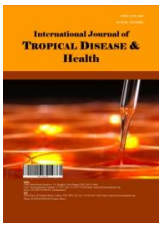

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Knowledge, Attitude and Reporting Practices on Adverse Events Following Immunization among Routine Immunization Service Providers in Health Facilities of Sokoto State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author UMS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author UMA managed the analyses of the study. Authors MOO, MOR and NMJ managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background/Introduction: Health workers at primary health care facilities (PHCs) are primarily involved with routine immunization activities including detection, reporting and management of Adverse Events Following Immunization (AEFI). To undertake such responsibilities effectively, they need to have good knowledge on AEFI and its management.
Objective: To assess the knowledge, attitude and reporting practices of Routine Immunization Service Providers in health facilities of Sokoto State, Nigeria.
Methods: This was a descriptive cross-sectional study conducted at Primary Health Care (PHC) facilities of Sokoto State, Nigeria. Using a multi-stage sampling technique, a total of 285 routine

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immunization service providers were recruited from all the PHCs in one selected local government from each of the three health zones of the State. A semi-structured self-administered questionnaire was used to collect relevant information from eligible participants. Data were entered into SPSS version 20.0 and analyzed.

Results: Of the 285 distributed questionnaires, 258 (90.5%) were duly completed and returned. The M: F ratio was 1.4:1, with mean age of 34.24 ± 8.06 years. Up to 164 (63.6%) respondents had good knowledge (score ≥50%), while 37(14.3%) and 57(22.1%) respondents had fair (score 41-49%) and poor (score ≤40%) knowledge respectively. Reporting practices were appropriate in 224 (86.8%) respondents. The most common method for reporting was by manual filing of AEFI forms. Some respondents would however not report an AEFI to avoid being blamed, feeling guilty or creating unnecessary anxiety to the patient.

Conclusion: Though many respondents had good knowledge and reporting practices on AEFI, knowledge gap still exists; highlighting the need for continuous on-the-job training and retraining of these personnel.

Keywords: AEFI; knowledge; routine immunization service providers.

1. INTRODUCTION

Vaccines are biologic products that act by stimulating body's immune system, which helps to protect against subsequent infection or disease [1]. Worldwide, vaccines are estimated to protect nearly three-quarters of the world's children against major childhood illnesses and prevent up to six million deaths annually [2-5]. Though generally considered safe, they may occasionally cause undesirable effects that are referred to as Adverse Events Following Immunization (AEFI) [6,7]. By definition, AEFI is any untoward medical occurrence occurring after immunization and which does not necessarily have a causal relationship with the usage of the vaccine [1]. It may be due to vaccine reactions, program error, injection reaction, or may occur as a coincidental event [8].

AEFI can create fear and misconception about vaccine safety and negatively affect immunization uptake [4,9-13]. Studies have shown that mothers whose children developed AEFI are less likely to continue or complete immunization schedules [9]. This is of public concern since any drop in immunization coverage could potentially results in upsurge of previously controlled diseases and reverse the gains of the immunization program.

Health care workers at primary health centers (PHCs) are the key persons involve in routine immunization activities and represent the first level of contact with children and their caregivers [14]. In the event of an AEFI, they are expected to make correct diagnosis, provide firsthand information and prompt counseling to the parents of affected children, and be able to institute appropriate management [15]. To perform this responsibility effectively, they must have good knowledge on AEFI and other immunization-related activities.

Available literature showed that health care workers in many developing countries have poor attitude and inadequate knowledge on AEFI and AEFI reporting system [9,15-19]. In a study by Masika et al. [16] in Kenya, only 29.2% of health workers studied had good knowledge on AEFI surveillance. In Nigeria, only a few studies were conducted on AEFI [20-22]. A study by Ogunyemi and Odusanya [21] in Lagos southwestern Nigeria reported that 80% of the health workers studied have good knowledge on AEFI handling and reporting while a similar study by Mohammed et al. [22] in Zaria Northwestern Nigeria reported a relatively lower proportion (58.9%) of respondents having good knowledge on AEFI. Though the study by Ogunyemi and Odusanya evaluated the healthcare workers' knowledge and reporting practices on AEFI, it did not assess their attitude concerning AEFI management and reporting. In view of paucity of relevant data on the subject within the study area, this study was conducted to determine the knowledge, attitude and reporting practices of routine immunization health service providers on AEFI. Such information is necessary for identification of need areas and planning of effective interventions within the study area.

