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Full Length Research Paper

Epidemiologic study of influenza infection in a developing country – experience in a tertiary care center in South East Nigeria

Prosper OU Adogu*[1], Chiedozie I Achebe[2] and Chika F Ubajaka[1]

[1]Nnamdi Azikiwe University Teaching Hospital (NAUTH), Department of Community Medicine, Nnewi, Anambra state, Southeast Nigeria.
[2]Nnamdi Azikiwe University Teaching Hospital (NAUTH), Department of Family Medicine, Nnewi, Anambra state, Southeast Nigeria.
*Corresponding author's e-mail: prosuperhealth@yahoo.com; Phone: +2348037817707

ABSTRACT

The epidemiology of influenza varies depending on locale. Influenza is generally associated with seasonal (winter) epidemics in temperate region, but all year – round pattern with a rainy season peak is observed in the tropical regions. The Nigeria Influenza Sentinel Site Surveillance is a modified form of global Influenza surveillance and is an all year programme. This involves search for Influenza – like illness (ILI) and severe acute respiratory illness (SARI) in some selected sentinel site hospitals. This study is part of the National Influenza sentinel site surveillance as Nnamdi Azikiwe University Teaching hospital (NAUTH) Nnewi in Anambra state Southeast Nigeria is one of the sentinel site facilities. The few epidemiologic studies of human influenza in the country indicate that sporadic cases of influenza may occur throughout the year and that sporadic outbreaks do occur mainly during the rainy season or during times of the year with lower environmental temperatures. The influenza sentinel site surveillance at Nnewi – a unique geographical position in Southeast Nigeria will provide an efficient and reliable means of obtaining epidemiological and laboratory data regarding the disease burden, seasonality, and strain circulation. These data will critically inform prevention and control strategies. This is a cross – sectional, prospective and hospital based study. NAUTH Nnewi represents the Southeast zone of the 4 sites activated for Influenza Surveillance in Nigeria. Anambra state has an area of 4.844SqKm and a population of 4,055,048 by 2006 census. It has a population density of 840/Km^2. It is located in the warm tropical climate with relatively high temperature throughout the year. It has two seasons-rainy or wet season that last from mid-March to November and the Dry season that occupies the rest of the year. It has a mean annual temperature of 27^{o}C. The amount of rainfall is April – September =141.2cm, percentage of rainfall is 78% and October – March = 39.9cm with percentage of rainfall as 22%. The methodology used is according to the Federal Ministry of Health (FMOH) Nigeria protocol for national Influenza sentinel surveillance (FMOH. Protocol for National Influenza Sentinel site Surveillance: Epidemiology Department, Nigeria Centre for Disease Control, Revised Dec. 2011. P 6-12). A convenient sampling method was adopted in this study. Total number of samples collected from January – December 2011that met the ILI and SARI criteria were 347 out of the expected 832 by the sampling method used. Cases of ILI and SARI were seen throughout the year with the highest incidence for both occurring in July. The collected samples were sent to Influenza Reference Laboratory, out of which 305 were processed. Total ILI cases were 226(65.10%) while SARI cases were 121(34.90%). Out of the 305 processed, 278 tested negative, while there were 13 cases of Influenza type A and 10 of Influenza type B. Of the type A 7 were females while 6 were males. Also for type B 6 were females while 4 were males. Meanwhile 153 females and 125 males tested negative. Four cases were missing. The most affected age group for both ILI and SARI was 0-4 years with 111 ILI cases and 78 SARI cases while the age group 10-14 years is the least affected with 4 ILI and 3 SARI cases. The male (M): female (F) ratio for ILI is 103:123 while for SARI cases the ratio of M:F is 59:62. The study showed that acute respiratory infection occurs throughout the year with the highest incidence occurring in July which is the coldest and most rainy period of the year. The existence of Influenza type A and type B among the population was established and occur sparingly throughout the year. The target population for control and treatment is the under five. The percentage hospitalization due to SARI cases peaked in July which is the period with the highest burden of severe acute respiratory infection in the region. The implementation of Influenza Sentinel Surveillance enabled characterization of the epidemiology and seasonality of influenza in South East Nigeria for the first time. Future efforts should determine the population-based influenza burden to inform interventions such as targeted vaccination

