Original Research Article

Predictors of functionality of the community-based disease surveillance and notification system in Anambra State, Nigeria

Abstract

Background: Community-based disease surveillance systems (CBSS) are initiated to complement the health facility-based surveillance systems. The timeliness and completeness of reporting, CBSS as well as knowledge of CBSS among focal points, have been noted to influence the effectiveness of CBSS. However,, some independent predictors, may play roles in the functionality of the CBSS. This study determines the key factors affecting the effectiveness of CBSS in Anambra State, Nigeria**.**

Methods: A cross sectional descriptive study was carried out among 360 community -based focal points in the State, selected using multistage sampling technique. Data were obtained by interview using pre-tested, semi-structured questionnaires, except data on completeness of reporting which were obtained using observation checklist. Data were analysed using IBM SPSS version 20. Tests of statistical significance were done using Fishers exact, chi-square cum t tests, ANOVA and binary logistic regression as appropriate. Level of statistical significance was set at 5%

Results: The timeliness of reporting was (82.9%) with a completeness of (28.1%). The independent predictors of the functionality of the CBSS were means through which detected diseases were notified, availability of supervisors for focal points, keeping of records and giving feedback to the communities.

Conclusions: The index study reported high level of timeliness and poor completeness of reporting, as well as predictors of the sub-optimally functional CBSS in the State. There is need for sustained training and supervision of focal points, improved record keeping cum means of disease notification, and efficient feedback mechanism to the CBSS in Anambra State

Key words/phrases: Community-based surveillance, timeliness, completeness, predictors, Nigeria

1. Introduction

"Data generated from Disease Surveillance and Notification (DSN) is used for public health management at different levels of the health system"(1). "The CBSS relies on a network of lay people, referred to as community focal points to improve public health surveillance and response by bringing community participation to play in detecting, reporting, responding to and monitoring of health events" (2,3,4,5).

The establishment of effective surveillance and response strategies has been recognized globally as the pillar for tackling outbreaks as well as the control, elimination and eradication of diseases (6). Hence the establishment of national DSN systems. However, these systems were mainly health facility-based, passive, and function on the basis of the health-seeking behaviors and self-reporting (7).

The effectiveness of CBSS is influenced by a variety of factors, which have been divided into those at the organisational level, such as the provision of standards and guidelines, training, supervision, communication facilities, and resources (1, 2), and factors at the individual level, such as meeting needs, altruism, accessibility of family and community support, the provision of incentives, community involvement, and ownership, among others (8,9). Because of the high level of ignorance and lack of information present in many underdeveloped nations, particularly in sub-Saharan Africa, ailments are almost universally thought to be signs of demonic attack or to have been "bewitchment" by the evil (6,7,10). This, notion, coupled with the misconception that orthodox treatment could worsen disease conditions have led to disease cases presenting to alternative care providers, rather than health facilities (10).

Secondly, due to the weak health systems and the relative lack of access to health care services in sub-Saharan Africa, many disease cases do not present to health facilities (7,11,12,13).

"Nonetheless, there is a dearth of data on community-based surveillance to substantiate this claim in Nigeria and in most parts of the African sub-region. Where studies have been done on DSN, these were at the health facility level" (14,15,16). The study's findings are anticipated to aid in closing this knowledge gap and serve as a guide for legislators as they work to improve the State's current CBSS. The index research was designed to determine the key factors affecting the effectiveness of CBSS in Anambra State, Nigeria.

Research Report

''What is already known on this subject?

The health workers were not operating the surveillance system in the State to optimal functionality. Studies have been done on surveillance, but these were at the health facility level, without emphasis on the community-based aspect.

''What this study adds?

The timeliness of reporting was high, while the completeness was low. The focal points have high knowledge of CBSS, while the independent predictors of the functionality of the CBSS were means through which detected diseases were notified, availability of supervisors for focal points, keeping of records and giving feedback to the communities.

2. Materials and methods

2.1.Study setting: This study was conducted in Anambra State, South-Eastern Nigeria. The State has a current projected population of 5,527,809 persons (17). There are 1320 focal points in the State (18). "There are two tertiary health-care institutions in the State: the Nnamdi Azikiwe University Teaching Hospital, Nnewi and the Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Awka. It also hosts other health-care institutions at the secondary and primary levels" (19).

