and Central zones. There are a total of 622 health facilities providing routine immunization (RI) services, alongside other essential health services. These health facilities include secondary and primary care, as well as public and private health care facilities.

2.2. Study population

The study population included health care workers working with RI service providers and other primary health care facilities in Ondo State, Nigeria.

2.3. Study design and sampling method

This was a cross-sectional study carried out in the four selected LGAs; Akure North, Akure South, Ondo East, and Ifedore. The selection of these LGAs was based on convenience sampling. Fisher's formula [13] was used in determining the minimum sample size for the study ($n = 178$) at a confidence interval of 95% and standard deviation of 1.96, using prevalence rate of 0.71 (proportion of health workers with good knowledge on the AEFI reporting system) [14], and a precision of ±7% (0.07).

2.4. Data collection

Participants completed a self-administered, close-ended questionnaire, which was previously validated by a different study [8]. The questionnaire contained four sections: sociodemographic characteristics, knowledge of various aspects of AEFI, attitudes regarding reporting of AEFI, and AEFI reporting practices. It also considered health care

workers' training on AEFI and perceived barriers to AEFI reporting. Data collection was conducted over a period of two weeks by trained Disease Surveillance and Notification Officers (DSNOs) and their assistants. The study questionnaire was pretested among 10% of the intended sample size in health facilities outside the LGAs selected for the study. Pretesting was carried out to ensure internal consistency and eliminate ambiguities. Reliability was considered satisfactory (Cronbach's alpha coefficient was 0.75). Face and content validity were assessed by the main study supervisor and co-authors.

2.5. Measures

We assessed health workers' knowledge on AEFI through 52 questions regarding the definitions, classification, clinical signs of AEFIs as well as participants' understanding of reportable AEFIs and their management. A higher score indicated better knowledge. Correct responses scored one point each, while incorrect or "I don't know" responses scored zero points. A total of all correct responses was divided by all possible correct responses. Then this proportion was multiplied by 100 to obtain the percentage knowledge for each participant. Knowledge was classified as "good" for scores ≥75% (39–52 points); " fair" for scores between 50% and 74% (26–38 points) and "poor" for scores less than 50% (0–25 points) [8,10]. Respondent's attitudes were assessed based on five questions answered on a yes/no scale regarding the following issues: willingness to attend trainings on AEFI, willingness to advise colleagues to attend trainings, perception towards the necessity to report AEFIs, willingness to report AEFIs encountered, and whether or not they would advise co-workers to report AEFIs encountered. Those who responded "yes" to at least three out of the five questions were considered to have positive attitudes. Those who responded "yes" to two or fewer questions were considered to have negative attitudes. Positive responses (yes) were scored one point each, while negative responses (no) scored zero points. The proportion of attitudes for each participant was calculated by the sum of all correct responses divided by all possible correct responses (5), and then multiplied by 100. AEFI practices was calculated on the basis of two practice questions; health workers routine reporting of AEFIs they encountered ("yes" as correct and "no" as incorrect), and the time within which AEFIs they encountered were reported ("within 24 h of detection" as correct and "after 24 h of detection" as incorrect). In a similar fashion as respondents' attitudes, the proportion of good practices for each participant was calculated by the sum of all correct responses divided by all possible correct responses (2), and then multiplied by 100.

2.6. Data analysis

All completed questionnaires were analysed using IBM Statistical Package for Social Sciences (SPSS), version 27. Descriptive statistics were computed to generate frequencies, means, and standard deviations. Chi-square analysis was performed to explore associations between participants, sociodemographic characteristics and knowledge, attitudes, and practice on reporting AEFI. A significance level of $p < 0.05$ was considered statistically significant.

2.7. Ethical considerations

Ethical approval was sought and obtained from the Health Research and Ethics committee of the Ondo State Ministry of Health (NHREC/18/08/2016).

3. Results

A total of 178 participants were recruited for this study. However, 158 respondents provided complete data and were included in the final statistical analysis. Thus, participants' response rate was 88.8%.