Keywords: Epidemiology, Influenza, Tertiary care center, South east Nigeria

INTRODUCTION

Any influenza pandemic has the potential to cause millions of deaths and significantly impact on the global economy (Burns et al., 2008). Influenza is an acute viral respiratory tract disease often characterized by fever, headache, myalgia, coryza, sore throat, cough and prostration. Influenza is indistinguishable from other respiratory viral diseases without laboratory confirmation (Molinari et al., 2007). Influenza A and B viruses are respiratory pathogens that affect humans and other mammals and are responsible for substantial morbidity, mortality and decreased productivity in the United State of America (Molinari et al., 2007). Vaccination provides the primary means for protection from Influenza virus infections. Minor changes in the surface genes, termed 'antigenic drift' are responsible for annual seasonal epidemics. Antigenic shift, on the other hand, represents a major change in antigenicity such that results in the appearance of a novel influenza virus that can easily be transmissible among humans, leading to a pandemic. Due to the continuous evolution of major viral antigens, hemaglutinin (HA) and neuraminidase (NA) vaccine strains must be selected annually. This selection is based on global surveillance of A (H3N2), A (H1N1) and B Influenza viruses circulating in man.

Influenza is generally associated with seasonal (Winter) epidemics in temperate region, but a year – round pattern with a rainy season peak is observed in the tropical regions (Hampson, 1999; Viboud et al., 2006). In an epidemiological study of Influenza in Okinawa Prefecture, located in the subtropical zone of Japan indicated that the seasonality of Influenza in Okinawa showed two peaks (from December to March and May to August) (Suzuki et al., 2009). This pattern is characteristic of Influenza circulation in subtropical areas, as reported for North Vietnam, which has two peaks: in the hot rainy season and in winter (Saito et al., 2008).

The epidemiology of influenza varies according to the region in which it is found. In North America and other northern climates, influenza activity is generally seasonal meaning that activity increases during the cooler months and peaks from December to March. There is large variation in this activity, however, and peaks may occur as early as October and as late as May (Smith et al., 2007; Dowdle et al., 1974). In the United States, influenza rarely occurs between May and September, unless the virus was acquired outside the United States. For locations that are more proximate to the equator, the influenza season becomes prolonged to the point of multi-phasic or year round disease, and is influenced by other climate patterns such as rainy season (Suwanjutha et al., 1990; Nguyen et al., 2007; Dowell and Ho, 2004). The sentinel site surveillance at Nnewi – a unique geographical position in Eastern Nigeria allows for the study of the changes in the seasonal pattern of Influenza in the tropical climate. Sentinel site surveillance in Nnewi to monitor Influenza virus circulation is important for elucidating the dynamics of the virus transmission in this part of Nigeria which is a tropical country.

Current Epizootics of Avian Influenza among poultry and wild birds, and subsequent risk to human health highlight the necessity for surveillance systems to detect Influenza virus with pandemic potential. As the concern of human Influenza pandemics grows, Nigeria is preparing for this event alongside the rest of the global community. As part of this preparation, the Nigerian Ministry of Health established Influenza surveillance to understand the basic epidemiology of this infection in Nigeria. This involves search for Influenza – Like illness (ILI) and severe acute respiratory illness (SARI) in some selected sentinel hospitals. In addition to describing the epidemiology of Influenza, the sentinel surveillance will also characterize and epidemiologically link Influenza strains in circulation through a laboratory component. Sentinel surveillance may potentially contribute to the detection of other unusual respiratory viruses with pandemic potential. This study vis –a –vis the sentinel surveillance in Nigeria has the following implementing partners: Federal Ministry of Health of Nigeria(FMOH), State Ministry of Health, Sentinel site Health Facility, US – CDC, and WHO. The Nigeria Influenza Sentinel Site Surveillance is a modified form of global Influenza surveillance and is an all year programme. This study is part of the National Influenza sentinel site surveillance as Nnamdi Azikiwe University Teaching hospital Nnewi is one of the chosen health facilities.

The influenza virus spreads rapidly around the world in seasonal epidemics which result in excess morbidity and mortality. Data on influenza activities in Africa including Nigeria has been scarce due to lack of active surveillance for the disease. As a result, the epidemiology and disease burden of human influenza has not been adequately described in the region. The few available studies indicate that sporadic cases of influenza may occur throughout the year and that sporadic outbreaks do occur mainly during the rainy season or during times of the year with lower environmental temperatures (Dalhatu, 2008).