2. MATERIALS AND METHODS

Study area: The study was conducted in selected primary health care (PHCs) facilities in Sokoto state, which is located in North Western geopolitical zone of Nigeria. The state lies

between latitude $13^{0}00$ to $13^{0}06^{1}$ North and longitude $05^{0}11^{1}$ to $13^{0}03^{1}$ East; and has 23 local government areas (LGAs), which are divided into 3 health zones namely, east, west and central zones. The east and the central zones have a total of eight LGAs each, while the west zone has seven LGAs. There are total of 574 primary health care facilities (PHCs) in the state, which are under the control of LGAs and are mainly concerned with provision of essential health services including routine immunization program. These PHCs are primarily manned by nurses and community health extension workers (CHEW), who constitute the primary health service providers involve in routine immunization activities.

Study population: This comprised routine immunization service providers (RISP) working in government Primary Health Care (PHC) facilities of Sokoto State. Those who refused to give informed consent for participation in the study and those who were on work leave during the study period were excluded.

Study design: Descriptive cross sectional.

Sample size determination: Minimum sample size was determined using the formula as follows [23].

$$n= Z^2pq/d^2$$

Where

n= minimum sample size
Z= standard normal deviate set at 1.96
P=proportion of RI providers with knowledge on AEFI observed from a previous study = 79% = 0.79 [21].
q= Complimentary probability of P = 1.0-p
d= degree of accuracy desired, set at 0.05
Hence, $n= 1.96^2 X 0.79 x 0.21/ (0.05)^2 = 255$

Allowing for 10% non-response rate, the minimum sample size (ns) was given as:

10/100 X255 = 25.5, which was rounded up to 26.

Therefore, the sample size was 255+ 26 = 281

Sampling technique: A two-stage sampling technique was used to recruit eligible subjects:

Stage 1: One LGA was selected from each of the 3 health zones using simple random sampling (balloting). The local governments selected were Sokoto North, Wurno and Dange-Shuni belonging to the central, eastern and western health zones respectively. Line listing of all the health facilities in each of the selected LGAs was done. There were 12, 20 and 23 primary health facilities (PHCs) in Sokoto North, Wurno and Dange-Shuni local governments respectively. All the PHCs in each of the selected local government were included for the study.

Stage 2: Proportionate allocation of the study subjects was done based on the total number of staff in each of the selected health facility. This was done in order to obtain the desired sample size. There were 120, 115 and 65 Routine Immunization Service Providers (RISP) in the three selected local governments (LGAs) of Sokoto North, Wurno and Dange-shuni respectively, giving a total of 300. Hence, the proportion of respondents recruited from all the PHCs in the respective LGAs were 112 (120/300 x 281), 108 (115/300 x 281) and 61 (65/300 x 281).

2.1 Method/ Instrument of Data Collection

The method of data collection was by interview. The instrument of data collection was a pre-tested semi-structured standardized interviewer administered questionnaire with four sections. It was used to obtain information on socio-demographic characteristics of the respondents, knowledge of the respondents on AEFI, attitudes of the respondents towards AEFI and practices of reporting AEFI among the respondents. Research assistants comprising resident doctors and health Information officers were recruited for the study. They were trained for one day on general principles and conduct of the research, interpersonal communication skills and the use of study instrument. The principal researcher conducted the training. Data collection spanned over a period of four weeks.

2.2 Pre-testing and Validation

The research instrument (questionnaire) was first validated by giving it to a group of experts including the co-authors and other consultants in the Department of Community Health, Usmanu Danfodiyo University Teaching Hospital, Sokoto. It was also pre-tested among RI providers in a health facility of an LGA not selected for the study. After the pre-testing, a few modifications were made to enhance clarity of some of the questions and increase the speed of data collectors.

2.3 Data Analysis

Data entry and analysis were performed using statistical package for social sciences, IBM® SPSS version 20.0 (SPSS Inc, USA). Before analysis, data was first coded, cleaned and checked for wrong entry.

Descriptive statistics was presented as tables, frequencies and percentages for qualitative data; and as means, median and standard deviation for quantitative data.

Knowledge was assessed by asking questions on definition, classification, and features of AEFI; as well as on knowledge of reportable AEFIs and their management. Each correct response was scored one mark while incorrect or I don't know response was scored zero. All correct responses were totaled and divided by all the possible correct responses and then multiplied by 100. A Knowledge score of $\geq$50% (of the expected scores for correct responses) represents good knowledge on AEFI; while 41-49% was considered fair knowledge and $\leq$ 40% represents poor knowledge. Similarly, both attitude and practice were described as either being appropriate or inappropriate. A score of one was given when a practice was appropriate; while zero was given to inappropriate practice. The scale classified practice as good with cumulative score $\geq$50% and poor when ≤49%.