3.1. Sociodemographic characteristics of respondents

Most of the respondents were females (92.4%; n = 146), resulting in a female to male ratio of 12:1. Almost half of respondents (49.4%) were in the age range of 24–34 years, while only 3.8% were between 57 and 67 years of age. Participants' mean age and standard deviation (SD) was 35.7 ± 9.08. About 95.6% of respondents practiced Christianity as a religion (See Supplementary file). Community Health Extension Workers (CHEWs) accounted for the 48.1% (n = 76) of respondents. Other participants included Community Health Officers (CHOs) (6.3%; n = 10), nurses (6.5%; n = 26), medical doctors (1.3%; n = 2), and other allied health care workers (27.8%, n = 44). About 75% of health workers in this study had been practicing for more than 5 years, while only 28.5% of respondents had been practicing for less than 5 years. Out of the 158 respondents, 67.7% (n = 107) were involved in RI service delivery, while 32.3% (n = 51) had no direct involvement with the RI programme.

3.2. Knowledge on AEFI

Out of the 158 health workers who participated in this study, 62% (n = 98) correctly defined AEFI. Eighty-one percent of respondents knew that an AEFI could be constituted of only an unfavourable or unintended laboratory finding or disease symptom. Only 20.3% (n = 32) knew that an AEFI could occur within 30 days after vaccination (Table 1). The most common clinical signs of AEFI known by the respondents were swelling at injection site (94.9%; n = 150), redness at injection site (94.9%; n = 150), persistent crying (92.4%; n = 146) and fever (89.9%; n = 142). Less than half of the respondents were aware that other clinical signs of AEFI may include anaphylaxis (54.4%; n = 86), acute flaccid paralysis (57.6%; n = 91), convulsions/seizures (50%; n = 79), encephalitis (53.2%; n = 84), and hypotonic-hyporesponsiveness (51.9%; n = 82). In ascertaining health workers' knowledge on reportable AEFI, 69.6% (n = 110) of respondents knew that AEFI that should be reported. Most respondents correctly indicated that injection abscess (91.1%; n = 144) and local reaction of site (93.7%; n = 148) were reportable AEFI. However, there were low proportions of correct responses for knowing that immunization-related death (48.1%; n = 76), anaphylaxis (54.4%; n = 86), and convulsions/seizures (57.0%; n = 90) were reportable AEFI (Table 1).

Most respondents (97.5%; n = 154) knew completing an AEFI reporting form was an appropriate method of reporting AEFIs. Ninety-two percent (n = 146) also knew that AEFI could be reported via telephone. Even though very uncommon, 31.6% (n = 50) and 29.7% (n = 47) of respondents knew that AEFI could also be reported via email and fax, respectively. Emails or fax are infrequently used by health facilities to report as methods of communication due to lack of availability of these technology and poor Internet connectivity. A large proportion of health workers knew that the poor monitoring of AEFI could cause a reduction in immunization coverage (93.0%; n = 147) and that AEFI surveillance increases the public trust in the immunization programme (96.2%; n = 152). Many respondents were aware that it was important to document the circumstances of AEFI. For example, participants knew that it was important to report if the AEFI is part of a cluster (90.5%; n = 143), causes parental/public concern (89.2%; n = 141), or is due to a suspected immunization error (91.1%, n = 144) (Table 1). With regards to the timing for AEFI investigation, 69.6% (n = 110) and 26.6% (n = 42) of respondents acknowledged that AEFIs should be investigated as soon as possible and within 24 h, respectively (Table 1).

The overall proportion of respondents with good knowledge was 64.6% (n = 102), while 32.9% (n = 52) had fair knowledge and 2.5% (n = 4) had poor knowledge. The overall mean (±SD) knowledge score of respondents was 75.23 ± 17.12, indicating that the average level of knowledge was good.