The burden of Influenza is likely to be under-appreciated, as is the impact in this part of the world, where many persons are more susceptible to complications because of underlying malnutrition, tropical diseases and HIV infection. Therefore, more attention needs to be given to influenza surveillance in the current public health programs in Nigeria. Sentinel surveillance for influenza conducted as part of Integrated Disease Surveillance and Response (IDSR) strategy is expected to monitor the occurrence of influenza in Nigeria and provide a foundation for detecting outbreaks/pandemic or emergence of novel strains of influenza and help trigger a rapid public health response. Within this context, sentinel influenza surveillance will provide an efficient and reliable means of obtaining epidemiological and laboratory data

regarding the disease burden, seasonality, and strain circulation. These data will critically inform prevention and control strategies. The experience with avian and human cases of influenza due to highly pathogenic H5N1 and, recently, the 2009 Pandemic A/H1N1 in Nigeria underscores the necessity to set up and now strengthen the national surveillance systems to detect and determine the influenza virus patterns within the population. For these purposes, surveillance for human influenza is integrated into IDSR to secondarily create an early warning system. The system involves active search for influenza-like illness (ILI) and Severe Acute Respiratory Illness (SARI) in some selected sentinel hospitals. In addition to describing the epidemiology of influenza, the sentinel surveillance also characterizes and epidemiologically links influenza strains in circulation through a laboratory component.

Objectives of the Epidemiologic study:

1. To primarily define /characterize the epidemiology of seasonal human influenza in Nnewi, Nigeria, to generate information for public health decision making.
2. To characterize and monitor trends in morbidity and mortality attributable to influenza and other respiratory viruses and detect, unusually severe morbidity and mortality caused by both known and unknown respiratory pathogens that have the potential for large-scale epidemics or pandemics.
3. To provide data to identify and monitor groups at high risk for severe disease and provide information to establish baseline levels of activity for influenza like illness and severe acute respiratory infections, to facilitate assessment of severity and impact and provide context for unusual outbreaks of respiratory disease.
4. Identify locally circulating influenza types and subtypes and their relationship to global and regional patterns.

METHODOLOGY

This is a cross – sectional, descriptive and hospital based study. Nnamdi Azikiwe University Teaching Hospital-Nnewi in Anambra State represents the South East Zone, and is one of the four sites activated for Influenza Surveillance in Nigeria. Anambra state has an area of 4.844SqKm and a population of 4,055,048 by 2006 census (National Population Commission. 2006). It has seven months of heavy tropical rains (April – October) which are followed by five months of dryness (November – March). The harmattan, a particularly dry and dusty period occurs for about two weeks within the dry season. The temperature is generally hot and humid in the range 27^0C – 28^0C during July through December but rising to 35^0C between February and April (http://en.wikipedia.org/wiki/awka. Accessed September 2010).

The methodology used in this study is in line with the Federal Ministry of Health's (FMOH) Protocol for National Influenza Sentinel Surveillance (Federal Ministry of Health (FMOH) (2011).

Population sub-groups under Surveillance:

1. Adult and pediatric patients being admitted as in-patients in the Medical, Accident and Emergency, Children Emergency and Paediatric Wards of sentinel surveillance health facilities who meet the case definition for Severe Acute Respiratory Infection (SARI, see below for definition).
2. Adult and Pediatric patients being evaluated and receiving care in the General Outpatient Department (GOPD) of the sentinel surveillance health facility , who meet the case definition of influenza like illness (ILI), or SARI (out-patients).
3. Suspected Cases of Avian influenza or any pandemic influenza.

Case definitions

Patients with influenza-like illness (ILI) and severe acute respiratory illness (SARI) were enrolled. Definitions for ILI and SARI were adapted from those of the WHO (WHO Regional Office for Europe Guidance for Influenza Surveillance in Humans.http://www.euro.who.int/ data/assets/pdf file/0020/90443/E92738.pdf; http://whqlibdoc.who.int/publications/2005/9241546441.pdf; Human Infection with Pandemic (H1N1) 2009).

- ILI was defined as fever ≥ 38°C and cough or sore throat.
- For children > 1 week and < 2 months old, SARI was defined as an admission to the pediatric ward with any of the following: respiratory rate > 60 per minute, severe chest in drawing, nasal flaring, grunting, fever ≥ 38°C, hypothermia < 35.5°C, or pulse oxygenation < 90%.
- For children 2 months to < 5 years of age, SARI was defined as cough or difficulty breathing and any one of the following: respiratory rate > 50/min for infants 2 months to < 1 year old or > 40/min for children 1 to < 5 years old, chest in drawing or stridor in a calm child, unable to drink or breast feed, vomiting, convulsions, lethargic or unconscious, or pulse oxygen saturation < 90%.
- For older children and adults ≥ 5 years of age, SARI was defined as fever ≥ 38°C, and cough or sore throat, and shortness of breath or difficulty breathing.