Categorical variables were compared between groups using chi-square test or, where indicated, Fishers exact test. All variables found to be significant in the Chi-square test were subjected to logistic regression analysis, to determine the relationship between demographic/other independent variables of the respondents (age, gender, educational level, years of experience etc) and knowledge on AEFI (i.e dependent variable). Test of hypothesis was 2-tailed, with level of statistical significance (α) set at $p<0.05$.

3. RESULTS

A total of 283 questionnaires were distributed to the eligible study participants. However, 258 questionnaires were duly completed and returned by the respondents, giving a response rate of 91.2%.

3.1 Socio-demographic Characteristics

There were 150 (58.1%) males and 108 (41.9%) females, giving M: F ratio of 1.4:1. Mean age of the respondents was 34.24 $\pm$ 8.06 years (Range =19-58years). Of the 258 study respondents, 102(39.5%) were from Sokoto North Local Government area, 97 (37.6%) from Wurno Local Government and 59 (22.9%) from Dange-Shuni Local Government, representing the Central, the Western and the Eastern Health zones of Sokoto State respectively (Table 1).

Community Health extension workers (CHEWs) constituted majority of the respondents 185 (71.7%), followed in descending order by Community health Officers (CHOs)-28(10.9%), Nurses- 23 (8.9%), other allied healthcare workers-14 (5.4%) and doctors- 8 (3.1%). As shown in Table 1, the respondents have been practicing for a variable duration, ranging between one and 27 years (Mean 5.45+ 5.25 years).

3.2 Respondents' Knowledge on AEFI

Of the 258 respondents, more than 70% of them were able to define AEFI correctly. However, only 37.1% and 45.5% of the respondents, respectively, knew that abnormal laboratory findings following immunization also constitute an AEFI and that AEFI can occur even two weeks after immunization (Table 2a). Majority of the respondents knew how AEFIs are classified, although more than half of them (53.9%) did not know that coincidental reaction is also classified as a form of AEFI (Table 2a).

The most common AEFI symptoms known by the respondents were fever (97.3%), mild local reaction in form of pain/swelling (96.9%), redness at injection site (95.3%) and convulsions (76.0%). Only 51.6% and 48.8% of the respondents were aware that encephalitis and hypotonic-hyper-responsiveness are also features of AEFI. Majority of the respondents 224 (86.8%) knew that anaphylaxis could occur as a complication of vaccination. Regarding treatment of anaphylaxis, 219 (84.9%), 197 (76.4%), 173 (67.1%) and 136 (52.7%) of the respondents respectively knew that Adrenalin, Hydro-cortisone, Normal Saline and promethazine could be used.

Reportable AEFI known by the respondents who answered the question were injection site abscess in 89.5%, immunization- related hospitalization in 85.4%, immunization-related death in 78.6% and BCG lymphadenitis in 70.7%. However, more than 80% of the respondents wrongly thought that even mild redness/swelling and fever less than 38^{o}C were reportable AEFIs (See Table 2a).

Table 1. Socio demographic characteristics of the patients

Variables	n	%
Age (years)		
<20	2	(1.0)
20-29	57	(27.4)
30-39	89	(42.8)
40-49	52	(25.0)
50-59	8	(3.8)
Gender		
Male	150	(58.1)
Female	108	(41.9)
Local Government		
Sokoto North	102	(39.5)
Wurno	97	(37.6)
DangeShuni	59	(22.9)
Tribe (n=242)		
Hausa	229	(94.6)
Yoruba	7	(2.9)
Igbo	1	(0.4)
Others	5	(2.1)
Religion (n=252)		
Islam	235	(93.3)
Christianity	17	(6.7)
Cadre of staff		
***CHEW**	185	(71.7)
***CHO**	28	(10.9)
Nurse	23	(8.9)
Doctor	8	(3.1)
Others	14	(5.4)
Duration of practice		
< 5years	140	(54.3)
≥ 5years	85	(32.9)
Not stated	33	(12.8)

**CHEW –Community Health Extension Workers, *CHO –Community Health Officers*

More than 90% of the respondents were aware that filling AEFI form is a method of AEFI reporting, but majority did not know that electronic mail, fax and telephone are also used as methods for AEFI reporting. In addition, 64.5% of the respondents wrongly thought that AEFI reporting could be undertaken by talking to a colleague (Table 2a).