3.3. Attitudes on AEFI

Of the 158 respondents, 93.7% (n = 148) agreed to attend an AEFI training, if invited. Only 6.3% (n = 10) said that they were not willing to attend such training. On reasons why they would not attend trainings on AEFI, 60% (n = 6) felt it was unnecessary, 20% (n = 2) did not consider AEFI management their responsibility, while 20% (n = 2) did not think it was beneficial to them. A majority of respondents (94.3%; n = 149) would advise a colleague to attend trainings on AEFI, if invited (Table 3). Reporting of AEFI was considered necessary by 84.8% (n = 134) of respondents, while 5.2% (n = 24) felt it was unnecessary to report an AEFI. Among those who considered reporting AEFI unnecessary, 33.3% (n = 8) believed reporting AEFI would cause unnecessary fear or alarm, and also feared being blamed by supervisors for the AEFI. Also, 16% (n = 4) of these respondents said they did not have the time to report, and also felt no action could be taken even after reporting. Regarding the attitudes of health workers on reporting AEFI that they may encounter during their practice, ninety-one percent of respondents (n = 144) said they would report AEFI encountered. Only 8.9% (n = 14) said they would not report AEFIs encountered. Eliciting reasons for these negative attitudes, 8 out of these 14 respondents who said that they would not report said that this was due to fear of being blamed by their supervisors or colleagues. 6 of these respondents would not report AEFIs due to the unavailability of AEFI reporting forms (Table 2).

3.4. Reporting practices on AEFIs

Eighty-one percent of respondents (n = 128) had encountered an AEFI in practice, out of which 76.6% (n = 98) said they routinely report AEFI encountered. Thirty respondents who had encountered AEFIs did not report AEFI routinely. The reasons for not reporting were mainly due to the lack of AEFI reporting forms in the health facility (33.3%; n = 10). Other reasons for not reporting include fear of being blamed 13.3% (n = 4) and having no time to report (13.3%; n = 4). Among those who reported routinely, 68.4% (n = 67) reported AEFIs immediately, 10.2% (n = 10) reported within 24 h of detecting an AEFI,

Table 1. Health workers' knowledge on Adverse Events Following Immunization (AEFI), in Ondo State, Nigeria.

Variable (Knowledge)	Frequency	Percentage
AEFI definition	142	89.9
A medical incident that occurs after immunization		
The event may not necessarily be caused by the vaccine	88	55.7
It includes an unfavourable or unintended sign, abnormal laboratory finding, symptom or disease	128	81.0
It can occur within 30 days after vaccination	32	20.3
AEFI classification		
Vaccine product-related reaction	148	93.7
Vaccine quality defect-related reaction	98	62.0
Immunization error-related	110	69.6
Immunization anxiety-related	92	58.2
Coincidental event	98	62.0
AEFI clinical signs		
Swelling at injection site	150	94.9
Fever	142	89.9
Redness at injection site	150	94.9
Acute flaccid paralysis	91	57.6
Persistent crying	146	92.4
Encephalitis	84	53.2
Hypotonic-hyper-responsiveness	82	51.9
Anaphylaxis	86	54.4
Convulsions/seizures	79	50.0
Local or generalized oedema	88	55.7
Reportable AEFI		
Injection site abscess	144	91.1
Immunization-related hospitalization	98	62.0
Immunization-related death	76	48.1
Anaphylaxis	86	54.4
Convulsions/seizures	90	57.0
Bacille Calmette-Guérin (BCG) Lymphadenitis	98	62.0
Local reaction/swelling	148	93.7
Fever >38 °C	142	89.9
Whom should AEFI be reported to if detected		
Local Immunization officer	144	91.1
LGA Disease and Notification Officer	152	96.2
State Disease and Notification Officer	14	8.9
State Commissioner of Health	28	17.7
National office	34	21.5
Methods of AEFI reporting		
Filling of AEFI reporting form	154	97.5
Reporting via telephone	146	92.4
Talking to a colleague	26	16.5
Email	50	31.6
Fax	47	29.7
Poor monitoring of AEFI can cause reduction in immunization coverage	147	93.0
AEFI surveillance builds public trust in immunization programme	152	96.2
AEFI should be investigated in detail to determine causality		
If part of a cluster	143	90.5
If it causes significant parental/public concern	141	89.2
If it is a suspected immunization error	144	91.1
If it is a mild local reaction	20	12.7
If it is one of the events defined for AEFI investigation	145	91.8
AEFI investigation should commence		
As soon as possible	110	69.6
Within 24 h	42	26.6
After one week	81	43.0
Treatment measures after immunization		
A client should remain in the health facility to be observed for at least 15 min	145	91.8
If fever develops, the client should be given extra fluid to drink	106	67.1
Routine use of paracetamol at the time of vaccination is no longer advised	82	51.9
In case of a small hard lump is noticed after immunization, it should be cut immediately	136	86.1
If a client faints after immunization, he/she should be made to stand immediately	110	69.6

Table 2. Health workers' attitudes on Adverse Events Following Immunization (AEFI) in Ondo State, Nigeria.