"Data on DSN in the State are collected by the DSNOs at the LGAs through a network of health facility focal persons who collect and report to them based on DSN case definitions and using designated reporting forms. The State has a functional M&E office. After analysis of data at the State level, the information, is then sent to the Federal Ministry of Health and the WHO country office every month" (20). "The WHO conducts active surveillance and verifies reported cases vis-à-vis the 2015 International Health Regulations requirements" (21). The DSN process is coordinated by the State Epidemiologist.

2.2. Study Design: This was a cross-sectional descriptive study.

2.3. Study Population: This comprised the community focal points in Anambra. 2.*3.1. Inclusion criterion:* Participation in CBSS in the state for at least a year. 2.*3.2. Exclusion criterion:* Being too sick to participate in the study. For the purpose of this study, severity of ill health was graded on a scale of 1(one) to 5 (five), with 1 (one) being the lowest severity and 5 (five) being the highest severity. Participants who reported 4 (four) or 5(five) were deemed as being too sick to participate.

2.4. Sample Size Determination: The sample size of community focal points for this study was determined firstly, using Cochran formula for studying proportions in populations >10,000 (22). "Proportion of respondents that sent in reports early. In a study conducted in the northern region of Ghana, 74% of the expected number of village monthly reports were received timely" (23). This was considered to determine the minimum sample size (n) at 296. However, the target population was the community focal points in Anambra State and had an estimated population (N) of 1320 (18). Then the formula for studying proportions with populations <10,000 (22): was considered to determine the final sample estimate (n*f*) at 242. Anticipating a response rate of 90%, (f=% of response=90% (0.9)) to compensate for non-

response, the study sample size was calculated as (n*f*)/f (22) = $=\frac{242}{1-0.10}$ =269, but this was increased to 360 respondents, to improve the power of the study.

2.5. Sampling Technique: Multi-stage sampling technique was used to conduct this study. Anambra State is made up of three senatorial zones (Anambra North, Anambra Central and Anambra South), 21 LGAs (7(seven) urban and 14 rural) and 330 wards (ranging from 10 – 20 wards per LGA). Each ward has 4 (four) community focal points. *Stage1 - Selection of local government areas*: The 21 LGAs were stratified into the 7(seven) urban and 14 rural LGAs, giving a ratio of 1: 2. Using proportionate allocation, 3(three) LGAs were selected from the urban stratum while 6(six) LGAs were selected from the rural stratum through simple random sampling technique by balloting. Thus Onitsha South, Awka South, and Nnewi North LGAs were selected from the urban stratum while Oyi, Anambra East, Njikoka, Anaocha, Orumba North and Orumba South LGAs were selected from the rural stratum. *Stage 2 - Selection of Wards:* Proportionate numbers of wards were selected from each of these selected LGAs using Bowler's proportional allocation formula stated below as follows:(24): For Example, the number of wards selected for studying from Awka South LGA was 12 out of 20 wards. *Stage 3 - Selection of* community focal points: From each of these selected wards, all the community focal points met the eligibility criteria and were thus recruited into the study. In Awka South LGA for example, 48 respondents (12 wards x 4 community focal points) were studied.

2.6. Study Instruments: "A 46-item questionnaire from the WHO's protocol for the assessment of national communicable disease surveillance and response systems" (25) and "relevant literature (26) were used to collect data from the community focal points on socio-demographic characteristics, awareness and knowledge of CBSS, timeliness of reporting of CBSS and key factors affecting the functionality of the CBSS.. Observation checklist was used in obtaining data on completeness of reporting" (26).

2.7. Data Collection Methods: This involved two quantitative data collection methods: semi-structured interviewer-administered questionnaires and observation checklist.