Many of the respondent also knew that AEFI should be investigated if it occurs as part of a cluster 66 (76.7%), causes public concern 101(78.0%) or if it is due to suspected immunization error 143(91.1%). But 217 (96%) of the respondents wrongly though that even mild local reactions (redness and pain) require investigation (Table 2b). As regards the timing of AEFI investigation, majority 193 (96.5%) of those who responded to the question acknowledged that AEFI should be investigated as soon as possible or, it should be done within 24hours, 67 (80.7%) after detection (Table 2b).

Respondents were also aware of first aid measures to institute or to advice caregivers following immunization. These include giving extra fluid for fever 176 (85.0%), observing a patient for at least 15 minutes after immunization 231(97.5%), avoidance of standing during fainting attacks 151 (72.6%) and not cutting a small lump 142 (75.1%).

The overall mean knowledge score of the respondents was 51.46 ± 16.97. The proportion of respondents with good knowledge (score ≥50%) on AEFI was 164 (63.6%), while 37(14.3%) and 57(22.1%) had fair (41-49%) and poor (<40%) knowledge respectively.

3.3 Respondents' Attitude on Adverse Events Following Immunization and Its Reporting

Two hundred and forty-five (95.0%) respondents would attend AEFI training if invited. The remaining 13 (5.0%) respondents would not attend such training either because they feel it is unnecessary in 2 (15.4%) respondents, or because they consider AEFI investigation/ management not part of their responsibility in 4 (30.8%) respondents, or they believed learning

Table 2a. Proportion of respondents with correct knowledge on various aspects of AEFI

Variable (Knowledge category)	Correct response n (%)	Incorrect response n (%)
Definition of AEFI		
A medical incident that occurs after immunization	245 (96.8)	8 (3,2)
The event may not necessarily be caused by the vaccine	178 (79.1)	47 (20.9)
It includes unfavourable, or unintended sign, abnormal laboratory finding, symptom or disease	82 (37.1)	139 (62.9)
It does not occur after two weeks of vaccination	100 (45.5)	120 (54.5)
AEFI Classification		
Vaccine reaction (n=258)	219 (84.9)	39 (15.1)
Program error (n=258)	231 (89.5)	27 (10.5)
Injection reaction (n=258)	198 (76.7)	60 (23.3)
Coincidental reaction (n=258)	119 (46.1)	139 (53.9)
Causes of AEFI may be		
Vaccine-product related	119 (88.8)	15 (11.2)
Vaccine-quality defect related	75 (78.9)	20 (21.1)
Immunization error-related	115 (88.5)	15 (11.5)
Immunization anxiety-related	36 (51.4)	34 (58.6)
AEI features		
Fever (n=258)	251 (97.3)	7 (2.7)
Mild swelling at injection site (n=258)	250 (96.9)	8 (3.1)
Redness at injection site (n=258)	246 (95.3)	12 (4.7)
Convulsions (n=258)	196 (76.0)	62 (24.0)
Persistent crying (n=258)	161 (62.4)	97 (37.6)
Acute flaccid paralysis (n=258)	147 (57.0)	111 (43.0)
Encephalitis (n=258)	133 (51.6)	125 (48.4)
Hypotonic-hyper-responsiveness (n=258)	126 (48.8)	132 (51.2)
Anaphylaxis (n=258)	224 (86.8)	34 (13.2)
Reportable AEFI		
Injection site abscess (n=181)	162(89.5)	19 (10.5)
Immunization-related hospitalization (n=151)	129(85.4)	22 (14.6)
Immunization-related death	92(78.6)	25(21.4)
Anaphylaxis	123(76.9)	37 (23.1)
Seizures	115(71.4)	46 (28.6)
BCG lymphadenitis	87(70.7)	22 (29.3)
Mild local redness/ swelling (n=172)	23(13.4)	149 (86.6)
Fever below 38^{o}C (n=137)	16 (11.7)	121 (88.3)
To whom should AEFI be reported if detected?		
Local immunization program	221(97.8)	5 (2.2)
National immunization program managers	36 (49.3)	37(50.7)

State Commissioner of Health	24 (36.9)	41(63.1)
Methods of AEFI reporting		
Filling of AEFI form (n=241)	237(98.3)	4 (1.7)
Reporting via Telephone (n=238)	87 (36.6)	196(82.4)
Talking to colleague (n=231)	82(35.5)	149(64.5)
Email/online (n=212)	52 (24.5)	160(75.5)
Fax (n=238)	42 (17.6)	196(82.4)

