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## Impact of training on knowledge of frontline health workers about integrated disease surveillance and response in Ondo State, Nigeria

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### ABSTRACT

**Background:** Poor knowledge of health workers on integrated disease surveillance and response (IDSR) is among the causes of poor surveillance reporting performance in Nigeria.

**Objective:** This study determined the immediate impact of a surveillance training program on knowledge about IDSR.

**Methods:** A quasi-experimental study, involving a pre- and post-test design, was conducted among 134 frontline health workers who participated in a surveillance training in Ondo State, Nigeria. Data were analysed using descriptive and inferential statistics at a 5% statistical significance level.

**Results:** Mean age was  $38.8 \pm 9.8$  years, 65.1% were females, and 26.4% were doctors. Overall, the mean pre-test IDSR knowledge score ( $11.2 \pm 5.3$ ) increased significantly to  $17.9 \pm 4.6$  in the post-test ( $p < 0.001$ ). The mean post-test overall IDSR knowledge score for females [ $\beta = 2.977$  (95%CI: 0.993-4.960)], doctors [ $\beta = 5.059$  (95%CI: 2.599-7.519)] and nurses [ $\beta = 2.330$  (95%CI: 0.026-4.634)] was statistically and significantly higher. As the mean pre-test overall IDSR knowledge score increased by one unit, the mean post-test overall IDSR knowledge score increased by approximately 0.2 unit [ $\beta = 0.225$  (95%CI: 0.070-0.381)].

**Conclusions:** Training has the capacity to improve IDSR knowledge. Hence, training on IDSR should be conducted regularly for all healthcare workers.

## INTRODUCTION

The integrated disease surveillance and response (IDSR) strategy was adopted in 1998 by the WHO Regional Office for Africa and its Member States in order to improve the availability and use of data for prompt public health action at all levels of national health systems across the WHO African region. This strategy, when properly implemented, helps to improve the ability of all levels of the health

system to detect, confirm, and respond to diseases and other public health events with an ultimate reduction in high levels of death, illness and disability. (World Health Organization & Centers for Disease Control and Prevention, 2010)

Various actors are involved with the surveillance core functions at each level of the health system involved with IDSR (Federal Ministry of Health, 2013; World Health



Organization & Centers for Disease Control and Prevention, 2010). In Nigeria, the health facility focal person for IDSR helps to coordinate the IDSR activities at the health facility level. The health facility surveillance focal persons are also responsible for reporting all notifiable diseases under IDSR to the disease surveillance and notification officer at the Local Government Area (LGA) level. (Federal Ministry of Health, 2013; Isere, Fatiregun, & Ajayi, 2015) The work of the health facility focal persons cannot be effective, however, without them working closely with the frontline health workers who actually provide care to patients. As recommended, frontline health workers are expected to detect and report diseases with epidemic potential and those that are targeted for eradication and elimination when they come in contact with them in the course of their routine job. The health workers are expected to identify these diseases based on the standard case definitions and immediately report them to the surveillance focal person in the health facility, who, in turn, notifies the LGA using designated IDSR reporting forms. (Isere et al., 2015; World Health Organization, 2008) Contrary to this ideal, literature has shown that health workers in low- and middle-income countries do not have adequate training about IDSR (Fall et al., 2019; Mandiyata, Olowski, & Mutale, 2017; Phalkey, Yamamoto, Awate, & Marx, 2015) and are therefore not skilled at identifying the diseases under surveillance and notifying the surveillance focal person accordingly due to their poor knowledge of standard case definitions and the IDSR process.

The knowledge gap in disease surveillance among frontline health workers has been identified as one of the causes of poor surveillance reporting performance in some climes (Friedman, Sommersall, Gardam, & Arenovich, 2006; Maponga et al., 2014). The situation is not different in Nigeria either. Over the years, the surveillance reporting performance in Nigeria has not been encouraging, and the knowledge gap among frontline health workers has also been implicated (Jinadu, Adebisi, Sekoni, & Bangboye, 2018; Makinde & Odimegwu, 2020; Ofili, Ugwu, Ziregbe, Richards, & Salami, 2003).