2.8. Data Management: *2.8.1.Measurement of variables:* The level of knowledge of the community focal points was measured on a scale of 100%. (Ten correct answers were used to score knowledge. Each correct answer scored ten marks). Respondents were rated accordingly thus: 0 to 40% = poor knowledge; 50 to 70% = fair knowledge; 80 to 100% =good knowledge. Then, the composite score for the level of knowledge of the community focal points was obtained by dividing the total knowledge score of the respondents by the number of the respondents. The main outcome /dependent variable for this study was functionality of the CBSS while the independent variables were the key factors affecting the functionality of the CBSS. The functionality of the CBSS is a qualitative variable and was assessed via two key indicators of a quality reporting system-: Percentage timeliness and percentage completeness of reporting from the community level to the health facility level. Timeliness of disease notification was assessed as the proportion of expected reports received on time. Notification of the selected diseases immediately or within 24 hours of detection were considered as timely while notification after 24 hours of detection were considered as untimely. Timeliness of reporting was rated thus: (≥ 80% - optimal; <80% - suboptimal) (27). "Completeness of reporting was assessed using the proportion of expected reports received by the health facility focal persons or the DSNOs from the community focal points within the last 3 months from the time of the survey. The proportion of the community informant registers with the minimum expected surveillance data within the last 3 months from the time of the survey served as proxy for the proportion of expected reports received by the health facility focal persons or the DSNOs from the community focal points. Completeness of reporting was rated thus: (≥ 80% - optimal; <80% - suboptimal)" (27). For the purpose of this study, the CBSS is assumed to be functioning optimally if both indicators are up to ≥ 80%

and to be functioning sub-optimally if both or any of these two indicators is not up to 80%.

2.8.2.Statistical analysis: "The data collected were inspected for data collection or coding errors and then entered into and analysed with the International Business Machines-Statistical Package for Social Sciences (IBM-SPSS) version 20" (28). Frequency distribution of all relevant variables was developed. Means and proportions were calculated, while associations between variables were tested using Chi square, Fisher's exact test cum t tests and ANOVA as appropriate. The independent variables that were statistically significant on bivariate analysis were included in the logistic regression model for multivariate analysis and their independent effect on the outcome variable was determined. Level of statistical significance was set at p-value ≤ 0.05 for all inferential analysis and standard deviations. Odds ratios and 95% confidence interval were used in the data presentation for the regression model.

3. Results

The questionnaires were administered to a total of 360 community focal points in nine select LGAs of the State and were all retrieved, giving a response rate of 100%. **Table 1 summarizes the socio-demographic characteristics of the respondents.** The mean age of the respondents was 40.5 ± 9.8 years, while only 11(3.1%) of them had no formal education.

Table 2 summarizes the awareness and knowledge of CBSS among the respondents. Three hundred and fifty eight (99.4%) were aware of CBSS, 353 (98.1%) knew that they should report detected diseases, while 372 (75.4%) had good level of knowledge. The overall mean knowledge score was 83.7% ± 15.6.

Table 3 highlights the timeliness and completeness of disease notification among the respondents. Majority of them, 304 (84.4%) had ever detected a notifiable disease. The

timeliness of reporting in the CBSS was (82.9%). The completeness of reporting was (28.1%).

Table 4 summarizes the factors affecting the functionality of the CBSS in the State. Altruism was the main reason given by most of them for participating in the CBSS. Almost all 351 (97.5%) had ever been trained in CBSS. The principal challenges encountered by the respondents in carrying out CBSS were lack of funds 122(43.4%) and means of transportation 104(37.0%). Only 222(61.7%) of them felt satisfied with the CBSS.

Table 5 shows the multivariate analysis of factors affecting the functionality of the CBSS. After adjusting for potential confounders, the odds ratio for reporting notifiable diseases were statistically significant and the following are thus independent predictors of timeliness of reporting of notifiable diseases: other means apart from phone calls / SMS (OR = 2.765, CI = 1.288 – 5.935, p = 0.009); availability of supervisors for focal points (OR = 0.231, CI = 0.107–0.502, p = 0.000). For completeness of disease case notification, the independent predictors are: completely notifying detected disease cases by community focal points who kept records (AOR = 820.817, CI = 168.429-4000.138, p = 0.00 0) and giving feedback to the community. (AOR = 4.013, CI = 1.380-11.670).