Table 2b. Proportion of respondents with correct knowledge on various aspects of AEFI

Variable (Knowledge category)	Correct response n (%)	Incorrect response n (%)
Can poor monitoring of AEFI cause reduction in immunization coverage?	240(96.4)	9 (3.6)
AEFI surveillance builds public trust in immunization program	228(92.7)	18 (7.3)
AEFI should be investigated in detail to determine causality		
If part of a cluster (n-86)	66 (76.7)	20 (23.3)
If it causes significant parental/public concern (n=129)	101(78.3)	28 (21.7)
If it is a suspected immunization error (n=157)	143(91.1)	14 (8.9)
Mild local reactions (n=226)	9(4.0)	217(96.0)
If it is one of the events defined for AEFI investigation (n=188)	166(88.3)	22 (11.7)
When should AEFI investigation be commenced?		
As soon as possible (n=200)	193(96.5)	7 (3.5)
Within 24hours (n=75)	67 (89.3)	8 (10.7)
After one weeks (n=56)	25 (44.6)	31 (55.4)
Treatment measures after given immunization		
A patient should remain in the health facility and be observed for at least 15 minutes	231(97.5)	6 (2.5)
If fever develops, the patient should be given extra fluid to drink	176(85.0)	31 (15.0)
Routine use of paracetamol at the time of vaccination is no longer advised	179(82.9)	37 (17.1)
In case a small, hard lump is noticed after the immunization, it should be cut immediately	142(75.1)	47 (24.9)
If a patient faint after immunization, he/she should be made to stand Immediately	151(72.6)	57 (27.4)

about AEFI would be difficult in 4 (30.8%) respondents or did not think it will benefit them in 3 (23.1%) respondents (Table 3).

Reporting of AEFI was considered necessary by 252(97.7%) of the respondents. Only 6 (2.3%) respondents considered reporting AEFI to be unnecessary. This was because they felt they have no time in 3 (50.0) respondents, or believed reporting will create unnecessary fear - 2 (33.3) respondents, or because nothing may be done even if reported - one (16.7%) respondent. In the same vein, 98.8% of the respondents would not report AEFI incident even if encountered for fear of being blamed or because of time limitation (Table 3).

3.4 Respondents' Reporting Practices on AEFIs

Overall, the reporting practice was appropriate in 224 (86.8%) respondents. Of the 239 who responded to the question, 187 (78.2%) had received training on AEFI either during formal

classroom lectures, or seminars or as on-the-job training (Table 4).

A total of 85 (32.9%) respondents encountered AEFI, of which 61 (71.8%) reported it routinely while the remaining 24 (28.2%) did not do so for various reasons (Table 4). Among the 61 respondents who reported AEFI, 48 (78.7%) had done so immediately or within 24 hours of AEFI detection while the remaining 13 (21.3%) reported only after 24hours. The methods used for AEFI reporting by the 61 respondents were filling of AEFI forms in 58 (95.1%) and via telephone in 3 (4.9%) respondents (Table 4).

Two hundred and sixteen (90.4%) respondents indicated that they had AEFI reference guidelines in their facilities. Up to 228 (98.7%) of 231 respondents counsel caregivers on AEFI before immunization while 223 (94.1%) of 237 respondents practice routine prescription of paracetamol after immunization for prevention of fever (Table 4).

3.5 Factors Affecting RI Service Providers' Knowledge on AEFI

On bivariate analysis, the respondents' age group (X^2 = 14.424, df 4, *P* = 0.006), gender (X^2 =24.60, df 1, *P* = 0.001), duration of service (X^2 =9.727, df 1, p= P = 0.002), local government of origin and previous training experience (X^2 =18.231, df 1, *P* = 0.001) on AEFI were found to significantly affect respondents' knowledge on AEFI (Table 5). However, only duration of service was found to be an independent predictor of AEFI knowledge (*P* =0.043, OR 3.593, CI 1.040-12.406). Thus, routine immunization service providers whose duration of service was < 5years were 3.5 times more likely to have good knowledge on AEFI compared to those whose duration of practice was more than 5 years.

Similarly, respondents' Age group (Fishers exact test =15.483, p =0.05), Cadre (Fishers exact test = 10.171, p= 0.035) and AEFI knowledge status (p=0.039) were significantly associated with having appropriate attitudes towards AEFI reporting on bivariate analysis (Table 6). However, only knowledge status was found to be an independent predictor of having appropriate attitude on AEFI on logistic regression analysis (OR=8.933, p=0.013, 95% CI = 1.593 –50.102). On the other hand, no factor was identified to be significantly associated with respondents' AEFI reporting practice.