Ondo State is one of the subnational regions in Nigeria where the surveillance reporting

performance has been suboptimal, with annual underreporting or delayed reporting of cases of most priority diseases in the IDSR framework by frontline health workers, leading to annual outbreaks of diseases such as Lassa fever (Fatiregun & Isere, 2017; Isere et al., 2018). In order to enhance reporting of priority diseases in the State, the annual surveillance training for all surveillance actors was introduced by the State Government with funding from WHO through the Polio Eradication Initiative (PEI) programme. This training, which aims to enhance the knowledge and capacity of all surveillance actors to perform their roles in disease surveillance, is targeted at community informants, the health facility surveillance focal persons and frontline health workers.

This study determined the immediate impact of one such training on the IDSR knowledge of frontline health workers from two tertiary health facilities in Ondo State, Nigeria, as well as the predictors of their post-test IDSR knowledge score. Recommendations from this study will be useful in formulating guidelines and policies towards improving the knowledge of frontline health workers, who are not designated surveillance officers, on IDSR.

## METHODS

We conducted a quasi-experimental study, using a pre- and post-test design, among all 134 frontline health workers from two tertiary health facilities in Ondo State which were involved in the April, 2019 annual disease surveillance training and sensitisation program on surveillance activities for Acute Flaccid Paralysis (AFP) and other selected priority diseases (Measles, Yellow fever, Tuberculosis, Cerebrospinal Meningitis, Neonatal Tetanus and Lassa fever). The training program, which was conducted in all 18 LGAs in the State concurrently, spanned over a five-day period. Each target group had a one-day training in their LGA.

During the one-day training for the frontline health workers, they were introduced to the concept of surveillance and IDSR, detection and reporting of suspected cases of some priority diseases (AFP, Measles, Yellow fever, Tuberculosis, Cerebrospinal Meningitis, Neonatal Tetanus and Lassa fever) within the

IDSR strategy using standard case definition and the reporting process within the IDSR structure using designated reporting forms. A pre-tested self-administered questionnaire was used to obtain information on respondents' socio-demographics, involvement with and knowledge about IDSR before and after the training.

Data was entered into Statistical Package for Social Sciences (SPSS) version 23. The overall IDSR knowledge score was computed from five IDSR knowledge domains. The IDSR knowledge domains used to compute the overall IDSR knowledge score were knowledge of the number of diseases listed under IDSR, knowledge of the standard case definitions of selected diseases (AFP, Yellow Fever, Measles, Neonatal Tetanus, Lassa Fever) listed under IDSR, knowledge of IDSR reporting forms, knowledge of designated authorities to whom notifiable diseases are reported in Nigeria, and knowledge of uses of IDSR. Correct response to each of the knowledge questions was given a score of "1" while wrong responses were scored "0". The maximum obtainable overall IDSR knowledge score was "28", and the minimum obtainable score was "0". The dependent variable was the post-test overall IDSR knowledge score.

Data cleaning was done to ensure that responses were fit for further analysis. Further analysis involved data summarisation using proportions for categorical variables, while mean, standard deviation, median and interquartile range were used to summarise

the numerical variables. Knowledge of the various IDSR knowledge domains was compared before and after the training using McNemar's test. The overall knowledge score of IDSR was compared before and after the training using the paired t-test. Correlation analysis was used to determine the relationship between the independent continuous variables and the dependent variable. Student t-test was used to compare the difference in mean post-test overall IDSR knowledge score of the independent binary categorical variables. One-way ANOVA was used to compare the difference in mean post-test overall IDSR knowledge score of the categorical variable with several categories. All independent variables that were statistically significant at 20% in the bivariate analyses were fit into the multiple linear regression model to determine the predictors of the post-test overall IDSR knowledge score. The level of statistical significance was set at  $p < 0.05$  for all statistical analyses.

This work is part of the assessment of the effect of the annual surveillance training program, for which a formal ethical committee approval was not required. The training organisers gave permission and approval to conduct the assessment. In addition, the purpose of the study were explained to the participants and their written informed consents were obtained before the questionnaire administration was done.