Hospitalization was a required part of the SARI case definition in all ages. For every patient, surveillance officers recorded specific signs and symptoms so that case classification could be validated.

Inclusion Criteria:

1. ILI cases on each of the first 4 work days had their epidemiological data and respiratory specimens collected.
2. All ILI seen in the outpatient on the first 4 work days were counted. SARI cases were collected on Friday.
3. All SARI patients were counted; epidemiological data and specimen were collected.

Exclusion Criterium:

1. Persons whose symptoms were of greater than 14 days duration were excluded.

Data Collection

Surveillance officers at the sentinel hospital accessed patients, case registers and medical records in both the inpatient and outpatient departments to collect data. The following data were collected:

Case based data were collected from the following categories of patients: A standard case investigation form (See Appendix I) was used to collect epidemiological data from ILI and SARI cases who meet the case definition. In a sequential order a unique identification (ID) number which was generated by using the year, month, day, site number, and assigned to cases identified. The following other data were collected for each ILI/SARI patient from whom a specimen was collected: Sex, Age, Temperature, Date of onset, Date of specimen collection, Date of hospitalization (if SARI), Antiviral use, Co-morbidity (chronic respiratory disease, asthma, recurrent chest pain, cancer, diabetic, cardiac disease, chronic liver disease, chronic renal disease, HIV/AIDs, Pregnancy status.

a. ILI Case based data: Using the standard case investigation form, the surveillance officers obtained basic epidemiologic data from the first 4 patients that meet the case definition of ILI.

b. SARI case based data: On a daily basis, the surveillance officers identified all eligible patients with SARI within 24-48 hours after their hospitalization. Basic epidemiologic data were then collected using a standard case investigation form.

Total number of consultations in the outpatient department for any reason was tallied by age group. This is important because it allows a denominator to be determined and used in estimating the burden of influenza among outpatients seeking care for ILI. A total number of persons hospitalized, number of death and number of SARI death in the ward and the casualty area, were also obtained, this will serve as denominator for SARI patients recruited in the ward and the emergency unit. Clinical reminders such as posters in the examining room served to remind clinicians seeing case patient to record information relevant to identifying ILI and SARI patients.

Laboratory Specimen Collection (http://www.euro.who.int/__data/assets/pdf_file/0020/90443/E92738.pdf; http://whqlibdoc.who.int/publications/2005/9241546441.pdf; Human Infection with Pandemic (H1N1) (2009) includes Nasopharyngeal (NP) and Oropharyngeal (OP) specimen collected using appropriate swab sticks for virologic testing from the following category of cases: a) First four (4) eligible ILI per day for first 4 work days. b) All SARI presenting to the sentinel health facility. c) Any Suspected Case of Avian Influenza. d) Any suspected case of Pandemic H1N1.

The forms were safely stored to maintain confidentiality. The specimens were also labeled with the unique ID number, taken to the hospital laboratory for storage, and on a twice weekly basis (not more than 2 days after collection) were packaged and shipped to the reference laboratory for testing.

Sample Collection, Storage and Packaging Guideline (http://www.euro.who.int/__data/assets/pdf_file/0020/90443/E92738.pdf; http://whqlibdoc.who.int/publications/2005/9241546441.pdf; Human Infection with Pandemic (H1N1) (2009) was employed as follows: Only the sterile Dacron polyester swabs provided were used (flexible aluminum shaft for nasopharyngeal and rigid plastic shaft for oropharyngeal). Wood shaft or calcium alginate swabs were not used, as they may be inhibitory to viruses. For nasopharyngeal swab, the flexible aluminium shaft swab stick was gently inserted into the nose and back to the nasopharynx, where it was rotated 180 degrees and left in place for 3-5 seconds before withdrawing gently. For oropharyngeal swab, insert a swab stick with rigid plastic shaft into the mouth (behind the tongue) to the lower part of the oropharynx and rub vigorously. If patients were intubated, endotracheal aspirate or broncho-alveolar lavage were used where clinically indicated. Both nasopharyngeal and oropharyngeal swab(s) from the same patient were aseptically placed into the same vial of viral transport medium (VTM) and labeled with the same unique ID number as the patient's data collection form and indicate date of collection. Specimens were kept refrigerated (2-8 ^{o}C) in appropriate viral transport media and sent to the National Influenza Reference Laboratory (NIRL) Abuja along with the data collection and investigation form within 48hours. "Type of Specimen Collected" portion of the case investigation form was completed. Specimens were stored refrigerated at 2-8 ^{o}C and transported within 48hours of collection (Twice weekly -Tuesday and Thursday). Send specimens (Tuesday afternoon and Thursday afternoon) to arrive at NIRL within 24-48hours.Call reference laboratory to expect specimens