4. Discussion

The index research determines the predictors of functionality of CBSS in Anambra State, Nigeria. Not up to four in every hundred community focal points (3.1%) in this study had no formal education. This could be explained by the high literacy rates (91.4% in men) and (91.8% in women) in Anambra State as reported by the Nigeria Demographic and Health Survey (NDHS) 2013 (29). This is supported by the submissions of a Nigerian National Literacy Survey conducted by the National Bureau of Statistics, in which Anambra State had

a youth literacy rate of 92.9% and an adult literacy rate of 74.0%. (30). Even though a significant proportion of the respondents (about eleven in every hundred) in this study reports that they were unemployed, it may not mean that they do not have other sources of income since findings from the analysis of the reasons for becoming community focal points in this study showed that only 8.1% of them mentioned 'hope for employment.

This study reveals a high level of knowledge of CBSS by community focal points. This finding from the index study indicates that the community focal points studied are well informed about CBSS and can successfully detect and report notifiable diseases as expected. This finding is in keeping with the findings of the review of IDSR system in Nigeria by external experts from WHO which showed that community focal points have adequate knowledge of diseases under in detecting, reporting, responding to and monitoring of health events in the community (2,3,4,31). This finding is also similar to findings from studies elsewhere which showed that community volunteers were knowledgeable on the requirements of DSN (32,33). Contrary to these findings, the study by Isibor *et al.,* in northern Nigeria reported that apart from the DSNOs, all the other cadres involved in AFP surveillance, had poor knowledge of AFP. This finding could possibly be explained by the disparity in the educational statuses and literacy rates between these two regions (southern and northern)) of the country (7,29). Apparent gap in the level of knowledge of the community focal points could threaten the effectiveness of the CBSS in the study area (34). It is therefore imperative that we ensure periodic but comprehensive trainings and refresher courses on all the diseases targeted for surveillance in the State and not just on those being funded presently. This study shows an apparently greater than three- fourth and less than one-third of the participants had high timeliness and low completeness reporting of notifiable diseases respectively, in the CBSS in Anambra State. This implies that the CBSS in Anambra State is

functioning to provide timely information on the occurrence of outbreaks to the appropriate authorities. Even, when reports are timely, the CBSS is not functional enough to provide a comprehensive and representative picture of the health situation in the communities. This finding in the index study concurs with that in a study in Ghana (35). “The timeliness of reporting obtained in this study is comparable to that of 74% reported in a study by Maes and Zimicki (22) in northern Ghana”. Contrary to our findings, studies elsewhere reported appreciable levels of completeness ranging from 59% to 95.6% (22,36,37,38,39), However, the assessment of completeness of reporting via proxy data in the form of community focal points registers instead of from health facility records may have led to the apparently low value obtained in this study (37). Some community focal points may not have recorded the disease cases they detected and notified in their registers. The implication for this, is the probable compromised reliability in the quality of generated data (e.g. low value obtained for completeness of reporting) and the inaccuracies in disease evaluation and management accruing thereof.

“This study also examines the influence of some other factors on the functionality of the CBSS in the State. The age, gender, educational status and occupation of the respondents were significantly associated with either timeliness and or completeness of reporting. The index research has shown a relationship between means through which detected diseases were notified and timeliness of disease notification, as those who notified disease cases using other means were twice more likely to notify more timely than those who notified using phone calls or SMS. After adjusting for possible confounders, using means other than phones was found to be an independent predictor of notifying diseases timely. This finding in the current study is contrary to findings from other studies which showed that the use of mobile phones makes for a more effective and efficient data transmission process” (40,41). “It is however consistent with findings from some other studies which reported that in as much as

the use of mobile phones may sound promising to the functional potential of communication between community health workers and their supervisors, it may not always be feasible in countries that are not well developed where challenges involved in internet-based systems, electricity, finance and other factors may be obstacles to implementation" (7,32,41). This scenario is made worse in a country like Nigeria where power supply presently, is very epileptic or non-existent. It may be necessary to investigate other reporting alternatives, such as reporting diseases that have been found to only nearby health facilities and then to the DSNOs, in order to make sure that reports are sent to the next level promptly. Alternatively, the logistics (e.g. alternative sources of electricity like solar panels) to energise mobile phones for data transmission should be provided by the government.