Table 1: Socio-demographics of respondents

<i>Variables</i>	<i>Frequency</i>	<i>Percentage (%)</i>
<b>Age in years: Mean <math>\pm</math> SD<sup>†</sup></b>	<b>38.8 <math>\pm</math> 9.8</b>	
<b>Sex</b> Male	37	34.9
Female	69	65.1
<b>Level of education</b> Secondary	2	1.9
Tertiary	104	98.1
<b>Designation</b>		
Doctor	28	26.4
Nurse	39	36.8
Physiotherapist	14	13.2
Community Health Extension Worker	7	6.6
Others <sup>‡</sup>	18	17.0
<b>Years in service: Median (IQR)<sup>§</sup></b>	<b>10.5 (6.0 – 17.3)</b>	

<sup>†</sup>Standard deviation; <sup>‡</sup>Medical laboratory scientist, Pharmacist, Medical record officers, Radiographers; <sup>§</sup>Interquartile range

**RESULTS**

**Socio-demographic characteristics**

Only 106 (79.1%) respondents out of the 134 respondents who participated in the study had responses that were fit for analysis.

The mean age of the respondents was 38.8 ± 9.8 years, close to two-thirds (65.1%) were females, and the majority (98.1%) had tertiary education. Thirty-nine (36.8%) and 28 (26.4%) of the respondents were nurses and doctors, respectively (Table 1).

**Awareness about IDSR and involvement with IDSR**

Although the majority (81.1%) of the respondents reported that they were aware of the IDSR strategy, only 21.7% had been involved with any IDSR activity before the training, and a smaller proportion (19.8%) had ever been involved in a formal training on IDSR (Table 2).

**Impact of training on knowledge about IDSR**

The knowledge about the number of diseases that were listed for surveillance under the IDSR strategy in Nigeria for 15 (14.2%) respondents, out of the total respondents, improved from incorrect in the pre-test to correct in the post-test while the knowledge of a lower proportion (1.9%) became worse from correct in the pre-test to incorrect in the post-

test. This difference was statistically significant (p = 0.002) (Table 3).

From the total number of respondents, the knowledge of 39.6%, 17.9%, 25.5% and 15.1% of the respondents about the standard case definitions of AFP, yellow fever, measles and neonatal tetanus, respectively, improved from incorrect in the pre-test to correct in the post-test. The knowledge of a smaller proportion (2.8%, 2.8%, 0.9 % and 0.9%) of the respondents about the standard case definitions of AFP, yellow fever, measles and neonatal tetanus, respectively, however, worsened from correct in the pre-test to incorrect in the post-test. These differences were statistically significant (p < 0.001, p = 0.001, p < 0.001 and p < 0.001, respectively) (Table 3).

Knowledge about uses of IDSR001A and IDSR001B improved from incorrect in the pre-test to correct in the post-test among 56.6% and 46.2% respondents, correspondingly, out of the total number of respondents, while there was no negative change in knowledge about uses of IDSR001A and IDSR001B among any of the respondents. These differences were statistically significant (p < 0.001 and p < 0.001, respectively) (Table 3). Overall, the mean IDSR knowledge score increased from 11.2 ± 5.3 in the pre-test to 17.9 ± 4.6 in the post-test (p < 0.001) (Table 3).

**Predictors of the post-test overall IDSR knowledge score**

There was a statistically significant difference in the mean post-test overall IDSR knowledge score between the male respondents (16.4 ± 5.1) and the female respondents (18.7 ± 4.1) in bivariate analysis (p = 0.012). There was also a statistically significant difference in the mean post-test overall IDSR knowledge score between the doctors, nurses, physiotherapists, community extension workers and other health workers in the bivariate analysis (p = 0.001). The pre-test overall IDSR knowledge score was positively correlated with the post-test overall IDSR knowledge score, and this correlation was statistically significant (p = 0.001) (Table 4).

The predictors of the overall IDSR knowledge scores in the post-test were the respondents' sex, designation and pre-test overall IDSR knowledge score. The mean post-