Variable	Frequency responding "Yes" or given option	Percentage
If you were invited to attend training on AEFI, would you attend?	148	93.7
If you would not attend training on AEFI, if invited, why? (n = 10)		
a. I feel it is not necessary.	6	60
b. AEFI management is not my responsibility.	2	20
c. I don't think it will benefit me.	2	20
Would you advise your colleague to attend training on AEFI, if he/she was invited?	149	94.3
It is necessary to report an AEFI?	134	84.8
Why is it not necessary to report an AEFI? (n = 24)		
a. I do not have time.	4	16.7
b. Reporting AEFI can cause unnecessary fear/alarm.	8	33.3
c. I may be blamed by my supervisors.	8	33.3
d. Nothing can be done even if I report it.	4	16.7
Would you report a case of AEFI, if you encountered it?	144	91.1
Why would you not report a case of AEFI? (n = 14)		
a. I may be blamed for it.	8	57.1
b. I don't have time to fill the forms.	6	42.9
Would you advise your co-worker to report a case of AEFI?	148	93.7

and 21.4% (n = 21) reported after 24 h. Of the 98 health workers who reported AEFIs routinely, 91.8% (n = 90) respondents completed an AEFI reporting form. On availability of AEFI data tools in the health facility, 50.6% (n = 80) had AEFI line listing forms, 29.1% (n = 46) had AEFI reporting forms, and 3.8% (n = 6) had AEFI investigation forms. Only 8.9% (n = 14) of respondents reported having all AEFI data tools in the health facility. However, it is expected that all HFs have all AEFI data tools (line listing form, reporting form, and investigation form) in place. Ninety-one percent of the respondents (n = 144) acknowledged routinely counselling parents and caregivers on AEFI when immunizing their children (Table 3).

3.5. Factors associated with respondents' knowledge, attitudes, and practices on AEFI

Respondents' age group was significantly associated with knowledge ($p = 0.010$). Younger health workers (24–34 years) were more likely to have good knowledge compared to older groups. A significant relationship was also found between health workers' direct involvement in RI and duration of practice with knowledge status ($p < 0.05$). Health workers who were directly involved with the RI programme and who had more than five years of service experience were more likely to have good knowledge on AEFI. Other sociodemographic factors did not show any significant relationship with knowledge scores (Table 4). Only respondents' age group and gender were significantly associated with attitudes ($p < 0.05$). Respondents who were between the age of 24–34 years were more likely to have positive attitudes. Similarly, female health workers were more likely to have positive attitudes when compared to males (Table 5). Knowledge status, gender, and cadre were found to have a significant relationship with respondents' practices ($p < 0.05$). Respondents with good knowledge, who were female, and were CHEWs were more likely to have good practices on AEFI surveillance. Other factors such as health workers' age group, religion, duration of practice, involvement in RI, and attitudes had no significant relationship with reporting practices (Table 6).

4. Discussion

Surveillance for AEFI remains critical to the sustenance of quality routine and supplemental immunization programmes in every country [10]. Public mistrust and consequent decline in immunization coverages are the direct negative implications of poorly detected and managed AEFI. Thus, there is need for health workers to have good knowledge on AEFI and to pay adequate attention to its reporting [3,15]. This study assessed the knowledge, attitudes, and reporting practices on AEFI among health workers in Ondo State, Nigeria.

In the present study, 64.6% of health workers were found to have good knowledge on AEFI. This finding is similar with studies in Northwest Nigeria [8,16], which found health workers having good knowledge on AEFI at 63.6% and 58.9%. In contrast, a study in Kenya found only 30% of health workers with good knowledge on AEFI [17]. Though the overall knowledge on AEFI in this study was good, there existed gaps in knowledge in specific areas. A

Table 3. Health workers' reporting practices on Adverse Events Following Immunization (AEFI) in Ondo State, Nigeria.