"In the index study, keeping of records by the community focal points was found to be a significant predictor of completeness of reporting. This is consistent with findings from some other studies" (7,22,36,42). "After adjusting for potential confounders, keeping of records was also found to be an independent predictor of completeness of reporting in this study. Overall, (32.6%) of respondents in this study kept records. This finding in the index study is comparable to the 33.8% reported by Ababa in the pastoralist and semi-pastoralist communities in Ethiopia" (38). This could indicate that adequate number of detected disease cases may not have been reported from the community and concurs with the apparently low completeness of reporting and in essence functionality of the CBSS in this study.

Strength and limitation to the Study: The strengths include the (100%) response rate achieved, use of a standardised instrument, and assessment of functionality of CBSS across all (primary to tertiary) levels of health care. Also, the studied population is representative of the rural and urban settings in the State. Nonetheless, the reliability of data on completeness may have been affected by the use of proxy data in the form of community focal points registers. If the desired quality of data is to be obtained at the community level, then there

must be a reorientation of the focal points on the principles of CBSS, with a streamline of channels of reporting in the State (37). Further research needs to be conducted to provide more evidence for policy making.

Conclusions: The index study reported high level of timeliness and poor completeness of reporting. The independent predictors of the functionality of the CBSS were: means through which detected diseases were notified, availability of supervisors for focal points, keeping of records and giving feedback to the communities. The researchers therefore recommend as follows: There is need to institute rigorous mobilization and sensitization of communities and all other stake holders in order to create awareness of CBS in all the communities. The government should sustain the high level of knowledge of CBSS by the focal points by providing periodic training and supervision of focal points on all the diseases targeted for surveillance in the state. The logistics needed for adequate record keeping by the focal points should be fully provided by the organizers of the program. The channels of reporting in the CBSS in the State should be properly streamlined. There is need for improved and efficient mechanism for feedback to the communities in Anambra State.

Ethics approval and consent

The study has been examined and approved by the Nnamdi Azikiwe University Teaching Hospital Ethical Committee (NAUTHEC). Permission to conduct the study was obtained from the State Ministry of Health and the selected Local Government PHC Departments. In addition, verbal and written informed consents were obtained freely and without coercion from all the respondent for the conduct and publication of this research and assurance of confidentiality given Study participants were free to refuse or withdraw from the study at any time without any penalty. The study's purpose and objectives were explained to each participant prior to interview. All authors hereby declare that the study has therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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Tables

Table 1: Socio-demographic characteristics of the respondents

Variable	Frequency (N) N = 360	Percentage (%)
Age at last birthday (years)		
20 – 29	76	21.1
30 – 39	124	34.4
40 – 49	114	31.7
≥ 50	46	12.8
Mean age ± SD	40.5 ± 9.8	
Minimum, Maximum	20 years, 67 years	
Gender		
Male	105	29.2
Female	255	70.8
Educational status		
No formal education	11	3.1

Primary	22	6.1
Secondary	193	53.6
Tertiary	134	37.2
Occupation		
Civil service	115	31.9
Trading	123	34.2
Farming	37	10.3
*[1]Others	44	12.2
Unemployed	41	11.4
Religion		
Christianity	353	98.1
Traditional religion	7	1.9
Ethnic group		
Ibo	358	99.4
Yoruba	2	0.6
Length of service as a volunteer (years)		
1 - 3	252	70.0
4 – 6	76	21.1
7 – 9	12	3.3
≥ 10	20	5.6

***[1]Others – Nursing, patent medicine vendor, traditional birth attendant, artisan**

Table 2: Awareness and knowledge of community-based disease surveillance and notification among the respondents

Variable	Frequency(N) N = 360	Percentage (%)
Ever heard of CBS		
Yes	358	99.4
No	2	0.6
No	119	33.1
Do you know that you should report detected diseases		
Yes	353	98.1
No	7	1.9
Level of knowledge CBS (%)		
Poor	6	1.7
Fair	82	22.9
Good	272	75.4
Mean CBS knowledge score (%) ± SD	83.7 ± 15.6	

Minimum, Maximum score (%)	20,100

Table 3: Timeliness and completeness of disease notification among the respondents

Variable	Frequency(N) N = 360	Percentage (%)
Ever detected any notifiable disease		
Yes	304	84.4
No	56	15.6
Source of information on detected disease (N = 304)		
Routine visits to villagers	86	28.3
Family of sick person	152	50.0
Health committee	57	18.8
Traditional healer	9	3.0
Interval between detection and reporting of last detected case (N = 304)		
Immediately after or within 24 hours of detection	252	82.9
1-3 days after case detection	41	13.5
4 days or more after case detection	10	3.2
Detected case but did not report	1	0.3