Table 2: Awareness of and previous involvement with IDSR activities

<i>Variables</i>	<i>Frequency</i>	<i>Percentage (%)</i>
<b>Awareness of IDSR</b>		
No	20	18.9
Yes	86	81.1
<b>Previous involvement in IDSR activity</b>		
No	83	78.3
Yes	23	21.7
<b>Previous formal training on IDSR activity</b>		
No	85	80.2
Yes	21	19.8

test overall IDSR knowledge score for the females when compared to the males was statistically and significantly higher [ $\beta = 2.977$  (95%CI: 0.993-4.960)]. The mean post-test overall IDSR knowledge score for doctors and nurses were statistically and significantly higher, [ $\beta = 5.059$  (95%CI: 2.599-7.519)] and [ $\beta = 2.330$  (95%CI: 0.026-4.634)] respectively, when compared to the other health workers

that were not doctors, nurses, physiotherapists or community health extension workers. As the mean pre-test overall IDSR knowledge score increased by one, the mean post-test overall IDSR knowledge score increased by approximately 0.2 [ $\beta = 0.225$  (95%CI: 0.070-0.381)] (Table 4).

Table 3: Impact of training on knowledge of respondents about IDSR

<i>Variables</i>	<i>Frequency (%) †</i>	<i>Frequency (%) ‡</i>	<i>p-value*</i>
<b>Knowledge of number of diseases under IDSR</b>	15 (14.2)	2 (1.9)	0.002
<b>Knowledge of standard case definitions of diseases under surveillance</b>			
Acute flaccid paralysis	42 (39.6)	3 (2.8)	< 0.001
Yellow fever	19 (17.9)	3 (2.8)	0.001
Measles	27 (25.5)	1 (0.9)	< 0.001
Neonatal tetanus	16 (15.1)	1 (0.9)	< 0.001
Lassa fever	11 (10.4)	3 (2.8)	0.057
<b>Knowledge of IDSR reporting forms</b>			
IDSR 001A	60 (56.6)	0 (0.0)	< 0.001
IDSR 001B	49 (46.2)	0 (0.0)	< 0.001
IDSR 001C	28 (26.4)	1 (0.9)	< 0.001
IDSR 002	39 (36.8)	0 (0.0)	< 0.001
IDSR 003	42 (39.6)	0 (0.0)	< 0.001
AFP 001	50 (47.2)	0 (0.0)	< 0.001
AFP 002	30 (28.3)	0 (0.0)	< 0.001
AFP 003	33 (31.1)	0 (0.0)	< 0.001
<b>Knowledge of designated authorities to whom notifiable diseases are reported to in Nigeria</b>			
Health facility surveillance focal person	22 (20.8)	2 (1.9)	< 0.001
Local Government surveillance officials	29 (27.4)	7 (6.6)	< 0.001
State Ministry of Health	23 (21.7)	4 (3.8)	< 0.001
Federal Ministry of Health	27 (25.5)	4 (3.8)	< 0.001
<b>Knowledge of uses of IDSR</b>			
To know the trends in disease occurrence	19 (17.9)	3 (2.8)	0.001
For disease prevention and control	20 (18.9)	2 (1.9)	< 0.001
For statistics and planning	17 (16.0)	2 (1.9)	0.001
To detect and notify disease outbreak	19 (17.9)	1 (0.9)	< 0.001
For record or reference purposes	20 (18.9)	2 (1.9)	< 0.001
For research purposes	23 (21.7)	4 (3.8)	< 0.001
To initiate and monitor interventions	21 (19.8)	4 (3.8)	0.001
For reporting to DSNOs and other authorities	27 (25.5)	2 (1.9)	< 0.001
For health education and advocacy	23 (21.7)	4 (3.8)	< 0.001
To determine prevalence of disease	23 (21.7)	2 (1.9)	< 0.001

	<b>Pre-test</b>	<b>Post-test</b>	<b>p-value**</b>
Overall IDSR knowledge score: Mean score ± SD	11.2 ± 5.3	17.9 ± 4.6	< 0.001

†Proportion of respondents out of the total respondents who had incorrect knowledge in the pre-test but had correct knowledge in the post-test

‡Proportion of respondents out of the total respondents who had correct knowledge in the pre-test but had incorrect knowledge in the post-test

\*p-value in McNemar’s test

\*\*p-value in Paired t-test

Table 4: Bivariate and multivariate analysis of predictors of post-test overall IDSR knowledge score