Variable	Frequency responding "Yes" or given option	Percentage
Have you ever received any training on AEFI?	116	73.4
If you had training on AEFI, what type of training was it? (n = 116)		
On the job training	66	56.9
Seminar/workshop	46	39.7
Class lecture	4	3.4
Have you encountered an AEFI in your practice?	128	81.0
Do you routinely report an AEFI you encounter? (n = 128)	98	76.6
Why don't you report AEFI routinely? (n = 30)		
I feel it is not related to immunization	2	6.7
Reporting form is not available	10	33.3
I don't know how and where to report it	2	6.7
I am afraid of being blamed	4	13.3
Reporting it will make me feel guilty	2	6.7
I am too busy and have no time	4	13.3
No reason	6	20
If you do report routinely, when do you report AEFI you observe? (n = 98)		
Immediately/Within 24 h of detection	77	78.6
After 24 h of detection	21	21.4
What method do you use to report AEFI? (n = 98)		
Filling an AEFI reporting form	90	91.8
Via telephone	8	8.2
Which of the following AEFI data tools are available in the HF?		
AEFI line listing form	80	50.6
AEFI reporting form	46	29.1
AEFI investigation form	6	3.8
All AEF data tool available	14	8.9
Do you have AEFI reference guideline materials in your HF?	130	82.3
Do you routinely recommend the use of paracetamol to prevent fever post immunization?	110	69.6
Do you routinely counsel parents/caregivers on AEFI when immunizing their children?	144	91.1

Table 4. Associations between respondents' characteristics and knowledge on Adverse Events Following Immunization (AEFI) in Ondo State, Nigeria.

Respondents' characteristics	Respondents' knowledge (n)			Chi-square value (X^2)	df	p-value
	Good	Fair	Poor			
Age group (years)				20.260	6	0.010*
24–34	48	30	0			
35–45	31	19	4			
46–56	20	0	0			
57–67	3	3	0			
Gender				4.191	2	0.101
Male	11	1	0			
Female	91	51	4			
Religion				1.414	2	0.842
Christianity	97	50	4			
Islam	5	2	0			
Staff Cadre				13.078	8	0.109
CHEW[a]	53	19	4			
CHO[b]	8	2	0			
Nurse	16	10	0			
Doctor	0	2	0			
Others	25	19	0			
Duration of practice (years)				11.184	2	0.004*
<5	20	23	2			
>5	82	29	2			
Direct involvement in RI[c]				10.084	2	0.005*
Yes	78	27	2			
No	24	25	2			

*Significant at $p < 0.05$.
[a] Community Health Extension Worker (CHEW).
[b] Community Health Officer (CHO).
[c] Routine Immunization (RI).

Table 5. Associations between respondents' characteristics and attitudes on Adverse Events Following Immunization (AEFI) in Ondo State, Nigeria.

Respondents' characteristics	Respondents' attitudes (n)		Chi-square value (X^2)	df	P
	Negative	Positive			
Age group (years)			17.065	3	0.001*
24–34	2	76			
35–45	0	54			
46–56	4	16			
57–67	0	6			
Gender			5.887	1	0.015*
Male	2	10			
Female	4	142			
Religion			0.377	1	0.828
Christianity	6	145			
Islam	0	7			
Staff Cadre					
CHEW[a]	2	74	5.158	4	0.272
CHO[b]	0	10			
Nurse	0	26			
Doctor	0	2			
Others	4	40			
Duration of practice (years)					
<5	1	44	0.427	1	0.513
>5	5	108			
Direct involvement in RI[c]			0.003	1	0.955
Yes	4	103			
No	2	49			
Respondents' knowledge			3.424	2	0.180
Good	6	96			
Fair	0	52			
Poor	0	4			

*Significant at $p < 0.05$.
[a] Community Health Extension Worker (CHEW).
[b] Community Health Officer (CHO).
[c] Routine Immunization (RI).

Table 6. Associations between respondents' characteristics and reporting practices on Adverse Events Following Immunization (AEFI) in Ondo State, Nigeria.