Specimen Transportation, Processing and Testing Guideline (http://www.euro.who.int/__data/assets/pdf_file/0020/90443/E92738.pdf;

http://whqlibdoc.who.int/publications/2005/9241546441.pdf; Human Infection with Pandemic (H1N1) (2009) was also employed whereby courier services provided by DHL Company collected the sample from Nnewi to National Influenza Reference Laboratory (NIRL) Abuja within the above stated time. In the NIRL, the specimens were vortexed and separated into three aliquots. Two of the aliquots were archived in -80^{0}C freezer. One aliquot of each specimen was tested by real time PCR for influenza virus types A and B. All specimens positive for influenza type A were sub-typed. An aliquot was sent to Asokoro laboratory for confirmatory testing by PCR and additional PCR testing to determine serotype. In addition, 10% sample of negative specimens was sent to Asokoro laboratory on a routine basis for quality assessment testing. Remaining aliquots from collected specimens were stored at the respective reference laboratory for future testing for other respiratory pathogens. The results of all testing are entered into an electronic database in the Asokoro laboratory and reported to the FMOH and the sentinel site facility on a weekly basis.

Database management and analysis was performed using an electronic database (Epi Info 2000). Epidemiological data in the case investigation form were entered into an electronic database (Epi Info 2000). Virological information obtained from laboratory testing was also entered into the same database as well. The following aggregate data were collated weekly for ILI cases: i) Number of new ILI cases by age-group. ii) Number of new ILI cases sampled by age-group. iii) Number of total outpatient consultations for that week by age-group

The following data were collated weekly for SARI cases: i) Number of new SARI cases by age group. ii) Number of new SARI cases sampled by age-group. iii) Number of SARI deaths by age-group. iv) Number of total hospital admissions for that week by age-group (The number of total admissions can often be calculated from the log book of the hospital admissions/discharges).

Both case based epidemiological and virological data and aggregated data were analyzed on a weekly basis producing: i) Graph of weekly SARI cases per total number of hospitalizations at the national level and sentinel site by age group (where possible in comparison with previous years). ii) Graph of weekly ILI cases per total number of outpatient consultations at the sentinel site by age group (where possible in comparison with previous years). iii) Number of SARI/ILI patients tested and proportion positive, by influenza type and subtype. iv) Number of ILI and SARI cases reported by sentinel sites by week. v) If possible the data was presented with gender break down as well. v) Annually case-based information on risk factors and other data were often collated and analyzed at the national level to understand better the groups at risk for severe outcome and guide the control strategies for the coming year.

LIMITATIONS OF STUDY

Our study has several limitations: 1) Not all eligible individuals meeting the case definitions were identified, and not all those who were identified agreed to participate in the study. Thus the actual rates of SARI and virus infection associated SARI is likely higher than reported. 2) We did not attempt to collect data on all cases of ILI in that report to the hospital; therefore, we may not have been able to estimate the accurate proportions of ILI. 3) Although NAUTH is the only surveillance site in the South East, patients may have sought health care elsewhere; we did not capture all information on health utilization among the peoples within the hospital catchment areas. If patients did seek treatment elsewhere, our proportions would again underestimate the actual situation. 4) The results of this study should also be interpreted with caution especially for pathogens e.g. healthy, asymptomatic individuals will present epidemiological challenges since they were neither considered nor subjected to virus detection processes. 5) Finally, the surveillance system was not designed to measure all indicators of SARI disease; due to lack of data, estimates of key outcomes, including mortality and duration of hospitalization were not done.

Ethical approval for the surveillance activities was obtained from NRHEC, while Institutional review was waived by CDC because the study was considered to be a non-research public health activity. Informed written consent was obtained from all participants and from the guardians of minors.

RESULT

The total number of samples collected from Jan – Dec 2011 was 347 out of the expected 832

Between Jan-Dec 2011 a total of 347 samples were collected and sent to Influenza Reference Laboratory. Out of this number 306 was processed and the result forwarded to the site.

Figure 1 shows that the highest Numbers of ILI and SARI were reported in the month of July.

Table 1 shows that the most affected age group for both conditions was the 0-4 years age group while the least affected was the 5-14 years. Out of the 347 samples, 226 were found to be ILI while SARI cases were 121. Figure 2 and table 2 each depicts that out of the 306 samples processed; 278 was negative, Type A influenza was13 in number whereas Type B influenza was 10. Table 2 shows that there was no significant difference in the Distribution of ILI and SARI in the male and female subjects, ($p>0.05$). Similary, there was no significant difference between the proportions of influenza positive cases among ILI (4.1%) and SARI (3.4%) patients.