<i>Variables</i>	<i>Mean post-test overall IDSR knowledge score ± SD</i>	<i>Test statistics</i>	<i>p-value*</i>	<i>β-coefficient (95%CI)**</i>	<i>p-value***</i>
<b>Age in years</b>		r = 0.081†	0.408		
<b>Sex</b>					
Male	16.4 ± 5.1	t = -2.571‡	<b>0.012</b>	Reference	
Female	18.7 ± 4.1			2.977 (0.993 – 4.960)	<b>0.004</b>
<b>Level of education</b>					
Secondary	18.5 ± 2.1	t = 0.179‡	0.858		
Tertiary	17.9 ± 4.6				
<b>Designation</b>					
Doctor	20.0 ± 4.2	F = 5.302§	<b>0.001</b>	5.059 (2.599 – 7.519)	<b>&lt;0.001</b>
Nurse	18.8 ± 3.9			2.330 (0.026 – 4.634)	<b>0.048</b>
Physiotherapist	15.9 ± 4.4			2.094 (-0.821 – 5.008)	0.157
Community Health Extension Worker	15.9 ± 4.6			-0.190 (-3.769– 3.389)	0.916
Others	15.2 ± 4.7			Reference	
<b>Years in service</b>	12.0 ± 8.1	r = 0.103†	0.296		
<b>Awareness of IDSR</b>					
No	14.3 ± 9.5	t = -1.386‡	0.169	Reference	
Yes	18.0 ± 4.4			2.332 (-2.308 – 6.973)	0.321
<b>Previous involvement in IDSR activity</b>					
No	17.4 ± 4.6	t = 1.165‡	0.247		
Yes	18.4 ± 4.5				
<b>Previous formal training on IDSR activity</b>					
No	16.7 ± 5.3	t = 1.516‡	0.133	Reference	0.220
Yes	18.3 ± 4.3			-1.292 (-3.368 – 0.783)	
<b>Pre-test overall IDSR knowledge score</b>		r = 0.322†	<b>0.001</b>	0.225 (0.070 – 0.381)	<b>0.005</b>

\*p-value in bivariate analysis; \*\*β-coefficient (95% Confidence Interval); \*\*\*p-value in multiple linear regression; †Test statistics in correlation analysis; ‡Test statistics in student t-test; §Test statistics in One-way ANOVA; F (8, 97) = 5.709, p < 0.001, R<sup>2</sup> = 32.0%

**DISCUSSION**

This quasi-experimental study found that training on IDSR for frontline health workers, who are not designated public health surveillance officers, has the capacity to improve their knowledge on IDSR. Findings from this study also suggest that female health workers who are either doctors or nurses and had a higher pre-test overall IDSR knowledge score were more likely to have better short-term knowledge of IDSR following training.

The pattern of IDSR awareness and involvement in formal training on IDSR core functions among our study participants was

similar to what was reported by Jinadu and colleagues in another South-western State in Nigeria (Jinadu et al., 2018). Just as we found in our study, they also found that a high proportion of their study participants were aware of the IDSR strategy for epidemic-prone diseases, but only a few had been involved in formal training on IDSR core activities. This finding suggests that health workers are getting information about IDSR from sources other than formal training. We recommend that public health surveillance be included in the training curriculum of health workers, both at the undergraduate and postgraduate levels,

so that even before they graduate, they would have been sensitised about IDSR.

The proportion of respondents who had been involved in any IDSR core functions reported by Jinadu and colleagues was, however, in contrast to what we reported in our study. They reported that 93.3% of their respondents had been involved in any IDSR core functions (Jinadu et al., 2018), whereas only 21.7% of the study participants in our study reported that they had ever been involved in any IDSR core functions. The difference in the composition of study participants and the local context of the study settings may account for the difference in involvement in IDSR core functions noted between our study and that of Jinadu and colleagues.

Consistent with previous studies on public health surveillance (Bawa & Olumide, 2005; El-Nimr & Wahdan, 2013; Fatiregun, Sangowawa, & Abubakar, 2009; A. Fatiregun, Sangowawa, & Abubakar, 2010; Fatiregun, Bawa, Adejugbagbe, & Isere, 2017; Lar, Afolaranmi, Tagurum, Uzochukwu, & Zoakah, 2015), the overall knowledge of our study participants about IDSR increased in the post-test immediately after receiving a training on IDSR. This finding implies that training has the capacity to improve knowledge of frontline health workers on IDSR. As such, there is a need for frontline health workers to be trained periodically on IDSR so that they can have access to updated information if the war against diseases under surveillance, particularly those that need immediate notification, is to be won ultimately.