4. DISCUSSION

Adverse events following immunization (AEFIs) is of public health concern since it can lead to public distrust, with consequent decline in immunization coverage [10,11,13].

In the present study, more than 60% of the respondents had good knowledge on AEFI. This is consistent with a previous study by Ogunyemi and Odusanya in Lagos, South western Nigeria, which found that up to 80% of their respondents had fair/good knowledge on AEFI [21]. It was also consistent with a more recent study in Zaria, Northwestern Nigeria, which showed 58.9% of the respondents as having good knowledge on AEFI [22]. However, our finding was in contrast to that of Masika et al. [16] in Kenya where less than 30% of the respondents had good knowledge on AEFI.

Table 1. Attitude of study respondents regarding reporting of AEFI

Variable	Yes/Correct response n (%)	No/Incorrect response n (%)
If you were invited to attend training on AEFI would you attend?	245 (95.0)	13 (5.0)
Would you advice your worker colleague to attend training on AEFI if he was invited	219 (97.8)	5 (2.2)
Why would you not attend training on AEFI if invited? (n=13)		
a) **I feel it is not necessary**	-	2 (15.4)
b) **AEFI management is not my responsibility**	-	4 (30.8)
c) **I think it is a difficult topic for me**	-	4 (30.8)
d) **I don't think it will benefit me**	-	3 (23.1)
Is it necessary to report an AEFI?	252 (97.7)	6(2.3)
Why is it not necessary to report an AEFI? (n=6)		
a) **I do not have time**	-	3 (50.0)

b) **Reporting AEFI can cause unnecessary fear/alarm**	-	2 (33.3)
c) **I may be blamed by my supervisors**	-	0 (0.0)
d) **Nothing can be done even if I report it**	-	1 (16.7)
If you have a case of AEFI would you report it?	240 (98.8)	3 (1.2)
Why would you not report a case of AEFI? (n=3)		
a. **I may be blamed for it**	2 (66.7)	
b. **I don't have time to fill the forms**	1 (33.3)	
Would you advice your co-worker to report case of AEFI?	233 (98.3)	4(1.7)

Though the overall AEFI knowledge status of the respondents in the present study was good, knowledge gaps exist in some specific areas. For example, some of the respondents were not aware that abnormal laboratory findings and incidents, which may occur even two weeks after immunization, are also included within the broad definitions of AEFI. In a study by Muchekeza et al. [24], none of their respondents could correctly define AEFI. The implication of this is that such AEFIs may not be diagnosed or reported by the health service providers and this can hinder effective post marketing vaccine surveillance. Many of the study respondents knew that program error is a form of AEFI, but majority were not aware that some adverse events could be merely coincidental and not necessarily due to the vaccine. It is of note that a study by Hu et al. [25] has shown that a truly causal relation between immunization and presumed AEFI reaction is rare.

Adverse events such as fever, redness and swelling at injection site are well known by the respondents, most likely because these are the symptoms encountered most frequently in the course of their routine immunization activities. Previous studies have identified fever and mild local reactions as the most prevalent AEFIs [6,20,25,26]. It is instructive that almost half of the health workers in the index study were not aware that hypotonia-hyper responsiveness,

Table 4. Reporting practices of study respondents

Variable	Yes response n (%)	No response n (%)
Have you ever received any training on adverse event following immunization (AEFI)? (n-239)		
a. Yes	187 (78.2%)	-
b. No	52 (21.8%)	-
If you had received training on AEFI, what type of training was it? (n=187)		
On the job training	96 (51.3)	-
Seminar/Workshop	54 (28.9)	-
Class lecture	37 (19.8)	-
Have you encountered an AEFI in your practice? (n=258)	85 (32.9%)	173 (67.1)
Do you routinely report an AEFI you encountered? (n=85)	61 (71.8)	24 (28.2)
Why don't you report AEFI routinely? (n=24)		
I feel it is not related to immunization	5 (20.8)	-
Reporting form was not available	3 (12.5)	-
I don't know how and where to report it	3 (12.5)	-
I am afraid that I will be blamed	4 (16.7)	-
Reporting it will make me feel guilty	1 (4.2)	-
I am too busy and had no time	2 (8.3)	-
Reason not stated	6 (25.0)	-
If you do report AEFI routinely, when did you report the AEFI you observed? (n=61)		
Immediately	30 (49.2)	-
Within 24hours of detecting it	18 (29.5)	-
After 24hrs of detecting it	13 (21.3)	-