Figure 3 shows that the highest percentage of hospitalization due to SARI per monthly consultations was in the month of July which recorded approximately

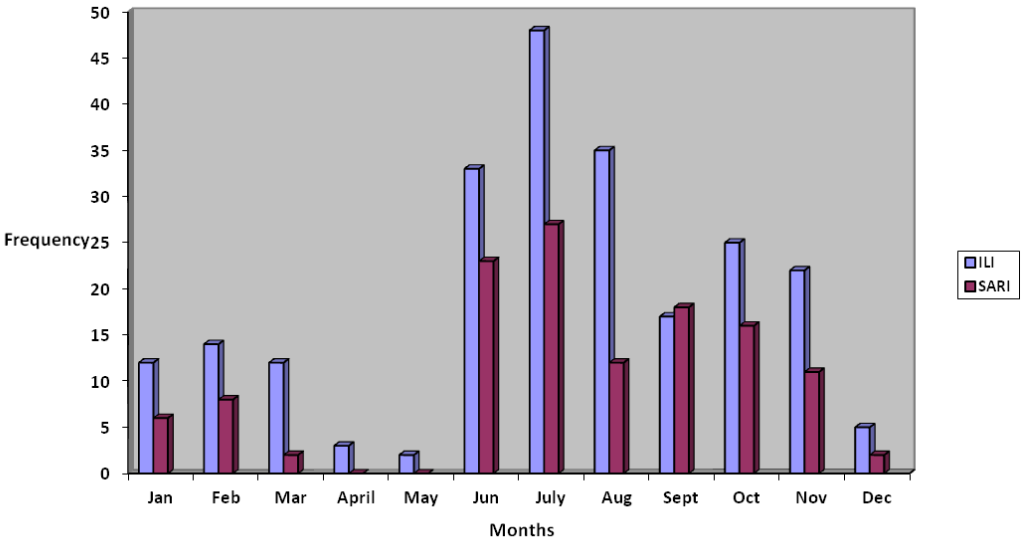

Figure 1. Seasonal trend of ILI/SARI among the subjects between Jan – Dec 2011

Table 1. Distribution of ILI and SARI according to age among the subjects

Age Group (years)	ILI	SARI	Total	% of Total
0-4	111	78	189	54.5
5-14	4	3	7	2.0
15-24	15	4	19	5.5
25-34	25	7	32	9.2
35-44	16	8	24	6.9
44-54	14	3	17	4.9
55-64	13	7	20	5.8
5-9	9	4	13	3.7
65 ABOVE	19	7	26	7.5
TOTAL	226	121	347	100

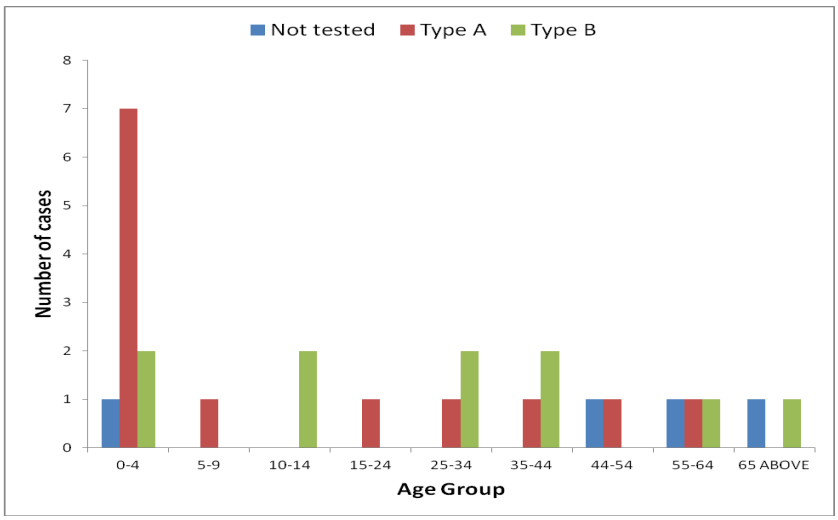

Figure 2. Distribution of cases by age group and influenza type in NAUTH Nnewi

Table 2. Distribution of cases by gender and types of influenza virus

Gender	Not tested	Negative	Type A	Type B	TOTAL
F	2	153	7	6	168
M	2	125	6	4	137
TOTAL	4	278	13 (4.2%)	10 (3.3%)	305
Total number (%) with influenza virus			23 (7.5%)		