Although statistically significant, the improvement in some of the knowledge domains assessed after training our study respondents on IDSR was not so impressive. Particularly of concern is the knowledge of the standard surveillance case definitions of the diseases, which were assessed in this study. Toda and colleagues also expressed the same concern as the knowledge of health workers on standard case definitions of tracer diseases, six months following a refresher surveillance training, was also suboptimal in their study. (Toda et al., 2018) Identification or detection of cases and events is one of the surveillance core functions expected to take place at all levels of the health system (Federal Ministry of Health, 2013; World Health Organization & Centers for

Disease Control and Prevention, 2010). At the health facility level, frontline health workers are in the best position to do this since they have direct access to the patients when they present to the health facility. Case detection of epidemic-prone diseases, diseases targeted for eradication and elimination, and other diseases of public health importance by frontline health workers for the purpose of surveillance will, however, not be so easy if they are not well-grounded about the standard surveillance case definitions of the diseases. Hence, a yearly training on IDSR, as done in Nigeria, may not be adequate for frontline health workers. Rather, continuous training, including on-the-job training, and supportive supervision should be the way to go, and the standard surveillance case definitions of the diseases under surveillance should be stressed during these exercises because this is the most important thing the health workers need to know to be able to identify the diseases under IDSR. Availability and display of information, education and communication materials on standard surveillance case definitions in offices is another way of learning, and this has been found to improve knowledge of health workers on standard surveillance case definitions (Toda et al., 2018).

Another worrisome finding is the fact that the knowledge of a few participants about the knowledge domains assessed became worse after the training. Multiple reasons may be responsible for this negative change. First, the training participants in our study who fell into this category may be overconfident in their knowledge about IDSR and hence were not paying much attention to the salient points during the training. Another possible reason that can be proffered is that this category of training participants did not pay attention to details when filling out the post-test questionnaire. They may feel their responses in the pre-test were too detailed and are not needed in the post-test. Lastly, this set of training participants might have been confused by the trainers. Whatever the reason, however, the need for continuous and regular training on IDSR cannot be overemphasised. Trainers should also ensure that strategies to assess the impartation of knowledge are used during training.

Consistent with a previous study on the effect of training of school physicians on their knowledge regarding disease surveillance in Alexandria (El-Nimr & Wahdan, 2013), we found that health workers with higher overall pre-test knowledge scores on IDSR were more likely to have higher overall post-test knowledge scores. This sounds reasonable. Those with higher scores are probably just building on the knowledge which they already have. We recommend that, before the proper commencement of subsequent trainings, the pre-test scores should be evaluated to know the weak points of the majority of the training participants. Such weak points should be well stressed during the training, and random assessment of the training participants should be done during the training to be sure that the majority understand what is taught.

Again, in line with previous studies (Fatiregun et al., 2010; A. Fatiregun et al., 2017), our study found that female health workers were more likely to have higher overall post-test knowledge scores. The reason why this is so is not clear, and further studies to determine why female health workers have better post-test knowledge scores following a surveillance training are suggested.

The observation that doctors and nurses were more likely to have higher overall post-test knowledge scores in our study was not surprising. The exposure of doctors and nurses to disease-specific diagnosis and management in their formal training is an advantage in understanding case definitions and other disease surveillance concepts. Our finding thus suggests that special attention should be paid to other cadres of health workers who are neither doctors nor nurses during subsequent training, and if possible, they should be trained separately from the doctors and nurses so that the trainers can come down to their level.

A limitation to this study, which must be acknowledged, is the small sample size, which may limit the generalizability of the study findings. Also, because we did not determine how many subjects would be required from the population of health workers in the state to demonstrate impact, representativeness of the sample is another issue in generalization. Despite this limitation, our study was able to add to the existing body of knowledge on disease surveillance.

## CONCLUSION

Training on IDSR for frontline health workers who are not designated public health surveillance officers has the capacity to improve their knowledge of IDSR. Hence, the need to invest more in IDSR training for all health care workers, irrespective of their previous involvement in IDSR, cannot be overemphasised. These trainings on IDSR should be conducted regularly for all healthcare workers.

**Conflict of interest:** None to declare.

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