What method did you use to report the observed AEFI? (n=61)		
filling AEFI form	58 (95.1)	-
via telephone	3 (4.9)	-
via e-mail	0 (0.0)	-
Have you ever seen an AEFI reporting and investigation for?m	248 (96.1)	10 (3.9)
Do you have AEFI reference guidelines materials at your workstation?	216 (90.4)	23 (9.6)
Do you routinely recommend the use of Paracetamol to prevent post-immunization fever?	223 (94.1)	14 (5.9)
Do you routinely counsel parents on AEFI when immunizing their children?	228 (98.7)	3 (1.3)

encephalitis and excessive crying are features of AEFI. Ogunyemi and Odusanya [21] in Lagos, Nigeria also made similar observation. Additionally, a retrospective study on spectrum of AEFI by Aderigbigbe et al. [20] in Ilorin, Nigeria did not report these symptoms amongst their patients. This may underscore the rarity of such symptoms or simply the inability of the healthcare workers to recognize and report them. Failure to report these AEFIs could under estimate the magnitude of the problem and hinder institution of necessary interventions including causality assessment, patients counseling and treatment.

Significant proportions of respondents were aware that anaphylaxis can occur following immunization, and they also had good knowledge concerning its treatment. This is comparable to a study in Srilanka where 92% of nurses showed good knowledge on how to use adrenaline in the management of anaphylaxis [27]. However, the study result is in contrast with findings from an earlier study in Kenya, where less than 40% of the nurses knew how to manage post immunization anaphylaxis [16]. Generally, the incidence of severe adverse events such as anaphylaxis resulting from immunization is rare [28]. A review of large AEFI data from a population study covering a period of four years showed that only 1% of the total AEFIs identified is serious [25]. An even lower incidence (0.65 cases/million doses of vaccine) has been reported as regards anaphylaxis [21,29].

AEFI reporting is an integral component of AEFI surveillance [30]. In the present study, significant proportion of the respondents wrongly thought that mild redness, pain, and low-grade pyrexia were reportable. This can result in over reporting of AEFIs. Though a similar study in Lagos, Nigeria [21] showed more than half (57.9%) of the respondents knew that low-grade fever is not reportable, majority (68.9%) wrongly thought mild redness at the site of injection is a reportable event. A general guideline on AEFI reporting is to report any AEFI that is of concern to the parents or to the healthcare workers [31]. These include serious events, signal reactions and events

Table 5. Factors affecting AEFI knowledge amongst routine immunization service providers' in Sokoto State

Variable	Poor knowledge	Good knowledge	Test statistics/ p-value
Previous training experience			
Yes	49	138	X^2 =18.231, df 1
No	30	22	*P* = 0.001
Duration of service			
<5 years	36	100	X^2 =9.727, df 1
> 5years	40	45	*P* = 0.002
Age group (years)			
<20	2.0	0.0	
20-29	22.0	30.0	
30-39	28.0	61.0	X^2 =14.424, df 4
40-49	14.0	38.0	*P* = 0.006
50-59	6.0	2.0	

Gender			
Male	32.0	108.0	X^2 =24.60, df 1
Female	54.0	46.0	*P* = 0.001
Religion			
Islam	86	148	Fishers exact test
Christianity	1	5	*P* = 0.422
Tribe	80	148	
Hausa	40	3	Fishers exact test 5.633,
Yoruba	1	0	*P* = 0.098
Igbo	0	5	
Local Government (LGA)			
Dange/shuni	24.0	34.0	
Sokoto North	59.0	42.0	X^2 =58.549, df 3,
Wurno	7.0	88.0	*P* = 0.001