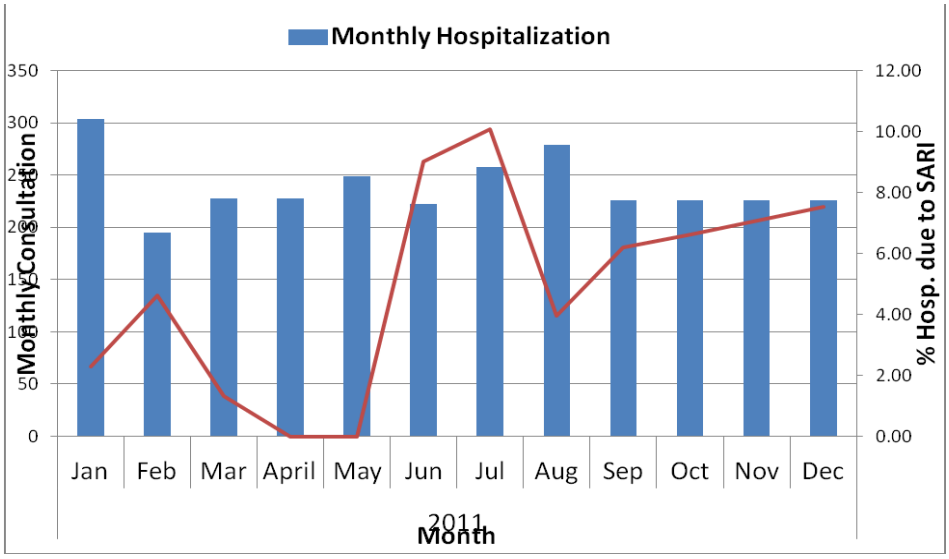

Figure 3. Total hospitalization and percentage hospitalization due to SARI in NAUTH Nnewi between Jan to Dec 2011

Table 3. Distribution of ILI and SARI cases according to gender

Type of Case	Females Frequency (%)	Males Frequency (%)	Total
ILI	123 (66.5)	103 (63.6)	226 (65.1)
SARI	62 (33.5)	59 (36.4)	121(34.9)
Total	185 (100)	162 (100)	347 (100)

X^2 = p>0.05

Table 4. State Distribution of Cases from Jan – Dec 2011

TYPE OF CASE			
State of Residence	ILI	SARI	TOTAL
Abia	1	6	7
Anambra	209	103	312
Delta	1	0	1
Cameroon	1	0	1
Ebonyi	2	2	4
Enugu	5	1	6
Imo	7	4	11
Lagos	0	3	3
Rivers	0	1	1
TOTAL	226	121	347

10% admissions due to SARI. Table 4 shows that Majority of Influenza cases were recruited from Anambra state.

DISCUSSION

The aim of this study is to give a descriptive epidemiology of influenza at a tertiary care hospital in South East Nigeria. In this analysis, both ILI and SARI occurred all year round with peak levels around mid-year; June, July and August. In all the months of the year, SARI was found to be more prevalent than ILI. This is similar to the result of a Kenyan study of influenza epidemiology which found that influenza circulates all year round with some peaks during wet months: March-April and Oct- Nov and cold month of July (Ahmed et al., 2012). Influenza is known to come in epidemics during winter in temperate regions as opposed to what has been observed in tropical countries where it is present throughout the year often with cold season period of exacerbations.

This study found that influenza viruses constitute 7.5% of the causes of SARI and ILI in the site, among those who were tested. To decrease the burden of respiratory illnesses requires a multipronged interventional plan. Physical interventions like hand washing with soap have been found to decrease the odds of respiratory infection by as much as 55%, and nosocomial transmission has been shown to decrease by 66% when cohort nursing and wearing of gloves and gowns were introduced (Jefferson et al., 2010; Madge et al., 1992; Luby et al., 2005). Measures could be put in place to minimize crowding, which is very common and has been associated with increased transmission of respiratory infections, and to target public health education messages during peak transmission months (Graham, 1990).