Respondents' characteristics	Reporting practices (n)		Chi-square value (X^2)	df	P
	Poor	Good			
Age group (years)			4.961	3	0.175
24–34	36	42			
35–45	18	36			
46–56	12	8			
57–67	2	4			
Gender			17.188	1	<0.001*
Male	12	0			
Female	56	90			
Religion			3.339	1	0.188
Christianity	64	87			
Islam	4	3			
Staff Cadre			12.402	4	0.015*
CHEW[a]	38	38			
CHO[b]	4	6			
Nurse	4	22			
Doctor	2	0			
Others	20	24			
Duration of practice (years)			0.879	1	0.349
<5	22	23			
>5	46	67			
Direct involvement in RI[c]			0.000	1	0.986
Yes	46	61			
No	22	29			
Respondents' knowledge					
Good	53	49	18.765	2	<0.001*
Fair	11	41			
Poor	4	0			
Respondents' attitudes			1.420	1	0.233
Positive	64	88			
Negative	4	2			

*Significant at $p < 0.05$.
[a] Community Health Extension Worker (CHEW).
[b] Community Health Officer (CHO).
[c] Routine Immunization (RI).

large proportion of respondents in this study did not know that an AEFI may not necessarily be caused by the vaccine, or that AEFI could occur within 30 days after vaccination. The implication of this knowledge gap is that AEFI may be underreported by health workers, thus decreasing the quality of the AEFI surveillance system [10]. The majority of the respondents had very good knowledge of non-serious AEFIs such as fever, swelling at injection site, redness of injection site, and persistent crying. The high level of knowledge on these clinical signs of AEFI is most likely due to their frequent encounters of these AEFI during RI service delivery. This finding is in line with other studies [10,17], which identified fever and mild local reactions as the most prevalent symptoms post-vaccination. In contrast, respondents showed poor knowledge in recognizing symptoms of serious AEFIs. This knowledge gap may suggest that such AEFIs may be missed or not reported. This finding is consistent with previous studies which also found knowledge gaps in the indication and reporting of serious AEFIs [8,10]. Failure to report these AEFIs could negatively impact the immunization programme, underestimate the magnitude of the problem, and limit the instituting of relevant interventions. Underreporting of AEFIs could also hinder case management and causality assessments by the national expert committee (NEC) in Nigeria.

An integral part of AEFI surveillance is AEFI reporting [1,4]. In the present study, a large proportion of respondents were conversant with reportable AEFIs and the processes of reporting. The national guideline is that all AEFI cases, serious and non-serious, should be reported [18]. Any AEFI of concern to parents/public or to the health workers should be reported [18]. These include any events or signals, as well as events linked to the introduction of new vaccines. All immunization error-related AEFI as well as events of inexplicable

cause but occurring within 30 days after vaccination for RI and within 42 days after vaccination for Supplemental Immunization Activities (SIAs) should be reported [18]. The use of an AEFI reporting form as well as the use of telephones were the most common methods of reporting AEFIs. This is in line with the national guidelines, as the traditional method of documentation of an AEFI is through the filling of the paper-based reporting form from the health facility and submitting the form to the LGA DSNO or Local Immunization Officer (LIO) [18]. Findings from the present study are consistent with quantitative studies in Nigeria and Canada, where all health workers in the study were very familiar with the use of reporting forms and telephone as reporting procedures [10,19].

Respondents showed positive attitudes and good practices regarding AEFI surveillance and reporting. A considerable proportion had received training on AEFI previously, either through training or mentorship on the job, occasional seminars, or regimented classroom lectures. This may be explain the good level of knowledge on AEFI displayed by the respondents. Notably, most of the respondents understood the necessity of reporting AEFI and exhibited their willingness to report all AEFI they encounter. However, a handful of respondents felt it was unnecessary to report AEFI due to perceived creation of unnecessary fear and alarm from reporting, as well as not having the time to report. Also, some respondents highlighted not reporting AEFIs encountered because of the fear of being blamed by immediate supervisors, as well as the lack of time to complete the paper-based AEFI reporting forms. This negative attitude is consistent with other findings where health workers had fear of personal consequences, litigation, and a sense of guilt [8,10] related to AEFI. All these negative attitudes undoubtedly impact on AEFI reporting.