Table 6. Factors affecting RI providers' attitude regarding AEFI reporting

Variable	Appropriate n(%)	Inappropriate n(%)	P –value
Age group (years)			
<20	0	1(100.0)	Fishers exact test =
20-29	56 (100.0)	0	15.483, p = 0.05
30-39	83(100.0)	0	
40-49	51(100.0)	0	
50-59	6 (100.0)	0	
Gender			
Male	136 (100.0)	0	Fishers exact test=
Female	91(96.8)	3(3.2)	2.093, p = 0.06
Religion			
Islam	224 (98.7)	3(1.3)	Fishers exact test =
Christianity	5 (100.0)	0	0.067, p= 1.0
Cadre of staff			
CHEW	8 (100.0)	0	Fishers exact test =
Community Health officer	153 (98.7)	2 (1.3)	10.171, p= 0.035
Nurses	11 (100.0)	0	
Doctors	8 (88.9)	1(11.1)	
Tribe			
Hausa	218 (99.1)	2 (0.9)	Fishers exact test=
Yoruba	6 (85.7)	1(14.3)	9.291, p=0.148
Igbo	1 (100.0)	0	
Others	4 (100.0)	0	
Local government`			
Dange-Shuni	56 (98.2)	1(1.8)	Fishers exact test=
Sokoto North	93 (97.9)	2 (2.1)	4.559, p=0.462
Wurno	90 (100.0)	0	
Knowledge on AEFI			
Poor knowledge	80 (96.4)	3(3.6)	Fishers exact test
Good knowledge	160 (100.0)	0	=5.855, p=0.039
Previous training on AEFI			
Yes	183(98.9)	2(1.1)	Fishers exact test =
No	51(98.1)	1(1.9)	0.23, p=0.52
Duration of practice			
<5years	130 (99.2)	1(0.8)	Fishers exact test=
>5years	80 (100.0)	0	0.614, p=1.00

associated with a newly introduced vaccine. Other reportable AEFIs are AEFIs caused by immunization error, significant events of unexplained cause occurring within 30 days after vaccination, events causing significant parental or community concern, swelling, redness or soreness at the injection site if it lasts for more than 3 days or if it extends beyond the nearest joint [30]. Minor features such as fever and local reactions are not reportable.

There are various methods of reporting AEFI. Majority of the respondents were aware of the paper reporting procedure, which is a traditional method of documentation that entails filling an AEFI reporting form. However, significant proportions were not familiar with the electronic/ internet-based system of AEFI reporting most probably because such technology is yet to be fully integrated into the immunization services within the study area. A similar study in southern part of Nigeria had shown that majority of their health workers were not aware of the electronic system of reporting [21]. This is in contrast to other climes in which the Information System of Adverse Events Following Immunization (IS-AEFI) is fully computerized and networked, enabling easier storage and retrieval of information and faster processing of large volume of data [31-33].

Overall, the respondents displayed appropriate attitude and practices towards AEFI reporting/ surveillance. They were favorably disposed to undertaking future training on AEFI and, notably, majority of them actually had previous training on AEFI either through didactic classroom lectures or periodic seminars and workshops. This might underscore the good AEFI knowledge level of the respondents. In addition, many respondents believed it is important to report AEFIs, though a few felt otherwise due to limited time resulting from work pressure or because such reporting may cause unnecessary anxiety to the patient and/or their guardians. As highlighted by other workers, fear of personal consequence or litigation, indifference, and sense of guilt on the part of healthcare workers constitute other negative attitudes that impede AEFI reporting [21].

Good practices such as prompt reporting (within 24hours), use of AEFI reporting forms for documentation and counseling of parents following immunization were observed among majority of the respondents who witnessed cases of AEFI in the course of providing routine immunization services. It is of note that routine prescription of paracetamol to prevent fever is still widely practiced by the respondents, even though this is no longer advised. The current recommendation is that anti-pyretics such as paracetamol should be used only when fever is noticed [34].

Many factors either alone or in combination were found to influence health workers' knowledge on AEFI and its management. Ogunyemi and Odusanya [21] showed that healthcare personnel who are younger were more knowledgeable compared to older workers. In the present study, only duration of service less than 5-years was found to be an independent predictor of having good knowledge on AEFI. This may appear surprising since learning curve is expected to improve with increasing duration of practice or years of experience. It may be argued, however, that those with shorter duration of service are the younger workers who represent the most agile workforce, having more passion and zeal for learning. They are more likely to be actively engaged in the field, conducting immunization activities, and may thus have a more up-to-date knowledge on AEFI. Though this finding needs further validation, it underscores the need to ensure that health workers (particularly those with longer duration of service) are periodically trained and retrained.

5. CONCLUSION

More than half of the respondents have good knowledge, appropriate attitude and reporting practices on AEFI. Nevertheless, knowledge gap exists in some specific aspects of AEFI areas among the respondents. Hence, there is need for continuous training of the Routine Immunization (RI) Health Service Providers to further improve their knowledge and enhance their capacity.

CONSENT AND ETHICAL APPROVAL

Ethical approval for the study was obtained from the Ethics Committee of Sokoto State Ministry of Health (MOH). Written informed consent was also obtained from the study subjects.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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