Means through which notification of detected disease was sent (N = 303)		
Phone/SMS	261	86.1
*Others	42	13.9
Records of detected notifiable disease kept by informant		
Yes	116	32.6
No	244	67.8
Mode of keeping records (N = 116)		
Using registers / Exercise books	116	100
Reasons for not keeping records (N = 244)		
Non-availability of registers (exercise books)	145	59.4
Lack of time	44	18.0
See no need for it	24	9.8
Inability to write	8	3.3
Others	23	9.4
Community register completed within the last three months		
Yes	101	28.1
No	259	71.9

***Others – Letter writing, fax, email, transport by bus.**

Table 4: Factors affecting the functionality of the CBSS in Anambra State, Nigeria

Variable	Frequency N = 360	Percentage (%)
Reason for becoming a volunteer (Multiple response)		
Desire to save lives	266	73.9
To educate people on the causes of disease	139	38.6
To know when a disease outbreak is occurring	53	14.7
Chosen by the health committee	36	10.0
Hope of employment	29	8.1
To acquire knowledge	40	11.1
To become visible and well known	9	2.5
Received training in CBSS		
Yes	351	97.5
No	9	2.5
Availability of supervisors		
Yes	319	88.6

No	41	11.4
Volunteer benefit from CBS		
Yes	343	95.3
No	17	4.7
Benefits from being a an informant (Multiple response)		
Receiving trainings	265	76.8
In-kind gifts from community members	20	5.8
Community members help with farm work	6	1.3
Recognition from the community	97	28.1
Recognition from health workers	155	44.9
Types of challenges in CBS (Multiple response)		
Lack of means of transportation	104	37.0
Non regularity of payment of stipend	50	17.8
The meagre amount of stipend attached to notifying disease	52	18.5
Inability to write	2	0.7
Lack of funds	122	43.4
Lack of cooperation from community members	44	15.7
The long hours spent during trainings	3	1.1
Lack of personal protective equipment	2	0.7
Lack of time	16	5.7
Inadequacy of trainings	23	8.2
Poor communication network	28	10
Lack of work materials	32	11.4
Coping strategies (N = 280)		
Support from family members	75	26.5
Relying on incentives from organizations	56	20.0
Hope of acquisition of knowledge	114	40.7
Supportive supervision	34	12.1
Being gainfully employed	1	0.4
Satisfied with CBS		
Yes	222	61.7
No	138	38.3

Table 5: Multivariate analysis of factors affecting the functionality (Timeliness and Completeness) of disease case notification among the respondents

Variable	**Timeliness**		**AOR**	**95% CI**	**Test statistics**	**p-value**
	Timely	**Untimely**				
Means of notifying detected disease					$\chi^2 = 6.945$	
Phone call / SMS	223 (85.3)	38 (14.6)				
Others	29 (69.0)	13 (31.0)	2.765	1.288 – 5.935		0.009*
Availability of supervisors					$\chi^2 = 6.945$	
No	21 (60.0)	14 (40.0)				
Yes	231 (85.9)	38 (14.1)	0.231	0.107 – 0.502		0.000*
	Completeness of		**AOR**	**95% CI**	**Test statistic**	**p-**

	reporting					value
	Yes	**No**				
Record kept in the last one year					Exact = 278.292	
No	2 (0.8)	242 (99.2)	1			
Yes	99 (85.3)	17 (14.7)	820.817	168.429 – 4000.138		0.000*
Feedback given to the community					$\chi^2 = 23.197$	
No	17 (13.0)	114 (87.0)	1			
Yes	84 (36.7)	145 (63.3)	4.013	1.380 – 11.670		0.011*
Satisfied with CBS					$\chi^2 = 13.131$	
No	25 (18.1)	113 (81.9)	1			
Yes	76 (34.2)	146 (65.8)	0.563	0.165 -1.924		0.360

***Statistically significant ($p \leq 0.05$), Exact = Fisher's exact, χ^2 = Chi square, AOR = Adjusted odds ratio, CI = Confidence interval.**