Of all ILI and SARI samples, 7.5% were positive for influenza; 4.2% yielded influenza A virus, and 3.3% yielded influenza B virus. This finding is similarly comparable to the result of a 30 month national sentinel surveillance for influenza in Tanzania, 2008-2010 which recorded 8.0% positive for influenza; 6.9% for influenza A virus, and 1.1% yielded influenza B virus[27]

Furthermore, the proportion of influenza-positive cases among ILI was (4.1%) and SARI (3.4%) patients with no significant difference between the two proportions ($p>0.05$), a situation equally applicable to the result of the Tanzanian surveillance which yielded influenza positivity of 8.5% among the ILI cases, not significantly different from 7.3% found among the SARI cases (($P = 0.39$), (Mmbaga et al., 2012). Also this is similar to result of Nigerian influenza sentinel surveillance 2008-2010 where 7.7% were positive for influenza viruses; 3.4% were from subjects with ILI, 3.1% was from subjects with SARI, and 1.2% was from subjects with an unclassified condition (Dalhatu et al., 2012).

This study adds to knowledge of the seasonal variations of respiratory viral infections in Africa. It was found that remarkable differences in seasonal variation of SARI and by extension, specific virus activity exist, and this might be an indication of varied transmission patterns in different sub-regions of Africa. Similar differences in seasonality between neighboring tropical countries in Africa and Asia have been reported previously (Robertson et al., 2004; Chan et al., 2002). Additional surveillance points are required to further evaluate temporal variations of SARI due to viral illness.

All SARI cases in this study were hospitalized in a ward shared by other sick children presenting with other conditions. While we have not explored hospital acquired infection in this study, measures could also be taken to minimize potential nosocomial transmission. Because of the high rates of morbidity associated with these viruses, in addition to the implementation of innovative and effective approaches to achieve sustained compliance with hand hygiene promotions, children of age group most at risk should be prioritized for vaccines when they become available (Centers for Disease Control and Prevention. Prevention and control of seasonal influenza with vaccines, 2009; Hall, 2001; Teng, 2011; Yu et al., 2008). SARI prevention and control in vulnerable populations should be a key priority area for government, its partner agencies, and the international community.

CONCLUSION

The conclusions drawn from this research have been and will continue to be compared with that of similar research works in the West Africa sub region, Africa and the world. The result of the study will be made available to policy makers to enable them formulate public health policies for the public good as the data generated will critically inform prevention and control strategies for Influenza infection.

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Appendix I National Influenza Sentinel Surveillance Case Investigation Form

FEDERAL MINISTRY OF HEALTH **National Influenza Sentinel Surveillance** **Case Investigation Form**				
Site Location	□ Abuja □ Kano □ Lagos □Nnewi □ Ibadan □ Maiduguri □ Port Harcourt			
Type of Case	□ ILI □ SARI □ Suspect AI □ Suspect Novel A/H1N1			
Identification and Demographic Information	NISS No.	Hospital No.	Date of Onset of Fever (dd/mm/yy) ……/……../……..	Date of Interview (dd/mm/yy) ……/……../…….
	Age of patient: Years	Months(if < 2yrs)	DOB:	
	Sex: □ Male □ Female			
	Current Residenitial Address: House No. Street:			
	Village/City:			
	LGA State:			
Epidemiological and Clinical Information	**Occupation of the patient:**			
	□ Health Care worker □ Poultry Worker □ Veterinerian □ Others (Specify)…..			
	Patient Hospitalized ? □ Yes □ No Outcome □ Dead □ Alive			
	Preexisting medical conditions:			
	□ Heart Disease □ Chronic Shortness of breath □ Recurrent Chest Pain □ Asthma □ Cancer			
	Does patient smoke? □ Yes □ No; Pregnancy □ Yes □ No; Diabetes □ Yes □ No;			
	Chronic liver disease □ Yes □ No; Chronic Renal Disease □ Yes □ No; HIV/AIDS □ Yes □ No			
	Treatment	Patient vaccinated against Flu? □ Yes □ No		
		Currently taking antiviral medicine? □ Yes □ No		
	If taking antiviral medicine please name			
	Temperature			
	Cough □ Yes □ No			
	SOB / Difficulty Breathing □ Yes □ No			
	Lethargy, Chest indrawing □ Yes □ No			
	Sore Throat □ Yes □ No			
	Nausea/ vomiting □ Yes □ No			
	Diarrhea □ Yes □ No			
	History of exposure/ contact in the last 7 days	Sick or dead bird or poultry	Yes / No / Unk	
		Family member any person with severe respiratory illness	Yes / No / Unk	
		Recent travel to area with avian flu/Novel H1N1	Yes / No / Unk	
		Eating raw or undercooked poultry	Yes / No / Unk	
		Contact with		
Type of specimen collected	□ Throat/ oropharyngeal □ Nasal/nasopahryngeal			
	Date of collection: Day: Month: Year:			
Result:				
Remark:				
Name and signature of Interviewer				
Name and signature of Lab. Scientist				
Name and signature of Surveillance Coordinator:				