In recent decades, vaccine hesitancy has become a more significant problem for public health. Concerns about vaccine safety and AEFI are the most common reported reasons for vaccine hesitancy [20]. Another illustration of this challenge of vaccine hesitancy is the ongoing COVID-19 pandemic and the response of the general public and health workers to the COVID-19 vaccine. Vaccine hesitancy may hamper the scientific community's efforts to end the COVID-19 pandemic, despite unparalleled global efforts. In a recent survey in Nigeria [21] among the general public, 71.4% expressed unwillingness to receive COVID-19 vaccines due to concerns about the side effects of the vaccine. Another study among health workers [22] indicated that 40% of respondents had concerns on effects of the vaccine. Findings from the present study highlight the gaps in knowledge and practices, and consequently management of AEFIs, among health workers. Hence, there is the need for frequent trainings for health workers to enhance vaccine safety, the functionality of pharmacovigilance systems, and the proper management of AEFIs.

The proportion of health workers who had encountered an AEFI in their practice and reported it was similar to rates reported by a study where 93% of healthcare providers had diagnosed or had managed a case of AEFI, while with 65% of them reporting it [23]. Poor practices of not reporting AEFIs encountered were also related to the non-availability of AEFI reporting tools in the health facility and the wrong perception of the health workers not being responsible to report because they did not work directly in the immunization unit. A majority of health workers in this study reported following good practices included the immediate notification of AEFIs detected, use of appropriate AEFI reporting forms where available, and routine counselling of mothers/caregivers on AEFI during child routine vaccination visits.

Findings of the present study showed that health workers' age was associated with knowledge on AEFI. Health workers within the age group of 24–34 years had higher knowledge on AEFI, when compared to older age groups. We expected that older health workers would have more experience on AEFI. However, this study's finding may likely be due to the fact that younger health workers may have participated in more recent trainings on AEFI, compared to the older groups. This finding is also consistent with the Lagos study [10], which found health workers of younger age groups had higher knowledge scores. Similarly, health workers who were directly involved in RI service delivery were more likely to have good knowledge. This finding may not be surprising as health workers directly supporting the RI programme are likely to have seen patients with AEFI and would have benefited from more trainings. This however highlights the need for continuous training of all health workers to remain up to date with AEFI guidelines. Health workers' cadre and gender were factors associated with AEFI practices. The relationship between health workers' cadre and AEFI practices may also be due to the level of trainings. CHEWs and Community Health Officers (CHOs) work mostly in primary health facilities were routine immunization takes place. Thus, they are more likely to be more engaged with trainings on AEFI and also have experience in RI service delivery. As expected, higher knowledge on AEFI was associated with good practices.

4.1. Limitations

We cannot rule out potential biases such as recall and social desirability biases due to the cross-sectional nature of the present study. Also, our sampling method was based on convenience, which may affect the generalizability of our findings.

5. Conclusion

Although more than half of health workers in Ondo State, Nigeria were knowledgeable on several aspects of AEFI, we found knowledge gaps among health workers in recognizing more serious AEFIs. Overall, health workers in this study had positive attitudes and practices towards AEFI surveillance and reporting. Our study's findings regarding respondents' knowledge, attitudes and practices on AEFIs, as well as associated factors were different when compared to other studies. Yet, similar to other studies conducted in different states in Nigeria, our respondents had difficulty recognizing more serious AEFI. Specifically, this study adds a better understanding about the level of knowledge and practices on AEFI among health workers in the Ondo State of southwest Nigeria. Our findings allow us to compare practices between different regions of the country. It also serves as a current indicator of the strength of the AEFI surveillance system in the Ondo State. Findings from this study will be useful in the development of policies, frameworks, and training modules, to improve the knowledge and practices on AEFI reporting. Furthermore, these findings can be used to mitigate negative perceptions towards AEFI reporting among health workers. Frequent training and retraining of health workers regardless of cadre and their involvement in RI service delivery are necessary. Periodic and continuous supportive supervision as well as on-the-job mentoring of health workers by the immunization and data management teams are recommended. These recommendations will not only further improve health workers' knowledge on AEFIs, enhance reporting and managing AEFIs, but ultimately improve the AEFI surveillance system in the Ondo State, Nigeria.

Conflict of Interest

None.

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